

4.7.3.1.2 GMM common procedure initiation

The network may initiate GMM common procedures, e.g. the GMM identification and GMM authentication and ciphering procedure, depending on the received information such as IMSI, CKSN, old RAI and P-TMSI.

4.7.3.1.3 GPRS attach accepted by the network

If the GPRS attach request is accepted by the network, an ATTACH ACCEPT message is sent to the MS.

The P-TMSI reallocation may be part of the GPRS attach procedure. The P-TMSI that shall be allocated is then included in the ATTACH ACCEPT message. The network shall, in this case, change to state GMM-COMMON-PROCEDURE-INITIATED and shall start timer T3350 as described in section 4.7.6. Furthermore, the network may assign a P-TMSI signature for the GMM context which is then also included in the ATTACH ACCEPT message. If the LAI or PLMN identity that has been transmitted in the ATTACH ACCEPT message is a member of any of the "forbidden" lists, any such entry shall be deleted.

The MS, receiving an ATTACH ACCEPT message, stores the received routing area identification, stops timer T3310, enters state GMM-REGISTERED and sets the GPRS update status to GUI UPDATED.

If the message contains a P-TMSI, the MS shall use this P-TMSI as the new temporary identity for GPRS services. In this case, an ATTACH COMPLETE message is returned to the network. The MS shall delete its old P-TMSI and shall store the new one. If neither a P-TMSI nor an IMSI has been included by the network in the ATTACH ACCEPT message, the old P-TMSI, if any available, shall be kept.

If the message contains a P-TMSI signature, the MS shall use this P-TMSI signature as the new temporary signature for the GMM context. The MS shall delete its old P-TMSI signature, if any is available, and shall store the new one. If no P-TMSI signature has been included by the network in the ATTACH ACCEPT message, the old one, if any is available, shall be kept.

The network receiving an ATTACH COMPLETE message stops timer T3350, changes to GMM-REGISTERED state and considers the P-TMSI sent in the ATTACH ACCEPT message as valid.

4.7.3.1.4 GPRS attach not accepted by the network

If the attach request cannot be accepted by the network, an ATTACH REJECT message is transferred to the MS. The MS receiving the ATTACH REJECT message stops timer T3310 and takes one of the following actions depending upon the reject cause:

3 (Illegal MS)

6 (Illegal ME)

7 (GPRS services not allowed)

The MS shall set the GPRS update status to GU3 ROAMING NOT ALLOWED (and shall store it according to section 4.1.3.2.9) and shall delete any P-TMSI, P-TMSI signature, RAI and GPRS ciphering key sequence number. The SIM shall be considered as invalid until switching off or the SIM is removed. The new state is GMM-DEREGISTERED.

11 (PLMN not allowed)

12 (Location area not allowed)

13 (Roaming not allowed in this location area)

The MS shall delete any RAI, P-TMSI, P-TMSI signature and GPRS ciphering key sequence number stored, shall set the GPRS update status to GU3 ROAMING NOT ALLOWED (and shall store it according to section 4.1.3.2.9) and shall change to state GMM-DEREGISTERED.

The MS shall store the LAI or the PLMN identity in the appropriate forbidden list, i.e. in the "forbidden PLMN list" for cause #11, in the list of "forbidden location areas for regional provision of service" for cause #12 or in the list of "forbidden location areas for roaming" for cause #13. In case cause #11 or #13 was received, the MS shall perform a PLMN selection instead of a cell selection.

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Other values are considered as abnormal cases. The specification of the MS behaviour in those cases is specified in section 4.7.3.1.5.

4.7.3.1.5 Abnormal cases in the MS

The following abnormal cases can be identified:

a) Access barred because of access class control

The GPRS attach procedure shall not be started. The MS stays in the current serving cell and applies normal cell reselection process. The GPRS attach procedure is started as soon as possible, i.e. when access is granted or because of a cell change.

b) Lower layer failure before the ATTACH ACCEPT or ATTACH REJECT message is received

The procedure shall be aborted, the MS shall keep, if any, the stored P-TMSI, RAI, and GPRS ciphering key sequence number and shall proceed as described below.

c) T3310 time-out

On the first expiry of the timer, the MS reset and restart timer T3310 and shall retransmit the ATTACH REQUEST message. This retransmission is repeated until the timer has expired four times, i.e. on the fifth expiry of timer T3310, the GPRS attach procedure shall be aborted and the MS shall proceed as described below.

d) ATTACH REJECT, other causes than those treated in section 4.7.3.1.4

e) Change of cell into a new routing area

If a cell change into a new routing area occurs before an ATTACH ACCEPT or ATTACH REJECT message has been received, the GPRS attach procedure shall be aborted and re-initiated immediately. If a routing area border is crossed when the ATTACH ACCEPT message is received but before an ATTACH COMPLETE message is sent, the GPRS attach procedure shall be aborted and the routing area updating procedure shall be initiated. If a P-TMSI was allocated during the GPRS attach procedure, this P-TMSI shall be used in the routing area updating procedure. If a P-TMSI signature was allocated together with the P-TMSI during the GPRS attach procedure, this P-TMSI signature shall be used in the routing area updating procedure.

f) Power off

If the MS is in state GMM-REGISTERED-INITIATED at power off, the GPRS detach procedure shall be performed.

g) Procedure collision

If the MS receives a DETACH REQUEST message from the network in state GMM-REGISTERED-INITIATED, the GPRS detach procedure shall be progressed and the GPRS attach procedure shall be aborted. If the cause IE, in the DETACH REQUEST message, indicated a "reattach request", the GPRS attach procedure shall be progressed and the DETACH REQUEST message shall be ignored.

In cases b, c and d the MS shall proceed as follows. Timer T3310 shall be stopped if still running. The GPRS attach attempt counter shall be incremented.

If the GPRS attach attempt counter is less than 4:

- timer T3311 is started and the state is changed to GMM-DEREGISTERED.ATTEMPTING-TO-ATTACH.

If the GPRS attach attempt counter is greater than or equal to 4:

- the MS shall delete any RAI, P-TMSI, P-TMSI signature, and GPRS ciphering key sequence number, shall set the GPRS update status to NOT UPDATED, shall start timer T3302 and shall change to state GMM-DEREGISTERED.PLMN-SEARCH.

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4.7.3.1.6 Abnormal cases on the network side

The following abnormal cases can be identified:

a) Lower layer failure

If a low layer failure occurs before the message ATTACH COMPLETE has been received from the MS and a new P-TMSI (or a new P-TMSI and a new P-TMSI signature) has been assigned, the network shall consider both the old and new P-TMSI each with its corresponding P-TMSI-signature as valid for a certain recovery time and shall not resent the message ATTACH ACCEPT. During this period the network may:

- consider the new P-TMSI only as valid, if it is used by the MS in a subsequent message;
- use the identification procedure followed by a P-TMSI reallocation procedure if the old P-TMSI is used by the MS in a subsequent message.

b) Protocol error

If the ATTACH REQUEST message is received with a protocol error, the network shall return an ATTACH REJECT message with one of the following reject causes:

- #96: Mandatory information element error;
- #99: Information element non-existent or not implemented;
- #100: Conditional IE error;
- #111: Protocol error, unspecified.

c) T3350 time-out

On the first expiry of the timer, the network shall retransmit the ATTACH ACCEPT message and shall reset and restart timer T3350.

This retransmission is repeated until the timer has expired four times, i.e. on the fifth expiry of timer T3350, the GPRS attach procedure shall be aborted. If a new P-TMSI or a new P-TMSI together with a new P-TMSI signature were allocated in the ATTACH ACCEPT message, the network shall consider both the old and new P-TMSI each together with the corresponding P-TMSI signatures as valid for a certain recovery time. During this period the network acts as specified for case a.

d) More than one ATTACH REQUEST received

If an ATTACH REQUEST message is received before a previously initiated GPRS attach procedure has resulted in a transition into state GMM-REGISTERED and the indicated RAI differs from the RAI received within the previous ATTACH REQUEST message, the previously initiated GPRS attach procedure shall be aborted and the new GPRS attach procedure shall be progressed. If the RAI does not differ, the ATTACH ACCEPT message shall be resent.

e) ATTACH REQUEST received in state GMM-REGISTERED

If an ATTACH REQUEST message is received in state GMM-REGISTERED the network may initiate the GMM common procedures; if it turned out that the ATTACH REQUEST message was send by an MS that has already been attached, the GMM context and PDP contexts, if any, are deleted and the new ATTACH REQUEST is progressed.

f) ROUTING AREA UPDATE REQUEST message received before ATTACH COMPLETE message.

Timer T3350 shall be stopped. The allocated P-TMSI shall be considered as valid and the routing area updating procedure shall be progressed as described in section 4.7.5.

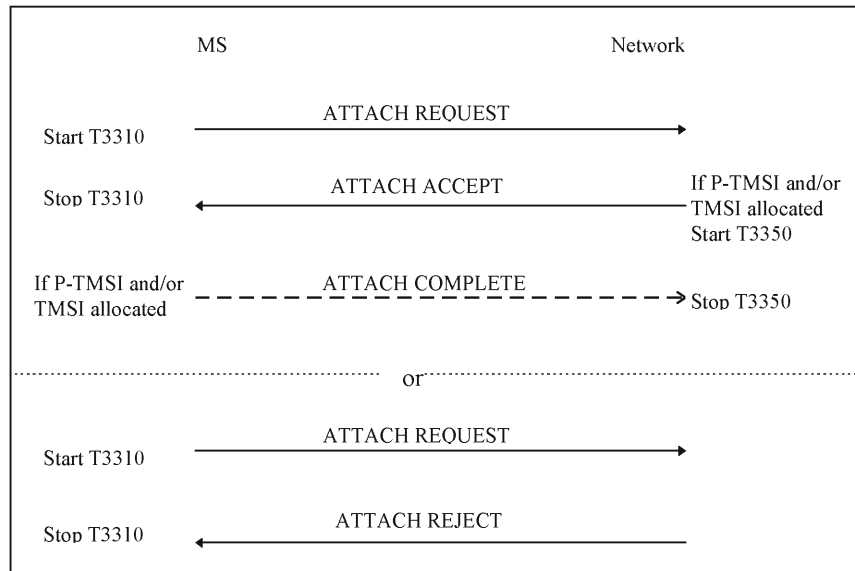


Figure 4.7.3/1 GSM 0408: GPRS attach procedure and combined GPRS attach procedure

4.7.3.2 Combined GPRS attach procedure for GPRS and non-GPRS services

The combined GPRS attach procedure is a GMM procedure used by a GPRS MS operating in MS operation modes A or B for IMSI attach for GPRS and non-GPRS services.

If a GPRS MS operating in MS operation modes A or B is already attached for non-GPRS services by use of the MM specific IMSI attach procedure, but additionally wishes to perform an IMSI attach for GPRS services, the combined GPRS attach procedure shall also be used.

The attach type information element shall indicate "combined GPRS attach". In this case, the messages ATTACH ACCEPT, ATTACH COMPLETE, and ATTACH REJECT used by the combined GPRS attach procedure carry information for both the GPRS and the non-GPRS services.

4.7.3.2.1 Combined GPRS attach procedure initiation

In state GMM-DEREGISTERED and MM IDLE, the MS initiates the combined GPRS attach procedure by sending an ATTACH REQUEST message to the network, starts timer T3310 and enters state GMM-REGISTERED-INITIATED and MM LOCATION UPDATING PENDING.

The MS shall include a valid P-TMSI, if any is available, the P-TMSI signature associated with the P-TMSI and the routing area identity associated with the P-TMSI in the ATTACH REQUEST message. If there is no valid P-TMSI available, the IMSI shall be included instead of the P-TMSI, P-TMSI signature and RAI.

4.7.3.2.2 GMM Common procedure initiation

The network may initiate GMM common procedures, e.g. the GMM identification and GMM authentication and ciphering procedure, depending on the received information such as IMSI, CKSN, old RAI and P-TMSI.

4.7.3.2.3 Combined GPRS attach accepted by the network

Depending on the value of the attach result IE received in the ATTACH ACCEPT message, two different cases can be distinguished:

- Case 1) The attach result IE value indicates "combined GPRS attach": IMSI attach for GPRS and non-GPRS services have been successful.

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Case 2) The attach result IE value indicates "GPRS only": IMSI attach for GPRS services has been successful but IMSI attach for non-GPRS services has not been successful.

Case 1

The description for IMSI attach for GPRS services as specified in section 4.7.3.1.3 shall be followed. In addition, the following description for IMSI attach for non-GPRS services applies.

The TMSI reallocation may be part of the combined GPRS attach procedure. The TMSI allocated is then included in the ATTACH ACCEPT message together with the location area identification (LAI). The network shall, in this case, change to state GMM-COMMON-PROCEDURE-INITIATED and shall start timer T3350 as described in section 4.7.6.

The MS, receiving an ATTACH ACCEPT message, stores the received location area identification, stops timer T3310, enters state MM IDLE and sets the update status to U1 UPDATED. If the message contains an IMSI, the mobile station is not allocated any TMSI, and shall delete any TMSI accordingly. If the message contains a TMSI, the MS shall use this TMSI as the new temporary identity. The MS shall delete its old TMSI and shall store the new TMSI. In this case, an ATTACH COMPLETE message is returned to the network. If neither a TMSI nor an IMSI has been included by the network in the ATTACH ACCEPT message, the old TMSI, if any available, shall be kept.

The network receiving an ATTACH COMPLETE message stops timer T3350, changes to state GMM-REGISTERED and considers the new TMSI as valid.

Case 2

The description for IMSI attach for GPRS services as specified in section 4.7.3.1.3 shall be followed. In addition, the following description for IMSI attach for non-GPRS services applies.

The MS receiving the ATTACH ACCEPT message takes one of the following actions depending on the reject cause:

2 (IMSI unknown in HLR)

If the MS was not IMSI attached for non-GPRS services before the combined GPRS attach procedure was initiated, the MS shall set the update status to U3 ROAMING NOT ALLOWED and shall delete any TMSI, LAI and ciphering key sequence number. The new MM state is MM IDLE.

If the MS was IMSI attached for non-GPRS services, before the combined GPRS attach procedure was initiated, this cause is considered as an abnormal case.

16 (MSC temporarily not reachable)

A GPRS MS operating in MS operation mode A shall then perform an IMSI attach for non-GPRS services by use of the MM IMSI attach procedure; a GPRS MS operating in MS operation mode B may then perform an IMSI attach for non-GPRS services by use of the MM IMSI attach procedure.

Other values are considered as abnormal cases. The behaviour of the MS in those cases is specified in section 4.7.3.2.5.

4.7.3.2.4 Combined GPRS attach not accepted by the network

If the attach request can neither be accepted by the network for GPRS nor for non-GPRS services, an ATTACH REJECT message is transferred to the MS. The MS receiving the ATTACH REJECT message stops timer T3310 and takes one of the following actions depending upon the reject cause:

3 (Illegal MS);

6 (Illegal ME); or

8 (GPRS services and non-GPRS services not allowed).

The MS shall set the GPRS update status to GU3 ROAMING NOT ALLOWED (shall store it according to section 4.1.3.2.9) and shall delete any P-TMSI, P-TMSI signature, RAI and GPRS ciphering key sequence number. The new state is GMM-DEREGISTERED. The new MM state is MM IDLE. The SIM shall be considered as invalid until switching off or the SIM is removed.

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The MS shall set the update status to U3 ROAMING NOT ALLOWED, shall delete any TMSI, LAI and ciphering key sequence number. The SIM shall be considered as invalid until switching off or the SIM is removed.

7 (GPRS services not allowed)

The MS shall set the GPRS update status to GU3 ROAMING NOT ALLOWED (and shall store it according to section 4.1.3.2.9) and shall delete any P-TMSI, P-TMSI signature, RAI and GPRS ciphering key sequence number. The SIM shall be considered as invalid for GPRS services until switching off or the SIM is removed. The new GMM state is GMM-DEREGISTERED; the MM state is MM IDLE. A GPRS MS operating in MS operation mode A shall then perform an IMSI attach for non-GPRS services by use of the MM IMSI attach procedure; a GPRS MS operating in MS operation mode B may then perform an IMSI attach for non-GPRS services by use of the MM IMSI attach procedure.

11 (PLMN not allowed);

12 (Location area not allowed); or

13 (Roaming not allowed in this location area).

NOTE: These cause codes are applicable only in case the MS was not IMSI attached for non-GPRS services before the procedure was initiated.

The MS shall delete any RAI, P-TMSI, P-TMSI signature and GPRS ciphering key sequence number stored, shall set the GPRS update status to GU3 ROAMING NOT ALLOWED (and shall store it according to section 4.1.3.2.9) and changes to state GMM-DEREGISTERED. The MS shall set the update status to U3 ROAMING NOT ALLOWED and shall delete any TMSI, LAI and ciphering key sequence number. The new MM state is MM IDLE.

The MS shall store the LAI or the PLMN identity in the appropriate forbidden list, i.e. in the "forbidden PLMN list" for cause #11, in the list of "forbidden location areas for regional provision of service" for cause #12 or in the list of "forbidden location areas for roaming" for cause #13. In case cause #11 or #13 was received, the MS shall perform a PLMN selection instead of a cell selection.

Other values are considered as abnormal cases. The specification of the MS behaviour in those cases is specified in section 4.7.3.2.5.

4.7.3.2.5 Abnormal cases in the MS

The abnormal cases specified in section 4.7.3.1.5 apply with the exceptions for case b in which in addition to the P-TMSI, P-TMSI signature, RAI, GPRS ciphering key sequence number the TMSI, LAI and ciphering key sequence number are kept if any.

4.7.3.2.6 Abnormal cases on the network side

The abnormal cases specified in section 4.7.3.1.6 apply with the following exception for cases a, c and d in the above referenced section:

a) Low layer failure

If a low layer failure occurs before the message ATTACH COMPLETE has been received from the MS and a new P-TMSI and/or TMSI has been assigned, the network shall consider both the old and new P-TMSI and/or TMSI as valid for a certain recovery time and shall not resent the message ATTACH ACCEPT. During this period the network may:

- consider the new P-TMSI and/or TMSI only as valid, if it is used by the MS in a subsequent message,
- use the identification procedure followed by a P-TMSI and/or TMSI reallocation procedure if the old P-TMSI and/or TMSI is used by the MS in a subsequent message.

c) T3350 time-out

On the first expiry of the timer, the network shall retransmit the ATTACH ACCEPT message and shall reset and restart timer T3350. This retransmission is repeated until the timer has expired four times, i.e. on the fifth expiry

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of timer T3350, the GPRS attach procedure shall be aborted. If a new P-TMSI or a new P-TMSI together with a new P-TMSI signature and/or TMSI were allocated in the ATTACH ACCEPT message, the network shall consider both the old and new P-TMSI each together with the corresponding P-TMSI signatures and/or the old and new TMSI as valid for a certain recovery time. During this period the network acts as specified for case a.

d) More than one ATTACH REQUEST received

If an ATTACH REQUEST message is received before a previously initiated GPRS attach procedure has resulted in a state transition to the state GMM-REGISTERED state and the indicated RAI differs from the RAI included in the previous ATTACH REQUEST message, the previously initiated GPRS attach procedure shall be aborted and the new GPRS attach procedure shall be progressed. If the RAI does not differ the ATTACH ACCEPT message shall be transmitted with the same P-TMSI and/or P-TMSI signature and/or TMSI as in the earlier message if the P-TMSI and/or TMSI reallocation shall be performed.

4.7.4 GPRS detach procedure

The GPRS detach procedure is used:

- to detach the IMSI for GPRS services only. Independent of the network operation mode, this procedure is used by all kind of GPRS MSs;
- as a combined GPRS detach procedure used by GPRS MSs operating in MS operation mode A or B to detach the IMSI for GPRS and non-GPRS services or for non-GPRS services only, if the network operates in network operation mode I; or
- in the case of a network failure condition to indicate to the MS that a re-attach with successive activation of previously active PDP contexts shall be performed.

After completion of a GPRS detach procedure or combined GPRS detach procedure for GPRS and non-GPRS services the GMM context is released.

The GPRS detach procedure shall be invoked by the MS if the MS is switched off, the SIM card is removed from the MS or if the GPRS or non-GPRS capability of the MS is disabled. The procedure may be invoked by the network to detach the IMSI for GPRS services. The GPRS detach procedure causes the MS to be marked as inactive in the network for GPRS services, non-GPRS services or both services.

4.7.4.1 MS initiated GPRS detach procedure

4.7.4.1.1 MS initiated GPRS detach procedure initiation

The GPRS detach procedure is initiated by the MS by sending a DETACH REQUEST message. The detach type information element may indicate "GPRS detach with switching off", "GPRS detach without switching off", "IMSI detach", "GPRS/IMSI detach with switching off" or "GPRS/IMSI detach without switching off". If the MS is not switched off, timer T3321 shall be started after the DETACH REQUEST message has been sent and state GMM-DEREGISTERED-INITIATED is entered. If the detach type information element value indicates "IMSI Detach" or "GPRS/IMSI Detach", state MM IMSI DETACH PENDING is entered.

4.7.4.1.2 MS initiated GPRS detach procedure completion for GPRS services only

When the DETACH REQUEST message is received by the network, the network shall send a DETACH ACCEPT message to the MS, if the detach cause IE value indicates that the detach request has not been sent due to switching off. If switching off was indicated, the procedure is completed when the network receives the DETACH REQUEST message. The network and the MS shall delete all PDP contexts and deactivate the logical link(s), if any have been established.

The MS is marked as inactive in the network for GPRS services; state GMM-DEREGISTERED is entered in the MS and the network.

NOTE: When the DETACH REQUEST message is received by the network, and if the detach cause IE value indicates that the detach is not due to power off, the authentication and ciphering procedure as well as the identification procedure may be performed.

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4.7.4.1.3 MS initiated combined GPRS detach procedure completion

When the DETACH REQUEST message is received by the network, a DETACH ACCEPT message shall be sent to the MS, if the detach cause IE value indicates that the detach request has not been sent due to switching off. Depending on the value of the detach type IE the following applies:

GPRS/IMSI detach:

The MS is marked as inactive in the network for GPRS and for non-GPRS services. The network and the MS shall delete all PDP contexts and deactivate the logical link(s), if any. States GMM-DEREGISTERED and MM NULL are entered in both the MS and the network.

IMSI detach:

The MS is marked as inactive in the network for non-GPRS services. State MM NULL is entered in the MS and the network.

4.7.4.1.4 Abnormal cases in the MS

The following abnormal cases can be identified:

a) T3321 time-out

On the first expiry of the timer, the MS shall retransmit the DETACH REQUEST message and shall reset and restart timer T3321. This retransmission is repeated until the timer has expired four times, i.e. on the fifth expiry of timer T3321, the GPRS detach procedure shall be aborted, the MS shall change to state:

- MM-NULL if IMSI detach was requested;
- GMM-DEREGISTERED if "GPRS detach" was requested;
- GMM-DEREGISTERED and MM-NULL if "GPRS/IMSI" detach was requested.

b) Lower layer failure before reception of DETACH ACCEPT message

The detach procedure is aborted and the MS shall change to state:

- MM-NULL if "IMSI detach" was requested;
- GMM-DEREGISTERED if "GPRS detach" was requested;
- GMM-DEREGISTERED and MM-NULL if "IMSI/GPRS" detach was requested.

c) Detach procedure collision

If the MS receives a DETACH REQUEST message before the MS initiated GPRS detach procedure has been completed, a DETACH ACCEPT message shall be sent to the network.

d) Detach and GMM common procedure collision

If the MS receives a message used in a GMM common procedure before the GPRS detach procedure has been completed this message shall be ignored and the GPRS detach procedure shall be progressed.

e) Change of cell into a new routing area

If a cell change into a new routing area occurs before an DETACH ACCEPT message has been received, the GPRS detach procedure shall be aborted and re-initiated after successfully performing a routing area updating procedure.

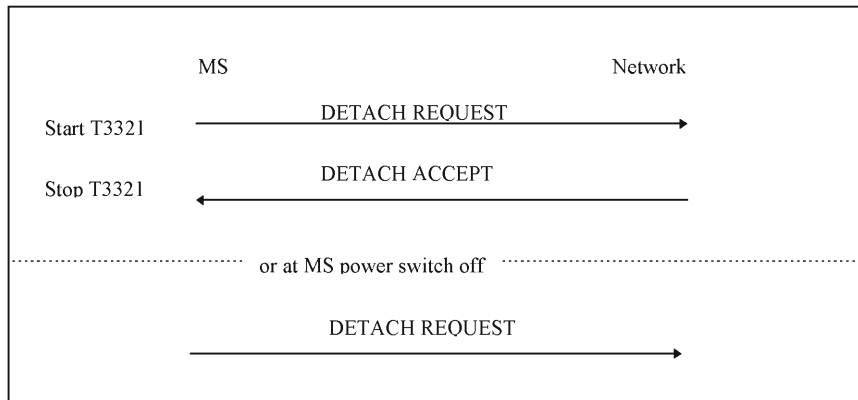


Figure 4.7.4/1 GSM 0408: MS initiated GPRS detach procedure

4.7.4.2 Network initiated GPRS detach procedure

4.7.4.2.1 Network initiated GPRS detach procedure initiation

The network initiates the GPRS detach procedure by sending a DETACH REQUEST message to the MS. The network shall start timer T3322, shall deactivate PDP contexts and the logical link(s), if any, and shall change to state GMM-DEREGISTERED-INITIATED. A detach type IE shall indicate that the network commands the MS to perform a new attach procedure and to reactivate PDP contexts, if any. In addition, the network may include a cause IE to specify the reason for the detach request.

4.7.4.2.2 Network initiated GPRS detach procedure completion

When receiving the DETACH REQUEST message, the MS shall deactivate all activated PDP contexts. The MS shall then send a DETACH ACCEPT message to the network and shall change state to GMM-DEREGISTERED. The MS shall, after the completion of the GPRS detach procedure, initiate a GPRS attach procedure if indicated by the network in the detach type IE. When the MS receives a cause IE, no specific action is required.

The network shall, upon receipt of the DETACH ACCEPT message, stop timer T3322 and shall change state to GMM-DEREGISTERED.

4.7.4.2.3 Abnormal cases on the network side

The following abnormal cases can be identified:

a) T3322 time-out

On the first expiry of the timer, the network shall retransmit the DETACH REQUEST message and shall start timer T3322. This retransmission is repeated until the timer has expired four times, i.e. on the fifth expiry of timer T3322, the GPRS detach procedure shall be aborted and the network changes to state GMM-DEREGISTERED.

b) Low layer failure

The GPRS detach procedure is aborted and the network changes to state GMM-DEREGISTERED.

c) GPRS detach procedure collision

If the network receives a DETACH REQUEST message with "switching off" indicated, before the network initiated GPRS detach procedure has been completed, both procedures shall be considered completed.

If the network receives a DETACH REQUEST message without "switching off" indicated, before the network initiated GPRS detach procedure has been completed, the network shall send a DETACH ACCEPT message to the MS.

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d) GPRS detach and GPRS attach procedure collision

If the network receives an ATTACH REQUEST message before the network initiated GPRS detach procedure has been completed, the network shall ignore the ATTACH REQUEST message, except the detach type IE value, sent in the DETACH REQUEST message, indicated that the MS shall perform a GPRS attach procedure. In this case, the GPRS attach procedure shall be progressed after the PDP contexts have been deleted.

e) GPRS detach and routing area updating procedure collision

If the network receives a ROUTING AREA UPDATE REQUEST message before the network initiated GPRS detach procedure has been completed, the routing area updating procedure is progressed. The detach procedure is aborted and re-initiated.

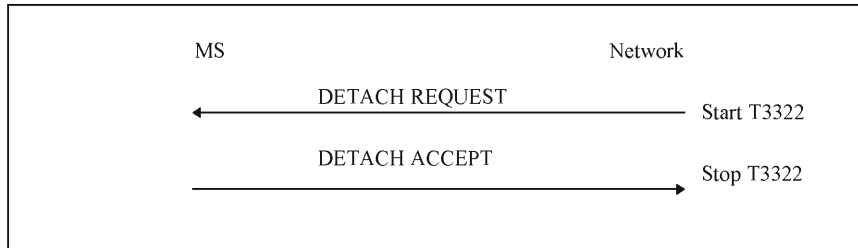


Figure 4.7.4/2 GSM 0408: Network initiated GPRS detach procedure

4.7.5 Routing area updating procedure

This procedure is used for:

- normal routing area updating to update the registration of the actual routing area of an MS in the network. This procedure is used by GPRS MSs in MS operation mode C and by GPRS MSs in MS operation modes A or B that are IMSI attached for GPRS and non-GPRS services;
- combined routing area updating to update the registration of the actual routing and location area of an MS in the network. This procedure is used by GPRS MSs in MS operation modes A or B that are IMSI attached for GPRS and non-GPRS services provided that the network operates in network operation mode I; or
- periodic routing area updating. This procedure is used by GPRS MSs in MS operation mode C and by GPRS MSs in MS operation modes A or B that are IMSI attached for GPRS and non-GPRS services;
- IMSI attach for non-GPRS services when the MS is IMSI attached for GPRS services. This procedure is used by GPRS MSs in MS operation modes A or B, if the network operates in network operation mode I.
- resuming GPRS services when the RR sublayer indicated a resumption failure after dedicated mode was left, see section 3.4.13.1.1.

Section 4.7.5.1 describes the routing area updating procedures for updating the routing area only. The combined routing area updating procedure used to update both the routing and location area is described in section 4.7.5.2.

The routing area updating procedure is always initiated by the MS. It is only invoked in state GMM-REGISTERED.

To limit the number of subsequently rejected routing area update attempts, a routing area updating attempt counter is introduced. The routing area updating attempt counter shall be incremented as specified in section 4.7.5.1.5. Depending on the value of the routing area updating attempt counter, specific actions shall be performed. The routing area updating attempt counter shall be reset when:

- a GPRS attach procedure is successfully completed; or
 - a routing area updating procedure is successfully completed;
- and additionally when the MS is in substate ATTEMPTING-TO-UPDATE:
- a new routing area is entered;

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- expiry of timer T3312; or
- at request from registration function.

The mobile equipment shall contain a list of "forbidden location areas for roaming", as well as a list of "forbidden location areas for regional provision of service". The handling of these lists is described in section 4.4.1.

User data transmission in the MS shall be suspended during the routing area updating procedure; user data reception shall be possible. User data transmission in the network may be suspended during the routing area updating procedure.

4.7.5.1 Normal and periodic routing area updating procedure

Periodic routing area updating is used to periodically notify the availability of the MS to the network. The value of the update type IE in the ROUTING AREA UPDATE REQUEST message shall indicate "periodic updating". The procedure is controlled in the MS by timer T3312. When timer T3312 expires, the periodic routing area updating procedure is started. Start and reset of timer T3312 is described in section 4.7.2.2.

The normal routing area updating procedure is initiated when the MS detects a change of the routing area in state GMM-REGISTERED or when the MS determines that GPRS resumption shall be performed. The ROUTING AREA UPDATE REQUEST message shall always be the first data sent by the MS when a routing area border is crossed. The routing area identification is broadcast on the broadcast channel(s). A normal routing area updating shall abort any ongoing GMM procedure. Aborted GMM procedures shall be repeated after the normal routing area updating procedure has been successfully performed. The value of the update type IE included in the message shall indicate "normal routing area updating".

4.7.5.1.1 Normal and periodic routing area updating procedure initiation

To initiate the normal routing area updating procedure, the MS sends the message ROUTING AREA UPDATE REQUEST to the network, starts timer T3330 and changes to state GMM-ROUTING-AREA-UPDATING-INITIATED. The message ROUTING AREA UPDATE REQUEST shall contain the P-TMSI signature when received within a previous ATTACH ACCEPT or ROUTING AREA UPDATE ACCEPT message.

4.7.5.1.2 GMM Common procedure initiation

The network may initiate GMM common procedures, e.g. the GMM authentication and ciphering procedure.

4.7.5.1.3 Normal and periodic routing area updating procedure accepted by the network

If the routing area updating request has been accepted by the network, a ROUTING AREA UPDATE ACCEPT message shall be sent to the MS. The network may assign a new P-TMSI and/or a new P-TMSI signature for the MS. If a new P-TMSI and/or P-TMSI have been assigned to the MS, it shall be included in the ROUTING AREA UPDATE ACCEPT message together with the routing area identification. The network shall, in this case, change to state GMM-COMMON-PROCEDURE-INITIATED and shall start the supervision timer T3350 as described in section 4.7.6.

If the LAI or PLMN identity contained in the ROUTING AREA UPDATE ACCEPT message is a member of any of the "forbidden" lists then any such entry shall be deleted.

Upon receipt of a ROUTING AREA UPDATE ACCEPT message, the MS stores the received routing area identification, stops timer T3330 and sets the GPRS update status to GUI UPDATED. If the message contains a P-TMSI, the MS shall use this P-TMSI as new temporary identity for GPRS services and shall store the new P-TMSI. If no P-TMSI was included by the network in the ROUTING AREA UPDATING ACCEPT message, the old P-TMSI shall be kept. Furthermore, the MS shall store the P-TMSI signature if received in the ROUTING AREA UPDATING ACCEPT message.

A ROUTING AREA UPDATE COMPLETE message shall be returned to the network if the ROUTING AREA UPDATE ACCEPT message contained:

- a P-TMSI; and/or
- LLC V(R) values (see 04.64 [76]).

In this case the LLC V(R) values valid in the MS, shall be included in the ROUTING AREA UPDATE COMPLETE message.

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4.7.5.1.4 Normal and periodic routing area updating procedure not accepted by the network

If the routing area updating cannot be accepted, the network sends a ROUTING AREA UPDATE REJECT message to the MS. An MS that receives a ROUTING AREA UPDATE REJECT message stops timer T3330 and enters state GMM-DEREGISTERED. The MS shall then take different actions depending on the received reject cause value:

3 (Illegal MS);

6 (Illegal ME).

The MS shall set the GPRS update status to GU3 ROAMING NOT ALLOWED (and shall store it according to section 4.1.3.2.9). Furthermore, it shall delete any P-TMSI, RAI and GPRS ciphering key sequence number and shall consider the SIM as invalid until switching off or the SIM is removed.

9 (MS identity cannot be derived by the network)

The MS shall set the GPRS update status to GU2 NOT UPDATED (and shall store it according to section 4.1.3.2.9), and shall delete any P-TMSI, P-TMSI signature, RAI and GPRS ciphering key sequence number. Subsequently, the MS may automatically initiate the GPRS attach procedure.

11 (PLMN not allowed)

12 (Location area not allowed)

13 (Roaming not allowed in this location area)

The MS shall delete any RAI or LAI, P-TMSI, P-TMSI signature and GPRS ciphering key sequence number, shall set the GPRS update status to GU3 ROAMING NOT ALLOWED (and shall store it according to section 4.1.3.2.9).

The MS shall store the LAI or the PLMN identity in the appropriate forbidden list, i.e. in the "forbidden PLMN list" for cause #11, in the list of "forbidden location areas for regional provision of service" for cause #12 or in the list of "forbidden location areas for roaming" for cause #13. If #11 or #13 was received, the MS shall perform a PLMN selection instead of a cell selection.

Other values are considered as abnormal cases. The specification of the MS behaviour in those cases is given in described in section 4.7.5.1.5.

4.7.5.1.5 Abnormal cases in the MS

The following abnormal cases can be identified:

a) Access barred because of access class control

The routing area updating procedure shall not be started. The MS stays in the current serving cell and applies the normal cell reselection process. The procedure is started as soon as possible and if still necessary, i.e. when the barred state is removed or because of a cell change.

b) Lower layer failure before the ROUTING AREA UPDATE ACCEPT or ROUTING AREA UPDATE REJECT message is received

The procedure shall be aborted. The MS shall keep, if any, the stored P-TMSI, RAI and GPRS ciphering key sequence number.

c) T3330 time-out

The procedure is restarted until the timer has expired four times, i.e. on the fifth expiry of timer T3330, the MS shall abort the procedure. The MS shall delete any RAI, P-TMSI, P-TMSI signature and GPRS ciphering key sequence number stored.

d) ROUTING AREA UPDATE REJECT, other causes than those treated in section 4.7.5.1.4

The MS shall keep, if any, the stored P-TMSI, P-TMSI signature, RAI and GPRS ciphering key sequence number.

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- e) If a routing area border is crossed, when the MS is in state GMM-ROUTING-AREA-UPDATE-INITIATED, the routing area updating procedure shall be aborted and re-initiated immediately.
- f) If a cell change occurs within the same RA, when the MS is in state GMM-ROUTING-AREA-UPDATE-INITIATED, the cell update procedure is performed, before completion of the routing area updating procedure.
- g) Routing area updating and detach procedure collision

If the MS receives a DETACH REQUEST message before the routing area updating procedure has been completed, the routing area updating procedure shall be aborted and the GPRS detach procedure shall be progressed.

- h) Routing area updating and P-TMSI reallocation procedure collision

If the MS receives a P-TMSI REALLOCATION REQUEST message before the routing area updating procedure has been completed, the P-TMSI reallocation procedure shall be aborted and the routing area updating procedure shall be progressed.

In cases b, c and d the MS shall proceed as follows:

Timer T3330 shall be stopped if still running. The routing area updating attempt counter shall be incremented.

If the routing area updating attempt counter is less than 4:

- the MS starts timer T3311 and changes state to GMM-REGISTERED.ATTEMPTING-TO-UPDATE.

If the routing area updating attempt counter is equal to 4:-

- the MS starts timer T3302 and changes state to GMM-DEREGISTERED.ATTEMPTING-TO-ATTACH.

4.7.5.1.6 Abnormal cases on the network side

The following abnormal cases can be identified:

- a) If a lower layer failure occurs before the message ROUTING AREA UPDATE COMPLETE has been received from the MS and a P-TMSI and/or PTMSI signature has been assigned, the network shall abort the procedure and shall consider both, the old and new P-TMSI and the corresponding P-TMSI signatures as valid for a certain recovery time. During this period the network may:

- use the IMSI for paging; and
- consider the new P-TMSI as valid if it is used by the MS in a subsequent message;
- use the identification procedure followed by a P-TMSI reallocation procedure if the old P-TMSI is used by the MS in a subsequent message.

- b) Protocol error

If the ROUTING AREA UPDATE REQUEST message has been received with a protocol error, the network shall return a ROUTING AREA UPDATE REJECT message with one of the following reject causes:

- #96: Mandatory information element error;
- #99: Information element non-existent or not implemented;
- #100: Conditional IE error;
- #111: Protocol error, unspecified.

- c) T3350 time-out

On the first expiry of the timer, the network shall retransmit the ROUTING AREA UPDATE ACCEPT message and shall reset and restart timer T3350. The retransmission is performed until the timer has expired four times, i.e. on the fifth expiry of timer T3350, the routing area updating procedure is aborted. Both, the old and the new P-TMSI and the corresponding P-TMSI signatures shall be considered to be occupied for a certain recovery time. During this period the network acts as described for case a above.

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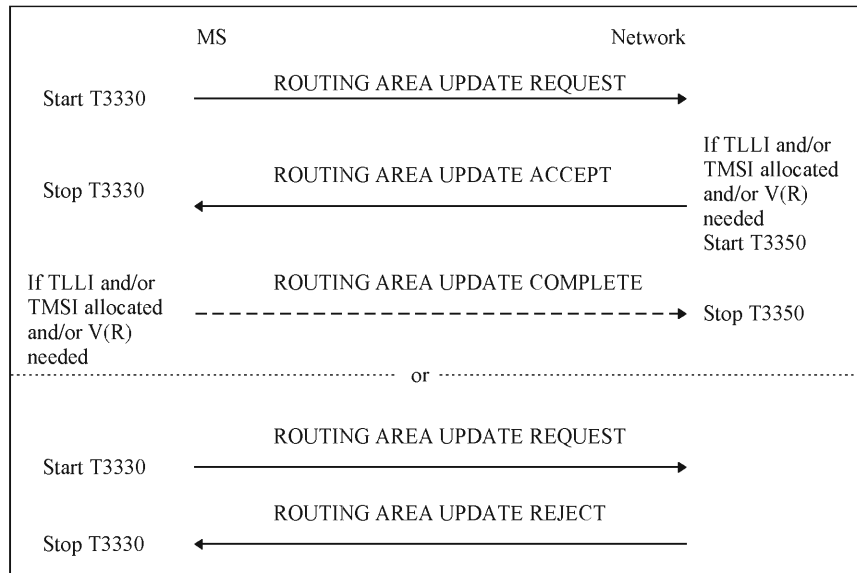


Figure 4.7.5/1 GSM 0408: Routing and combined routing area updating procedure

4.7.5.2 Combined routing area updating procedure

Within a combined routing area updating procedure the messages ROUTING AREA UPDATE ACCEPT and ROUTING AREA UPDATE COMPLETE carry information for the routing area updating and the location area updating.

4.7.5.2.1 Combined routing area updating procedure initiation

The combined routing area updating procedure is initiated only if the MS is in state GMM-REGISTERED and if the network operates in network operation mode I:

- when a GPRS MS that is IMSI attached for GPRS and non-GPRS services detects a change of the routing and location area in state GMM-REGISTERED and MM-IDLE; or
- when a GPRS MS that is IMSI attached for GPRS services wants to perform an IMSI attach for non-GPRS services; or
- after termination of a non-GPRS service via non-GPRS channels to update the association if the MS has changed the LA during that non-GPRS service transaction.

The routing and location area identification are broadcast on the broadcast channel(s). A combined routing area updating procedure shall abort any ongoing GMM procedure. Aborted GMM procedures shall be repeated after the combined routing area updating procedure has been successfully performed. The ROUTING AREA UPDATE REQUEST message shall always be the first message sent from the MS in the new routing area after routing area change.

To initiate a combined routing area updating procedure the MS sends the message ROUTING AREA UPDATE REQUEST to the network, starts timer T3330 and changes to state GMM-ROUTING-UPDATING-INITIATED and MM LOCATION UPDATING PENDING. The value of the update type IE in the message shall indicate "combined routing area updating".

GPRS MSs in MS operation modes A or B that are in an ongoing circuit-switched transaction, shall initiate the combined routing area updating procedure only after the circuit-switched transaction has been released, if the MS has changed the LA during the circuit-switched transaction.

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NOTE: A GPRS MS in MS operation mode A shall perform a normal routing area update procedure during an ongoing circuit-switched transaction and shall indicate this in the ROUTING AREA UPDATE REQUEST message.

4.7.5.2.2 GMM Common procedure initiation

The network may initiate GMM common procedures, e.g. the GMM authentication and ciphering procedure.

4.7.5.2.3 Combined routing area updating procedure accepted by the network

Depending on the value of the update result IE received in the ROUTING AREA UPDATE ACCEPT message, two different cases can be distinguished:

- Case 1) The update result IE value indicates "combined RA/LA": Routing and location area updating is successful;
- Case 2) The update result IE value indicates "RA only": Routing area updating is successful, but location area updating is not successful.

A ROUTING AREA UPDATE COMPLETE message shall be returned to the network if the ROUTING AREA UPDATE ACCEPT message contains:

- a P-TMSI and/or a TMSI; and/or
- LLC V(R) values (see 04.64 [76]).

In the latter case, the LLC V(R) values that are valid in the MS shall be included in the ROUTING AREA UPDATE COMPLETE message.

Case 1

The description for normal routing area update as specified in section 4.7.5.1.3 shall be followed. In addition, the following description for location area updating applies.

The handling at the receipt of the ROUTING AREA UPDATE ACCEPT depends on the value received in the update result IE as specified below.

The TMSI reallocation may be part of the combined routing area updating procedure. The TMSI allocated is then included in the ROUTING AREA UPDATE ACCEPT message together with the location area identification (LAI). The network shall, in this case, change to state GMM-COMMON-PROCEDURE-INITIATED and shall start the timer T3350 as described in section 4.7.6.

The MS, receiving a ROUTING AREA UPDATE ACCEPT message, stores the received location area identification, stops timer T3350, enters state MM IDLE and sets the update status to U1 UPDATED. If the ROUTING AREA UPDATE ACCEPT message contains an IMSI, the mobile station is not allocated any TMSI, and shall delete any TMSI accordingly. If the ROUTING AREA UPDATE ACCEPT message contains a TMSI, the MS shall use this TMSI as new temporary identity. The MS shall delete its old TMSI and shall store the new one. If neither a TMSI nor an IMSI has been included by the network in the ROUTING AREA UPDATE ACCEPT message, the old TMSI, if any is available, shall be kept.

The network receiving a ROUTING AREA UPDATE COMPLETE message stops timer T3350, changes to GMM-REGISTERED state and considers the new TMSI as valid.

Case 2

The description for normal routing area update as specified in section 4.7.5.1.3 shall be followed. In addition, the following description for location area updating applies.

The MS receiving the ROUTING AREA UPDATE ACCEPT message takes one of the following actions depending on the reject cause:

- #16 (MSC temporarily not reachable)

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A GPRS MS operating in MS operation mode A shall then perform an IMSI attach for non-GPRS services by use of the MM IMSI attach procedure; a GPRS MS operating in MS operation mode B may then perform an IMSI attach for non-GPRS services by use of the MM IMSI attach procedure.

Other values are considered as abnormal cases. The specification of the MS behaviour in those cases is specified in section 4.7.5.2.5.

4.7.5.2.4 Combined routing area updating not accepted by the network

If the combined routing area updating cannot be accepted, the network sends a ROUTING AREA UPDATE REJECT message to the MS. An MS that receives a ROUTING AREA UPDATE REJECT message stops timer T3330 and enters state GMM-DEREGISTERED and MM IDLE. The MS shall then take different actions depending on the received reject cause:

3 (Illegal MS); or

6 (Illegal ME).

The MS shall set the GPRS update status to GU3 ROAMING NOT ALLOWED and the update status to U3 ROAMING NOT ALLOWED (and shall store it according to section 4.1.3.2.9). Furthermore, it shall delete any P-TMSI, P-TMSI signature, TMSI, RAI, LAI, ciphering key sequence number and GPRS ciphering key sequence number and shall consider the SIM as invalid until switching off or the SIM is removed.

9 (MS identity cannot be derived by the network)

The MS shall set the GPRS update status to GU2 NOT UPDATED (and shall store it according to section 4.1.3.2.9), and shall delete any P-TMSI, P-TMSI signature, RAI and GPRS ciphering key sequence number. Subsequently, the MS may automatically initiate the GPRS attach procedure.

12 (Location area not allowed)

13 (Roaming not allowed in this location area)

The MS shall set the GPRS update status to GU3 ROAMING NOT ALLOWED and the update status to U3 ROAMING NOT ALLOWED (and shall store it according to section 4.1.3.2.9). Furthermore, it shall delete any P-TMSI, P-TMSI signature, TMSI, RAI, LAI, ciphering key sequence number and GPRS ciphering key sequence number.

The MS shall store the LAI or the PLMN identity in the appropriate forbidden list, i.e. in the list of "forbidden location areas for regional provision of service" for cause #12 or in the list of "forbidden location areas for roaming" for cause #13. In case #13 was received, the MS shall then perform a PLMN selection instead of a cell selection.

Other values are considered as abnormal cases. The specification of the MS behaviour in those cases is described in section 4.7.5.2.5.

4.7.5.2.5 Abnormal cases in the MS

The abnormal cases specified in section 4.7.5.1.5 apply with the exceptions for cases b, c and d in which in addition to the P-TMSI, RAI, GPRS ciphering key sequence number the TMSI, LAI and ciphering key sequence number are kept if any.

4.7.5.2.6 Abnormal cases on the network side

The abnormal cases specified in section 4.7.5.1.6 apply with the exceptions for cases a and c in which in addition to the P-TMSI and P-TMSI signature the TMSI shall be considered occupied.

4.7.6 P-TMSI reallocation procedure

A temporary mobile station identity for GPRS services, the Packet-TMSI (P-TMSI), is used for identification within the radio interface signalling procedures. The structure of the P-TMSI is specified in GSM 03.03 [10]. The P-TMSI has

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significance only within a routing area. Outside the routing area it has to be combined with the routing area identification (RAI) to provide for an unambiguous identity.

The purpose of the P-TMSI reallocation procedure is to provide identity confidentiality, i.e. to protect a user against being identified and located by an intruder (see GSM 02.09 [5] and 03.20 [34]).

Usually, P-TMSI reallocation is performed at least at each change of a routing area. (Such choices are left to the network operator).

The reallocation of a P-TMSI is performed by the unique procedure defined in this section. This procedure can only be initiated by the network in state GMM-REGISTERED.

P-TMSI can also be implicitly reallocated in the attach or routing area updating procedures. The implicit reallocation of a P-TMSI is described in the corresponding sections.

NOTE : Normally, the P-TMSI reallocation will take place in conjunction with another GMM procedure, e.g. at routing area updating (see GSM 09.02 [37]).

4.7.6.1 P-TMSI reallocation initiation by the network

The network initiates the P-TMSI reallocation procedure by sending a P-TMSI REALLOCATION COMMAND message to the MS and starts the timer T3350.

The P-TMSI REALLOCATION COMMAND message contains a new combination of P-TMSI and RAI allocated by the network.

The network shall not send any user data during the P-TMSI reallocation procedure.

4.7.6.2 P-TMSI reallocation completion by the MS

Upon receipt of the P-TMSI REALLOCATION COMMAND message, the MS stores the Routing Area Identifier (RAI) and the P-TMSI and sends a P-TMSI REALLOCATION COMPLETE message to the network.

4.7.6.3 P-TMSI reallocation completion by the network

Upon receipt of the P-TMSI REALLOCATION COMPLETE message, the network stops the timer T3350 and considers the new P-TMSI as valid and the old one as deleted.

The GMM layer shall notify the LLC layer that the P-TMSI has been changed (see GSM 04.64 [76]).

4.7.6.4 Abnormal cases in the MS

The following abnormal cases can be identified:

a) Lower layer failure

The MS shall consider the new P-TMSI and new RAI as valid and the old P-TMSI and old RAI as deleted as soon as another message containing a new P-TMSI (e.g. ROUTING AREA UPDATE ACCEPT) is correctly received. However, it should be noted that the MS should be able to handle packets with old P-TMSI and old RAI for a certain time to cope with delayed packets. Any lower layer failure at a later stage shall not have any impact on the P-TMSI and RAI storage.

4.7.6.5 Abnormal cases on the network side

The following abnormal cases can be identified:

a) Lower layer failure

If a lower layer failure is detected before the P-TMSI REALLOCATION COMPLETE message is received, both the old and the new P-TMSI shall 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. Upon response from the MS, the P-TMSI reallocation is restarted;
- consider the new P-TMSI as valid if it is used by the MS; and
- use the identification procedure followed by a new P-TMSI reallocation if the MS uses the old P-TMSI.

b) Expiry of timer T3350

The P-TMSI reallocation procedure is supervised by the timer T3350. The network shall, on the first expiry of timer T3350, reset and restart timer T3350 and shall retransmit the P-TMSI REALLOCATION COMMAND. This retransmission is repeated until the timer has expired four times, i.e. on the fifth expiry of timer T3350, the network shall abort the reallocation procedure and shall follow the rules for case a as described above.

c) P-TMSI reallocation and GPRS attach procedure collision

If the network receives an ATTACH REQUEST message before the ongoing P-TMSI reallocation procedure has been completed the network shall proceed with the GPRS attach procedure after deletion of the GMM context.

d) P-TMSI reallocation and an MS initiated GPRS detach procedure collision

If the network receives a DETACH REQUEST message before the ongoing P-TMSI reallocation procedure has been completed, the network shall abort the P-TMSI reallocation procedure and shall progress the GPRS detach procedure.

e) P-TMSI reallocation and a routing area updating procedure collision

If the network receives a ROUTING AREA UPDATE REQUEST message before the ongoing P-TMSI reallocation procedure has been completed, the network shall abort the P-TMSI reallocation procedure and shall progress the routing area updating procedure. The network may then perform a new P-TMSI reallocation.

If there are different new P-TMSI included in subsequent P-TMSI REALLOCATION COMMAND messages, due to an aborted or repeated P-TMSI reallocation procedure, the MS always regards the newest and its existing PTMSI as valid for the recovery time.

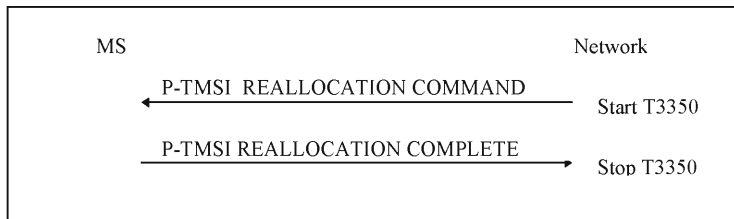


Figure 4.7.6/1 GSM 04.08: P-TMSI reallocation procedure

4.7.7 Authentication and ciphering procedure

The purpose of the authentication and ciphering procedure is threefold:

- First, to permit the network to check whether the identity provided by the MS is acceptable or not see GSM 03.20 [13]); and
- Second, to provide parameters enabling the MS to calculate a new GPRS ciphering key; and
- Third, to let the network set the ciphering mode (ciphering/no ciphering) and algorithm.

The cases in which the authentication and ciphering procedure shall be used are defined in GSM 02.09 [5].

The authentication and ciphering procedure is always initiated and controlled by the network. It shall be performed in a non ciphered mode because of the following reasons:

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- the network cannot decipher a ciphered AUTHENTICATION AND CIPHERING RESPONSE from an unauthorised MS and put it on the black list; and
- to be able to define a specific point in time from which on a new GPRS ciphering key should be used instead of the old one.

The network should not send any user data during the authentication and ciphering procedure.

4.7.7.1 Authentication and ciphering initiation by the network

The network initiates the authentication and ciphering procedure by transferring an AUTHENTICATION AND CIPHERING REQUEST message across the radio interface and starts timer T3360. The AUTHENTICATION AND CIPHERING REQUEST message shall contain all parameters necessary to calculate the response parameters (see GSM 03.20 [13]). It also contains the GPRS ciphering key sequence number, allocated to the GPRS ciphering key, a parameter indicating whether ciphering shall be used or not, and the GPRS ciphering algorithm.

Additionally, the network may request the MS to include its IMEISV in the AUTHENTICATION AND CIPHERING RESPONSE message.

4.7.7.2 Authentication and ciphering response by the MS

An MS that is attached to GPRS shall be ready to respond upon an AUTHENTICATION AND CIPHERING REQUEST message at any time. Upon receipt of the message, it processes the challenge information and sends an AUTHENTICATION AND CIPHERING RESPONSE message to the network. The new GPRS ciphering key calculated from the challenge information shall overwrite the previous one. It shall be stored and shall be loaded into the ME before the AUTHENTICATION AND CIPHERING RESPONSE message is transmitted. The GPRS ciphering key sequence number shall be stored together with the calculated key.

The GMM layer shall notify the LLC layer if ciphering shall be used or not and if yes which algorithm and GPRS ciphering key that shall be used (see GSM 04.64 [76]).

4.7.7.3 Authentication and ciphering completion by the network

Upon receipt of the AUTHENTICATION AND CIPHERING RESPONSE message, the network stops the timer T3360 and checks the validity of the response (see GSM 03.20 [13]).

The GMM layer shall notify the LLC sublayer if ciphering shall be used or not and if yes which algorithm and GPRS ciphering key that shall be used (see GSM 04.64 [76]).

4.7.7.4 GPRS 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 GPRS ciphering key can be computed given the secret key associated to the IMSI.

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

The MS stores this number with the key, and includes the corresponding sequence number in the ROUTING AREA UPDATE REQUEST and ATTACH REQUEST messages. If the sequence number is deleted, the associated key shall be considered as invalid.

The network may choose to start ciphering with the stored key (under the restrictions given in GSM 02.09) if the stored sequence number and the one given from the MS are equal and the previously negotiated ciphering algorithm is known and supported in the network. When ciphering is requested at GPRS attach, the authentication and ciphering procedure shall be performed since the MS does not store the ciphering algorithm at detach.

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4.7.7.5 Unsuccessful authentication and ciphering

If authentication and ciphering fails, i.e. if the response is not valid, the network considers whether the MS has used the P-TMSI or the IMSI for identification.

- If the P-TMSI has been used, the network may decide to initiate the identification procedure. If the IMSI given by the MS differs from the one the network had associated with the P-TMSI, the authentication should be restarted with the correct parameters. If the IMSI provided by the MS 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 AND CIPHERING REJECT message should be transferred to the MS.

After having sent this message, the network shall enter the state GMM-DEREGISTERED.

Upon receipt of an AUTHENTICATION AND CIPHERING REJECT message, the MS shall set the GPRS update status to GU3 ROAMING NOT ALLOWED and shall delete the P-TMSI, P-TMSI signature, RAI and GPRS ciphering key sequence number stored. If available, also the TMSI, LAI, ciphering key sequence number shall be deleted and the update status shall be set to U3 ROAMING NOT ALLOWED. The SIM shall be considered as invalid until switching off or the SIM is removed.

If the AUTHENTICATION AND CIPHERING REJECT message is received, the MS shall abort any GMM procedure, shall delete queued LLC frames (if any), shall stop the timers T3310 and T3330 (if running) and shall enter state GMM-DEREGISTERED.

4.7.7.6 Abnormal cases on the network side

The following abnormal cases can be identified:

a) Lower layer failure

Upon detection of a lower layer failure before the AUTHENTICATION AND CIPHERING RESPONSE is received, the network shall enter the state GMM-DEREGISTERED.

b) Expiry of timer T3360

The network shall, on the first expiry of the timer T3360, retransmit the AUTHENTICATION AND CIPHERING REQUEST and shall reset and start timer T3360. This retransmission is repeated until the timer has expired four times, i.e. on the fifth expiry of timer T3360, the procedure shall be aborted and the network shall enter the state GMM-DEREGISTERED.

c) Collision of an authentication and ciphering procedure with a GPRS attach procedure

If the network receives an ATTACH REQUEST message before the ongoing authentication procedure has been completed, the network shall abort the authentication and ciphering procedure and proceed with the new GPRS attach procedure.

d) Collision of an authentication and ciphering procedure with a GPRS detach procedure

If the network receives a DETACH REQUEST message before the ongoing authentication and ciphering procedure has been completed, the network shall abort the authentication and ciphering procedure and shall progress the GPRS detach procedure.

e) Collision of an authentication and ciphering procedure with a routing area updating procedure

If the network receives a ROUTING AREA UPDATE REQUEST message before the ongoing authentication procedure has been completed, the network shall progress both procedures.

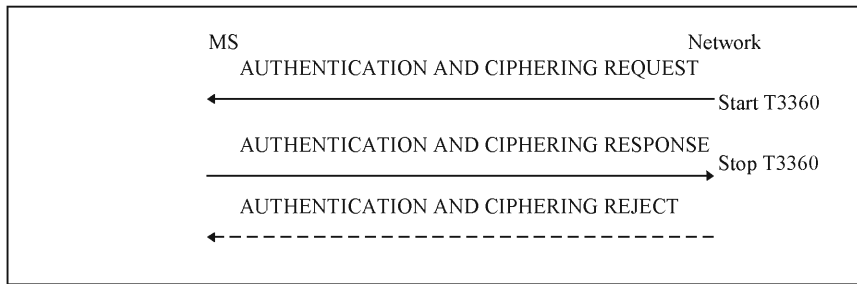


Figure 4.7.7/1 GSM 04.08: Authentication and ciphering procedure

4.7.8 Identification procedure

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

4.7.8.1 Identification initiation by the network

The network initiates the identification procedure by transferring an IDENTITY REQUEST message to the MS and starts the timer T3370. The IDENTITY REQUEST message specifies the requested identification parameters in the identity type information element.

4.7.8.2 Identification response by the MS

An MS that has been attached to GPRS shall be ready to respond to an IDENTITY REQUEST message at any time.

Upon receipt of the IDENTITY REQUEST message the MS sends back an IDENTITY RESPONSE message. The IDENTITY RESPONSE message shall contain the identification parameters as requested by the network.

4.7.8.3 Identification completion by the network

Upon receipt of the IDENTITY RESPONSE the network shall stop timer T3370.

4.7.8.4 Abnormal cases on the network side

The following abnormal cases can be identified:

a) Lower layer failure

Upon detection of a lower layer failure before the IDENTITY RESPONSE is received, the network shall abort any ongoing GMM procedure.

b) Expiry of timer T3370

The identification procedure is supervised by the network by the timer T3370. The network shall, on the first expiry of the timer T3370, retransmit the IDENTITY REQUEST message and reset and restart the timer T3370. This retransmission is repeated until the timer has expired four times, i.e. on the fifth expiry of timer T3370, the network shall abort the identification procedure and any ongoing GMM procedure.

c) Collision of an identification procedure with a GPRS attach procedure

If the network receives an ATTACH REQUEST message before the ongoing identification procedure has been completed, the network shall proceed with the GPRS attach procedure.

d) Collision of an identification procedure with an MS initiated GPRS detach procedure

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If the network receives a DETACH REQUEST message before the ongoing identification procedure has been completed, the network shall abort the identification procedure and shall progress the GPRS detach procedure.

e) Collision of an identification procedure with a routing area updating procedure

If the network receives a ROUTING AREA UPDATE REQUEST message before the ongoing identification procedure has been completed, the network shall progress both procedures.

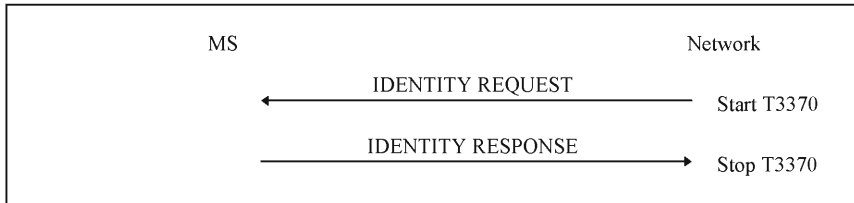


Figure 4.7.8/1 GSM 04.08: Identification procedure

4.7.9 Paging procedure

4.7.9.1 Paging for GPRS services

Paging is used by the network to identify the cell the MS has currently selected. The network shall initiate the paging procedure for GPRS services when GMM signalling messages or user data is pending to be sent to the MS while the STANDBY timer is running. The network may page only GPRS MSs which are GMM-REGISTERED and identified by a local P-TMSI or an IMSI.

The network may also initiate the paging procedure at an indication of a lower layer failure and in the course of a network failure recovery procedure.

To initiate the procedure the GMM entity requests the RR sublayer to start paging (see chapter 3 and GSM 04.60 [75]) and starts timer T3313. Upon reception of a paging indication, the MS shall respond to the paging (see GSM 04.07 [20] and GSM 03.60 [74]).

If the MS was paged by the network with the IMSI, the MS shall delete any RAI, P-TMSI, P-TMSI signature and GPRS ciphering key sequence number stored. It shall set the GPRS update status to GU2 NOT UPDATED and shall change to state GMM-DEREGISTERED. The MS shall then perform a GPRS attach or combined GPRS attach procedure.

The network shall stop timer T3313 when a response is received from the MS and shall start the READY timer. When the timer T3313 expires the network may reinitiate paging.

4.7.9.2 Paging for non-GPRS services

The network may initiate the paging procedure for non-GPRS services when the MS is IMSI attached for non-GPRS services. To initiate the procedure the GMM entity requests the RR sublayer to initiate paging (see chapter 3 and GSM 04.60 [75]) for non-GPRS services. The MS identity used for paging shall be the allocated TMSI if acknowledged by the MS, otherwise the IMSI.

4.7.10 Receiving a GMM STATUS message by a GMM entity

If the MS receives a GMM 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 GMM STATUS message in the network are an implementation dependent option.

4.7.11 GMM support for anonymous access

The GMM-AA entity within the MM sublayer (see GSM 04.07) supports SM message routing for anonymous PDP context handling independently of the GMM procedures described throughout section 4.7 as described in section 6.1.1.1. There are no dedicated signalling procedures specified for the GMM-AA entity.

An AA-READY timer is implemented in the GMM-AA entity. This timer is used to supervise the time an anonymous access may be active without user data transfer.

4.7.11.1 MS side

The AA-READY timer value shall either be the default value or a value set by the network and sent to the MS by means of an SM message. The READY timer shall be reset and restarted by the MS when user data is sent. When the AA-READY timer expires or a routing area border is crossed, the MS shall deactivate the anonymous access locally, i.e. no signalling messages are exchanged between the MS and the network.

While the AA-READY timer is running, the MS shall perform cell updates when a new cell is selected within the same RA.

4.7.11.2 Network side

The AA-READY timer value shall either be the default value or a value received from the MS and possibly modified by the network and sent to the MS by means of an SM message. The AA-READY timer shall be reset and restarted by the network when valid user data is received. When the AA-READY timer expires, the network shall deactivate the anonymous access locally, i.e. no signalling messages are exchanged between the network and the MS.

4.7.12 GMM Information procedure

The GMM information message support is optional in the network. The MM information procedure may be invoked by the network at any time during an established GMM context.

4.7.12.1 GMM information procedure initiation by the network

The GMM information procedure consists only of the GMM INFORMATION message sent from the network to the mobile station. During an established GMM context, the network may send none, one, or more GMM INFORMATION messages to the mobile station. If more than one GMM INFORMATION message is sent, the messages need not have the same content.

4.7.12.2 GMM information procedure in the mobile station

When the mobile station (supporting the GMM information message) receives an GMM INFORMATION message, it shall accept the message and optionally use the contents to update appropriate information stored within the mobile station.

If the mobile station does not support the GMM information message the mobile station shall ignore the contents of the message and return an GMM STATUS message with cause #97.

5 Elementary procedures for circuit-switched Call Control

5.1 Overview

5.1.1 General

This section describes the call control (CC) protocol, which is one of the protocols of the Connection Management (CM) sublayer (see GSM 04.07).

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Every mobile station must support the call control protocol. If a mobile station does not support any bearer capability at all then it shall respond to a SETUP message with a RELEASE COMPLETE message as specified in section 5.2.2.2.

In the call control protocol, more than one CC entity are defined. Each CC entity is independent from each other and shall communicate with the correspondent peer entity using its own MM connection. Different CC entities use different transaction identifiers.

With a few exceptions this Technical Specification describes the call control protocol only with regard to two peer entities. The call control entities are described as communicating finite state machines which exchange messages across the radio interface and communicate internally with other protocol (sub)layers. This description is only normative as far as the consequential externally observable behaviour is concerned.

Certain sequences of actions of the two peer entities compose "elementary procedures" which are used as a basis for the description in this section. These elementary procedures may be grouped into the following classes:

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

The terms "mobile originating" or "mobile originated" (MO) are used to describe a call initiated by the mobile station. The terms "mobile terminating" or "mobile terminated" (MT) are used to describe a call initiated by the network.

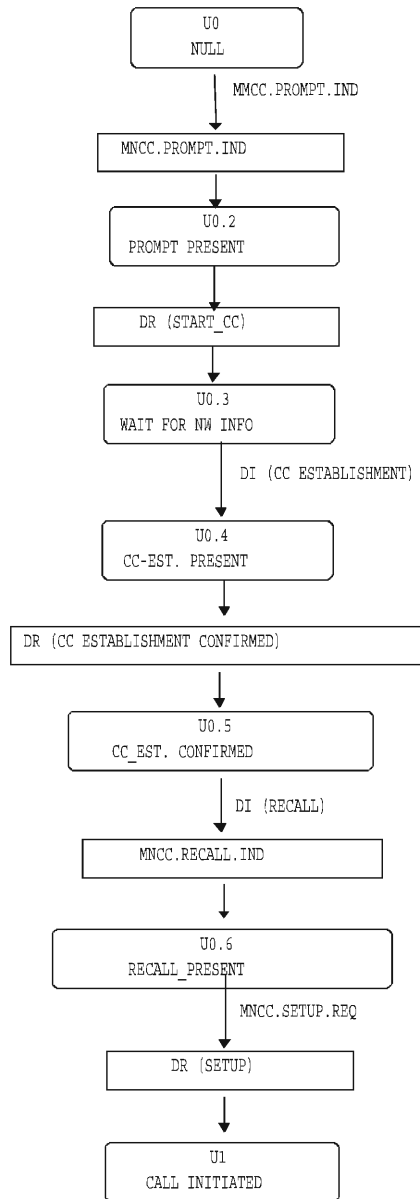
Figure 5.1a/GSM 04.08 gives an overview of the main states and transitions on the mobile station side.

The MS side extension figure 5.1a.1/GSM 04.08 shows how for the Network Initiated MO call the MS reaches state U1.0 from state U0 \$(CCBS)\$.

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

The Network side extension figure 5.1b.1/GSM 04.08 shows for Network Initiated MO Calls the Network reaches state N1.0 from state N0 \$(CCBS)\$.

Figure 5.1a.1/GSM 04.08
Overview call control protocol/MS side, extension:



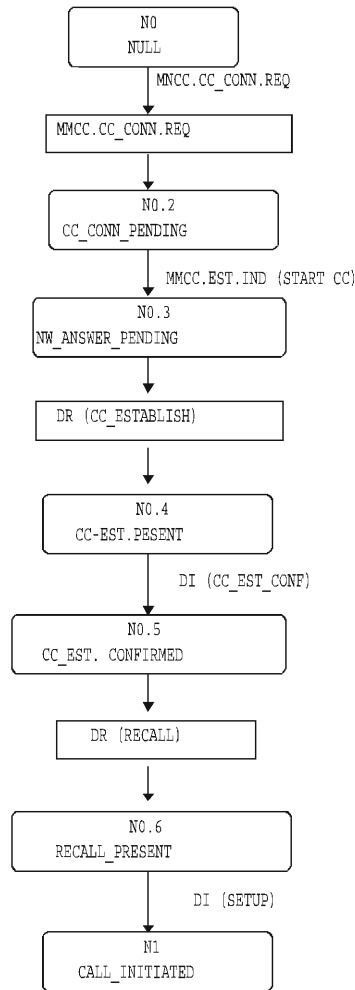


Figure 5.1b.1/GSM 04.08 Overview call control protocol/Network side, extension:

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: States U0.1, U0.2, U0.3, U0.4, U0.5, U0.6, U26, and U27 are GSM specific. All other states are ITU-T defined.

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.

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5.1.2.1.2a CC prompt present (U0.2) \$(CCBS)\$

This state exists for a mobile originating call when the network has prompted the mobile station to establish a CC connection but the mobile station has not yet responded.

NOTE: This state is transient.

5.1.2.1.2b Wait for network information (U0.3) \$(CCBS)\$

This state exists for a mobile originating call when the mobile station has responded to the prompt from the network to establish a CC connection and the mobile station is waiting for further information from the network.

5.1.2.1.2c CC-Establishment present (U0.4) \$(CCBS)\$

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

NOTE: This state is transient.

5.1.2.1.2d CC-Establishment confirmed (U0.5) \$(CCBS)\$

This state exists for a mobile originating call when the mobile station has sent the acknowledgement that the mobile station has received all the CC information that is needed.

5.1.2.1.2e Recall present (U0.6) \$(CCBS)\$

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

NOTE: This state is transient.

5.1.2.1.3 Call initiated (U1)

This state exists for a mobile originating call, when the MS 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 waiting to be awarded the call.

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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 MS has answered the call. This state exists for a mobile originating call when the MS 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 MS has requested the network 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 not yet sent a response to this request.

5.1.2.2 Network call states

NOTE: States N0.1, N0.2, N0.3, N0.4, N0.5, N0.6, N26, N27, N28, N3a, N4,a, N7a, and N9a are GSM specific. All other states are CCITT defined.

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.

5.1.2.2.2a CC connection pending (N0.2) \$(CCBS)\$

This state exists for a mobile originating call when the network has requested the mobile station to establish a CC connection.

5.1.2.2.2b Network answer pending (N0.3) \$(CCBS)\$

This state exists for a mobile originating call when the mobile station has established a CC connection upon the request of the network, but the network has not yet informed the mobile station of the reason for the network's action.

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5.1.2.2.2c CC-Establishment present (N0.4) \$(CCBS)\$

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

5.1.2.2.2d CC-Establishment confirmed (N0.5) \$(CCBS)\$

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

5.1.2.2.2e Recall present (N0.6) \$(CCBS)\$
This state exists for a mobile originating call when the network has sent a recall request but has not yet received a satisfactory response.

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 Not used

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 to network connection.

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5.1.2.2.13 Release request (N19)

This state exists when the network has requested the MS 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 mobile station.

5.2 Call establishment procedures

Establishment of a call is initiated by request of upper layer in either the mobile station or the network; it consists of:

- the establishment of a CC connection between the mobile station and the network;
- the activation of the codec or interworking function.

Whenever it is specified in GSM 04.08, section 5 that the mobile station shall attach the user connection, this means that the mobile station shall activate the codec or interworking function as soon as an appropriate channel is available. The mobile station shall de-activate the codec or interworking function whenever an appropriate channel is no longer available. As soon as an appropriate channel is (again) available, the codec or interworking function shall be re-activated. If a new order to attach the user connection is received, the new order shall supersede the previous one.

A channel shall be considered as appropriate if it is consistent with the possibly negotiated bearer capability applicable for the actual phase of the call. The mobile station shall not consider a channel as not appropriate because the type of the channel (full rate/half rate) is not the preferred one. If:

- the user connection has to be attached but no appropriate channel is available for a contiguous time of 30 seconds; or if
- the codec or interworking function is de-activated for a contiguous time of 30 seconds;

then the mobile station may initiate call clearing.

Upon request of upper layers to establish a call, restricting conditions for the establishment of the call are examined. These restricting conditions concern the states of parallel CC entities and are defined elsewhere. If these restricting conditions are fulfilled, the call establishment is rejected. Otherwise a CC entity in state U0, "null", is selected to establish the call. It initiates the establishment by requesting the MM sublayer to establish an MM connection.

5.2.1 Mobile originating call establishment

The call control entity of the mobile station initiates establishment of a CC connection by requesting the MM sublayer to establish a mobile originating MM connection and entering the "MM connection pending" state. There are two kinds of a mobile originating call: basic call and emergency call. The request to establish an MM connection shall contain a parameter to specify whether the call is a basic or an emergency call. This information may 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.

For mobile stations supporting eMLPP basic calls may optionally have an associated priority level as defined in GSM 03.67. This information may also lead to specified qualities of service to be provided by the MM sublayers.

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While being in the "MM connection pending" state, the call entity of the mobile station may cancel the call prior to sending the first call control message according to the rules given in section 4.5.1.7.

Having entered the "MM connection pending" state, upon MM connection establishment, the call control entity of the mobile station sends a setup message to its peer entity. This setup message is

- a SETUP message, if the call to be established is a basic call, and
- an EMERGENCY SETUP message, if the call to be established is an emergency call.

It then enters the "call initiated" state. Timer T303 is not stopped.

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

If timer T303 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.

5.2.1.1 Call initiation

The "call initiated" state is supervised by timer T303. For normal MO calls, this timer will have already been started after entering the "MM connection pending" state. For network-initiated MO calls this timer will be started in the recall present state as defined in section 5.2.3.4

When the call control entity of the mobile station is in the "call initiated" state and if it receives:

- i) a CALL PROCEEDING message, it shall proceed as described in section 5.2.1.3;
- ii) an ALERTING message, it shall proceed as described in section 5.2.1.5;
- iii) a CONNECT message, it shall proceed as described in section 5.2.1.6;
- iv) a RELEASE COMPLETE message it shall proceed as described in section 5.2.1.2.

Abnormal case:

- 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.

5.2.1.2 Receipt of a setup message

In the "null" or "recall present" states, upon receipt of a setup message (a SETUP message or an EMERGENCY SETUP message, see section 5.2.1.1), the call control entity of the network enters the "call initiated" state. It shall then analyse the call information contained in the setup message.

- i) If, following the receipt of the setup message, the call control entity of the network determines 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 section 5.4 with one of the following cause values:
 - # 1 "unassigned (unallocated) number"
 - # 3 "no route to destination"
 - # 22 "number changed"
 - # 28 "invalid number format (incomplete number)"
- ii) If, following the receipt of the setup message, the call control entity of the network determines that a requested service is not authorized or is not available, it shall initiate call clearing in accordance with section 5.4.2 with one of the following cause values:
 - # 8 "operator determined barring",
 - # 57 "bearer capability not authorized",

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

iii) Otherwise, the call control entity of the network shall either:

- send a CALL PROCEEDING message to its peer entity to indicate that the call is being processed; and enter the "mobile originating call proceeding" state.
- or: send an ALERTING message to its peer entity to indicate that alerting has been started at the called user side; and enter the "call received" state.
- or: send a CONNECT message to its peer entity to indicate that the call has been accepted at the called user side; and enter the "connect request" state.

The call control entity of the network may insert bearer capability information element(s) in the CALL PROCEEDING message to select options presented by the mobile station in the Bearer Capability information element(s) of the SETUP message. The bearer capability information element(s) shall contain the same parameters as received in the SETUP except those presenting a choice. Where choices were offered, appropriate parameters indicating the results of those choices shall be included.

The CALL_PROCEEDING message may also contain the priority of the call in the case where eMLPP is applied and where the network has assigned a different priority to the call than that requested by the user, or where the user has not requested a priority and the network has assigned a default priority. Mobile stations supporting eMLPP shall indicate this priority level to higher sublayers and store this information for the duration of the call for further action. Mobile stations not supporting eMLPP shall ignore this information element if provided in a CALL PROCEEDING message.

The call control entity of the network having entered the "mobile originating call proceeding" state, the network may initiate the assignment of a traffic channel according to section 5.2.1.9 (early assignment).

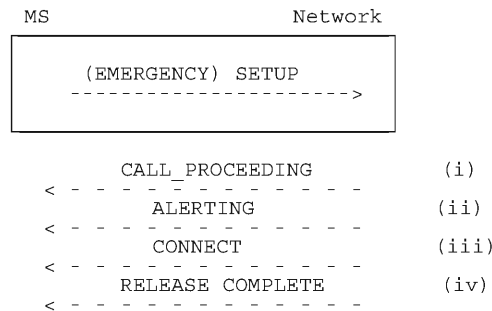


Figure 5.2/GSM 04.08 Mobile originated call initiation and possible subsequent responses.

5.2.1.3 Receipt of a CALL PROCEEDING message

Having entered the "call initiated" state, when the call control entity of the mobile station receives a CALL PROCEEDING message, it shall stop timer T303; start timer T310 unless

- the CALL PROCEEDING message contains a *progress indicator* IE specifying progress description #1, #2, or #64; or
- it has received a PROGRESS message containing a *progress indicator* IE specifying progress description #1, #2, or #64 prior to the CALL PROCEEDING message

and enter the "mobile originating call proceeding" state.

Abnormal case:

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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 5.4.

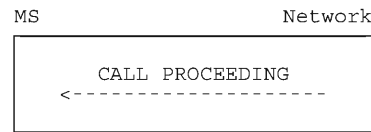


Figure 5.3/GSM 04.08 Call proceeding sequence at mobile originating call establishment

5.2.1.4 Notification of progressing mobile originated call

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.

5.2.1.4.1 Notification of interworking in connection with mobile originated call establishment

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; the call may also return to a PLMN/ISDN environment. When such situations occur, the network may send a *progress indicator* information element to the calling mobile station either:

- a) in an appropriate call control message, if a state change is required (e.g. ALERTING or CONNECT); or,
- b) in the PROGRESS message, if no state change is appropriate.

This *progress indicator* information element shall 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".

See also sections 5.5.1 and 5.5.6 for further reactions of the mobile station.

5.2.1.4.2 Call progress in the PLMN/ISDN environment

In order to inform the mobile station that the call is progressing in the PLMN/ISDN environment the network may send a *progress indicator* information element to the calling mobile station either:

- a) in an appropriate call control message, if a state change is required (e.g., ALERTING or CONNECT); or
- b) in the PROGRESS message, if no state change is appropriate.

This *progress indicator* information element shall contain progress description value #32 "Call is end-to-end ISDN/PLMN". See also section 5.5.6 for further reactions of the mobile station.

5.2.1.5 Alerting

Having entered the "mobile originating call proceeding" state, upon receiving an indication that user alerting has been initiated at the called address, the call control entity of the network shall: send an ALERTING message to its peer entity at the calling mobile station and enter the "call delivered" state.

When the call control entity of the mobile station in the "call initiated" state or "mobile originating call proceeding" state receives an ALERTING message then, the call control entity of the mobile station shall stop timer T303 and T310 (if running) and shall enter the "call delivered" state. In this state, for speech calls:

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- an alerting indication should be given to the user. If the mobile station has not attached the user connection then the mobile station shall internally generate an alerting indication. If the mobile station has attached the user connection then the network is responsible for generating the alerting indication and the mobile station need not generate one.

Abnormal cases:

On the mobile station side, if timer T310 expires, the call control entity of the mobile station shall initiate call clearing as described in section 5.4.



Figure 5.4/GSM 04.08 Call confirmation at mobile originating call establishment

5.2.1.6 Call connected

Upon receiving an indication that the call has been accepted, the call control entity of the network shall: through connect the traffic channel (including the connection of an interworking function, if required) and send a CONNECT message to its peer entity at the calling mobile station; start timer T313 and enter the "connect indication" state.

This message indicates to the call control entity of the calling mobile station that a connection has been established through the network.

The call control entity of the mobile station in the "call initiated" state, in the "mobile originating call proceeding" state or in the "call delivered" state, shall, upon receipt of a CONNECT message:

- attach the user connection;
- return a CONNECT ACKNOWLEDGE message;
- stop any locally generated alerting indication (if applied);
- stop timer T303 and T310 (if running);
- enter the "active" state.

Abnormal cases:

On the mobile station side, if timer T303 or T310 expires, the call control entity of the mobile station shall initiate call clearing as described in section 5.4.

NOTE: The mobile station may have applied an additional internal alerting supervision which causes initiation of call clearing prior to the expiry of T303 or T310.

The call control of the network in the "connect indication" state, shall, upon receipt of a CONNECT ACKNOWLEDGE message:

- 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.

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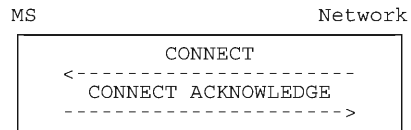


Figure 5.5/GSM 04.08 Call acceptance sequence at mobile originating call establishment

5.2.1.7 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 section 5.4 using the cause provided by the terminating network or the called user.

5.2.1.8 Transit network selection

NOTE: For further study.

5.2.1.9 Traffic channel assignment at mobile originating call establishment

It is a network dependent decision when to initiate the assignment of an appropriate traffic channel during the mobile originating call establishment phase. Initiation of a suitable RR procedure to assign an appropriate traffic channel does neither change the state of a call control entity nor affect any call control timer.

NOTE: During certain phases of such an RR procedure, transmission of CC and MM messages may be suspended, see GSM 04.08, section 3 and GSM 08.08.

The assignment procedure does not affect any call control timer.

5.2.1.10 Call queuing at mobile originating call establishment

The conditions to apply queuing are described in 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".

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".

Optionally, e.g. if eMLPP is used, the network may decide to pre-empt existing calls or to place the traffic channel request at some preferential position within the queue.

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

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 corresponding call control entity in 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 call control entity of the network shall: send the SETUP message to its peer entity at the mobile station, start timer T303 and enter the "call present" state.

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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 call control entity of the mobile station shall enter the "call present" state. An incompatible mobile station shall respond with a RELEASE COMPLETE message in accordance with section 5.2.2.3.4.

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

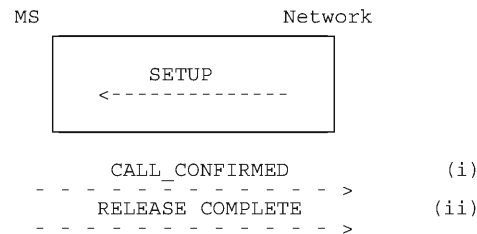


Figure 5.6/GSM 04.08 Mobile terminating call initiation and possible subsequent responses.

5.2.2.2 Compatibility checking

The mobile station receiving a SETUP message shall perform compatibility checking before responding to that SETUP message. Annex B defines compatibility checking to be performed by the mobile station upon receiving a SETUP message.

5.2.2.3 Call confirmation

5.2.2.3.1 Response to SETUP

Having entered the "call present state" the call control entity of 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 call control entity of the mobile station may include in the CALL CONFIRMED message to the network one or two bearer capability information elements to the network, either preselected in the mobile station or corresponding to a service dependent directory number (see GSM 09.07). The mobile station may also include one or two bearer capabilities in the CALL CONFIRMED message to define the radio channel requirements. In any case the rules specified in section 9.3.2.2 shall be followed.

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

A busy MS which satisfies the compatibility requirements indicated in the SETUP message shall respond either with a CALL CONFIRMED message if the call setup is allowed to continue or a RELEASE COMPLETE message if the call setup is not allowed to continue, 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 cases where the mobile station responds to a SETUP message with RELEASE COMPLETE message 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

The call control entity of the network in the "call present" state, shall, upon receipt of a CALL CONFIRMED message: stop timer T303, start timer T310 and enter the "mobile terminating call confirmed" state.

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The call control entity of the mobile station 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 call control entity of the MS to its peer entity in the network and entering the "call received" state.

The call control entity of the network in the "mobile terminated call confirmed" state shall, upon receipt of an ALERTING message: send a corresponding ALERTING indication to the calling user; stop timer T310; start timer T301, and enter the "call received" state.

In the "mobile terminating call confirmed" state or the "call received" state, if the user of a mobile station is User Determined User Busy then a DISCONNECT message shall be sent with cause #17 "user busy". In the "mobile terminating call confirmed" state, if the user of a mobile station wishes to reject the call then a DISCONNECT message shall be sent with cause #21 "call rejected".

5.2.2.3.3 Call failure procedures

In case of abnormal behaviour 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 MS in accordance with section 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 section 5.4.4, using cause #102 "recovery on timer expiry" or using cause #31 "normal, unspecified".

NOTE: The choice between cause #31 and cause #102 may have consequences on indications generated by the mobile station, see GSM 02.40.

5.2.2.3.4 Called mobile station clearing during mobile terminating call establishment

See section 5.4.2.

5.2.2.4 Notification of interworking in connection with mobile terminating call establishment

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 network may include a *progress indicator* information element to be included in the SETUP message to be sent to the called mobile station specifying progress description value

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- a) #1 "call is not end-to-end PLMN/ISDN; further call progress information may be available in-band" or
- b) #3 "origination address is non-PLMN/ISDN".

See also section 5.5.1 for further reactions of the mobile station.

5.2.2.5 Call accept

In the "mobile terminating call confirmed" state or the "call received" state, the call control entity in the mobile station indicates acceptance of a mobile terminating call by:

- sending a CONNECT message to its peer entity in the network;
- starting Timer T313; and
- entering the "connect request" state.

5.2.2.6 Active indication

In the "mobile terminated call confirmed" state or in the "call received" state, the call control entity of the network shall, upon receipt of a CONNECT message: through connect the traffic channel (including the connection of an interworking function, if required), stop timers T310, T303 or T301 (if running); send a CONNECT ACKNOWLEDGE message to its peer entity at the mobile station of the called user; initiate procedures to send a CONNECT message towards the calling user and enter the "active" state.

In the "connect request" state, the call control entity of the mobile station shall, upon receipt of a CONNECT ACKNOWLEDGE message: stop timer T313 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.

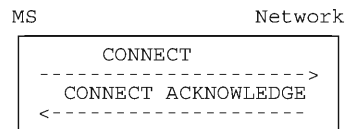


Figure 5.7/GSM 04.08 Call acceptance and active indication at mobile terminating call establishment

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.

Initiation of the assignment phase does not directly change the state of a CC entity nor affect any call control timer, but may have some secondary effects (see e.g. clause 5.2.2.3.2).

5.2.2.8 Call queuing at mobile terminating call establishment

The principles described in section 5.2.1.10 apply accordingly.

NOTE: The interworking to the fixed network has to fulfil the network specific requirements.

5.2.2.9 User connection attachment during a mobile terminating call

For speech calls:

The mobile station shall attach the user connection at latest when sending the connect message.

For data calls:

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The mobile station shall attach the user connection when receiving the CONNECT ACKNOWLEDGE message from the network.

5.2.3 Network initiated MO call \$(CCBS)\$

The procedures of section 5.2.3 are mandatory for mobile stations supporting "Network initiated MO call".

NOTE: The behaviour of a mobile station that does not support "Network initiated MO call" is described in section 4.

5.2.3.1 Initiation

Before call establishment can be initiated in the mobile station, the MM connection shall be established by the network.

After the arrival of an appropriate stimulus (for example a Remote User Free Indication), the corresponding call control entity in the network shall initiate the MM connection establishment according to section 4, enter the "CC connection pending" state and start timer T331. 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 received stimulus.

Upon completion of the MM connection, the call control entity of the mobile station shall send a START CC message to its peer entity in the network. The mobile station shall then enter the "Wait for network information" state and start timer T332.

If the network receives a START CC message while in the "CC connection pending" state, the network stops T331, sends the CC-ESTABLISHMENT message, starts timer T333 and enters the "CC-establishment present" state.

The MM connection establishment may be unsuccessful for a variety of reasons, in which case the MM sublayer in the network will inform the CC entity in the network with an indication of the reason for the failure. The CC entity shall then stop all running timers, enter the "Null" state and inform all appropriate entities within the network.

If timer T331 expires, the network shall abort the MM connection establishment attempt, stop all running CC timers, enter the "Null" state and inform all appropriate entities within the network.

5.2.3.2 CC-Establishment present

In the "CC establishment present" state, the mobile station, upon receipt of the CC-ESTABLISHMENT message, shall stop timer T332.

The CC-ESTABLISHMENT message contains information which the mobile station shall use for the subsequent SETUP message (if any) related to this CC-ESTABLISHMENT.

The CC-ESTABLISHMENT message shall contain the *Setup Container IE*.

If no CC-ESTABLISHMENT message is received by the call control entity of the mobile station before the expiry of timer T332, then the mobile station shall initiate clearing procedures towards the network using a RELEASE COMPLETE message with cause #102 "recovery on timer expiry" and proceed in accordance with section 5.4.2.

Upon receipt of a CC-ESTABLISHMENT message the mobile station shall perform checks on the Setup Container IE in order to align the contained information with the mobile's present capabilities and configuration. The "recall alignment procedure" is defined later on in this section.

If the recall alignment procedure has succeeded, the call control entity of the Mobile Station shall:

- form and store the SETUP message for sending later in the "Recall present" state,
- acknowledge the CC-ESTABLISHMENT message with a CC-ESTABLISHMENT CONFIRMED message,
- start timer T335, and
- enter the "CC-establishment confirmed" state.

Exception:

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A busy mobile station which has successfully performed the recall alignment procedure shall respond with a CC-ESTABLISHMENT CONFIRMED message with cause #17 "user busy", and proceed as stated above.

A mobile station, for which the recall alignment procedure failed, shall respond with a RELEASE COMPLETE message in accordance with section 5.4.2 with the appropriate cause code as indicated in the description of the recall alignment procedure.

The SETUP message is constructed from the *Setup Container IE* received in the CC ESTABLISHMENT MESSAGE. The mobile station shall assume that the *Setup Container IE* contains an entire SETUP message with the exception of the Protocol Discriminator, Transaction ID and Message Type elements. The mobile station may assume that the contents of the *Setup Container IE* are the same as were sent from the subscriber in a previous SETUP message of the mobile originating call establishment attempt. The mobile station shall copy the *Setup Container* to the SETUP message and not modify the contents except as defined in the recall alignment procedure and as defined in *exceptions* below. The mobile station shall not add other Information Elements to the end of the SETUP message.

Exceptions:

Bearer Capability IE(s), HLC IE(s) and LLC (s) IE(s) (including Repeat Indicator(s), if there are 2 bearer capabilities) require handling as described in the recall alignment procedure below.

If the *CC Capabilities* in the *Setup Container IE* is different to that supported by the mobile station, the mobile station shall modify the *CC Capabilities* in the SETUP message to indicate the true capabilities of the mobile station.

Facility IE(s) and SS Version IE(s) require handling as described in the recall alignment procedure.

If no response to the CC-ESTABLISHMENT message is received by the call control entity of the network before the expiry of timer T333, then the network shall initiate clearing procedures towards the called mobile station using a RELEASE COMPLETE message with cause #102 "recovery on timer expiry" and inform all appropriate entities within the network, proceeding in accordance with section 5.4.2.

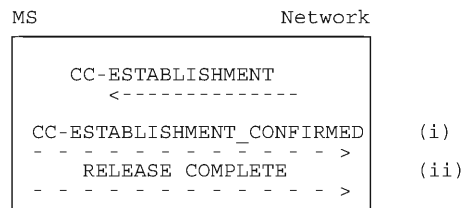


Figure 5.7a/GSM 04.08 Call initiation and possible subsequent responses.

5.2.3.2.1 Recall Alignment Procedure

The recall alignment procedure consists of two parts :

- basic service group alignment, and
- facility alignment.

Basic service group alignment:

The mobile station shall check that the *Bearer Capability, HLC and LLC and Repeat Indicator* fields, which are embedded in the *Setup Container IE*, match a basic service group supported by the mobile station.

If this check fails, then the recall alignment procedure has failed. The mobile station shall use the cause #88 "incompatible destination" afterwards.

Otherwise, the mobile station is allowed to alter the content within the *Bearer Capability, HLC and LLC* Information Elements (e.g. the speech coder version(s), the data rate, the radio channel requirement) provided that the basic service group is not changed. The result shall be that the mobile station has derived *Bearer Capability, HLC and LLC* Information Elements, which it can use for a later call setup according to its configuration and capabilities.

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Facility alignment:

This only applies if the *Setup Container* contains 1 or more *Facility IEs*. Each *Facility IE* within the *Setup Container* will be associated with the common *SS Version IE*, if present. The handling for each *Facility IE* is defined below. The mobile station shall align each *Facility IE* contained in the *Setup Container*. The rules defined in GSM 04.10 also apply.

The *Facility IE* is encoded as 'simple recall alignment', 'advanced recall alignment' or 'recall alignment not essential' (see GSM 04.10). If the encoding indicates, that

- a simple recall alignment is required, the mobile station shall copy the *Facility IE* and the common *SS version IE* from the *Setup Container* to the SETUP message without modifying the content.
- an advanced recall alignment is required, the mobile station must recognise and support the operation defined in the facility. If the mobile station does not recognise or support the operation, then the recall alignment procedure has failed and the mobile station shall use the cause #29 "facility rejected" in the subsequent rejection of the CC establishment request.
- the recall alignment is not essential, then the facility operation is not an essential part of the SETUP. If the MS does not recognise the operation then the *SS Version IE* and *Facility IE* are discarded, and NOT copied into the SETUP message.

NOTE. A mobile station may include a *Facility IE* without an associated *SS Version IE*. This would indicate that the *SS* operation is encoded using Phase 1 protocols.

Further details on Facility handling are given in GSM 04.10

5.2.3.3 CC-Establishment confirmation

The call control entity of the network in the "CC-establishment present" state, shall, upon receipt of a CC-ESTABLISHMENT CONFIRMED message, stop timer T333 and enter the "CC-establishmentconfirmed" state.

In the "CC-establishment confirmed" state, the network sends a RECALL message. This message initiates user alerting and also shall include the *Facility IE* (providing additional information to be presented to the user for notification). The network starts timer T334 and enters the 'recall present' state.

Upon reception of the RECALL message the Mobile station stops T335 and enters the "recall present" state.

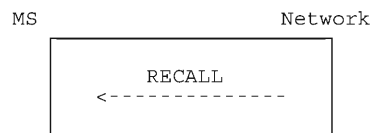


Figure 5.7b/GSM 04.08 Recall

5.2.3.4 Recall present

In the "recall present" state, the call control entity in the mobile station waits for acceptance of the Recall by the user. Once confirmation is received, the mobile station indicates acceptance of a recall by

- sending a SETUP message to its peer entity in the network;
- starting Timer T303; and
- entering the "call initiated" state and proceeding as described in section 5.2.1.1.

The MS shall ensure that the contents of the *Bearer Capability IE(s)* sent in the SETUP message are the same as the *Bearer Capability IE(s)* in the previous CC-ESTABLISHMENT CONFIRMED message related to this Network Initiated MO Call.

In the "recall-present" state, if the user of a mobile station is User Determined User Busy then a RELEASE COMPLETE message shall be sent with cause #17 "user busy" In the "recall-present" state. If the user of a mobile station wishes to reject the recall then a RELEASE COMPLETE message shall be sent with cause #21 "call rejected".

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In either case, the mobile shall release the connection in accordance with section 5.4.2

On receipt of the SETUP message in the "recall present" state, the network shall stop timer T334 and proceed as specified in section 5.2.1.2.

If the call control entity of the network does not receive a SETUP message before the expiry of timer T334, then the network shall send a RELEASE COMPLETE message to the mobile using cause #102 "recovery on timer expiry", release the MM connection, enter the "null" state and shall inform all appropriate entities within the network.



Figure 5.7b/GSM 04.08 Recall acceptance or rejection by user

5.2.3.5 Traffic channel assignment during network initiated mobile originating call establishment

It is a network dependent decision whether or not to initiate the assignment of a traffic channel during the "CC-establishment confirmed" state.

5.3 Signalling procedures during the "active" state

5.3.1 User notification procedure

The mobile terminating user notification procedure allows the network to notify a mobile station of any appropriate call-related event during the "active" state of a call. The procedure consists in the network sending a NOTIFY message to the mobile station. No state change occurs at any of the interface sides following the sending or the receipt of this message (but an appropriate indication may optionally be generated in the mobile station).

The mobile originating notification procedure allows the 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 radio interface are not supported by explicit messages (e.g. SUSPEND and RESUME messages as defined in ETS 300 102-1). 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 Not used

5.3.4 Support of Dual Services

The behaviour described in this section is used to realize the following required services throughout section 5.3.4. The mobile station is not obliged to support the network originated in-call modification procedure. In that case, the mobile station shall, when receiving a MODIFY message, treat the message as unknown and react as described in section 8.4. If the mobile station is already prepared to support the procedure in both directions, it shall act as described in this section.

- a) Alternate Speech/Data (BS 61 according to GSM 02.02);
- b) Speech followed by Data (BS 81 according to GSM 02.02);

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- c) Alternate Speech/Group 3 fax (Teleservice 61 according to 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.

If the negotiation during call establishment leads to the recognition of the above mentioned services, the in-call modification procedure is allowed to be executed within the current call by changing from one call mode to the other.

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 channel assignment procedure, handover 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

For both mobile originating and mobile terminating calls, the normal call establishment procedures apply.

5.3.4.2.1 Mobile Originating Establishment

The service is requested by the originating mobile station by transferring a SETUP message to the network containing the *BC repeat indicator* IE, the *bearer capability 1* information element, and the *bearer capability 2* information element. The first mode of operation ("call mode") shall be indicated by the *bearer capability 1* information element and the second call mode by the *bearer capability 2* information element.

A low layer compatibility may optionally be specified for each call mode in a *low layer compatibility I* and *low layer compatibility II* information element. In that case:

- the SETUP message shall contain the *LLC repeat indicator* IE and both *low layer compatibility I* and *low layer compatibility II* information elements. The *low layer compatibility I* information element then corresponds to the *bearer capability 1* information element and the *low layer compatibility II* information element to the *bearer capability 2* information element;
- if no low layer compatibility specification applies for one of the two call modes, the corresponding low layer compatibility IE (*low layer compatibility I* or *low layer compatibility II*) shall indicate "not applicable";
- the *LLC repeat indicator* shall specify the same repeat indication as the *BC repeat indicator* IE.

Similarly, a high layer compatibility may optionally be specified for each call mode in a *high layer compatibility i* and *high layer compatibility ii* information element. In that case:

- the SETUP message shall contain the *HLC repeat indicator* IE and both *high layer compatibility i* and *high layer compatibility ii* information elements. The *high layer compatibility i* information element then corresponds to the *bearer capability 1* information element and the *high layer compatibility ii* information element to the *bearer capability 2* information element;
- if no high layer compatibility specification applies for one of the two call modes, the corresponding high layer compatibility IE (*high layer compatibility i* or *high layer compatibility ii*) shall indicate "not applicable";
- the *HLC repeat indicator* shall specify the same repeat indication as the *BC repeat indicator* IE.

The receiving entity shall ignore whether the *LLC repeat indicator* IE or *HLC repeat indicator* are contained in the message or not; it shall also ignore the repeat indication of an *LLC repeat indicator* IE or *HLC repeat indicator* IE. If the *low layer compatibility II* IE is not contained in the message and the *low layer compatibility I* IE is contained in the

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message, the receiving entity shall relate it to a call mode indicated in the message that does not specify speech (if any). If the *high layer compatibility ii* IE is not contained in the message and the *high layer compatibility i* IE is contained in the message, the receiving entity shall relate it to a call mode indicated in the message that does not specify speech (if any).

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 by performing compatibility checking as defined in Annex B. If as a result of this compatibility checking the network decides to reject the 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 service not implemented"
- d) #70 "only restricted digital information bearer capability is available"

5.3.4.2.2 Mobile Terminating Establishment

The service is indicated to the called mobile station by a SETUP message coded in the same manner as in the mobile originating call establishment. As specified for normal terminating call establishment, the service may be indicated by the called mobile station in the CALL CONFIRMED message.

The destination mobile station shall perform the compatibility checking as defined in Annex B for both required modes if indicated in the SETUP message. If as a result of compatibility checking the mobile station decides to reject the call, the mobile station shall initiate call clearing 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.

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

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 (mobile station side) or the "mobile terminating modify" state (network side). 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. If the data call direction is different from the direction of the call setup a reverse call setup direction IE shall be included in the MODIFY message; otherwise this IE shall not be included. The MODIFY originating side shall stop sending Bm-channel information; and stop interpreting received Bm-channel information according to the old call mode.

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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 enter the "mobile originating modify" (network side) or "mobile terminating modify" state (mobile station side).

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 change the channel configuration, if required, and step on to any internal resources necessary to support the next call mode. If the requested mode is a data or facsimile mode, it shall also perform the appropriate means to take the direction of the data call into account. After successful change of the channel configuration it shall start sending user information according to the next call mode and start interpreting received user channel information according to the next call mode; send a MODIFY COMPLETE message with the new call mode included and enter the "active" state (mobile station or network side). If the MODIFY message had contained a *reverse call setup direction* IE, the same IE shall be included in the MODIFY COMPLETE message.

In case of an alternate speech/data or alternate speech/facsimile group 3 service (refer to section 5.3.4) the old resources may still be kept reserved, in case of speech followed by data service they may be released.

Upon receipt of the MODIFY COMPLETE message the originating side shall: initiate the alternation to those resources necessary to support the next call mode; stop timer T323; and enter the "active" state (mobile station or network side). The reaction of the originating side if it had included a reverse call setup direction IE in the MODIFY message, but the destination side did not include the IE in the MODIFY COMPLETE message is implementation dependent.

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 or if the change of the channel configuration fails 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. If the change of the channel configuration fails, the network shall return to the internal resources required for the old call mode.

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 user channel information according to the present call mode; resume interpreting received user 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 enter 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".

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5.3.4.4 Abnormal procedures

If a MODIFY, MODIFY COMPLETE or MODIFY REJECT message is received in the "disconnect indication", "disconnect request" (mobile station side only) 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.

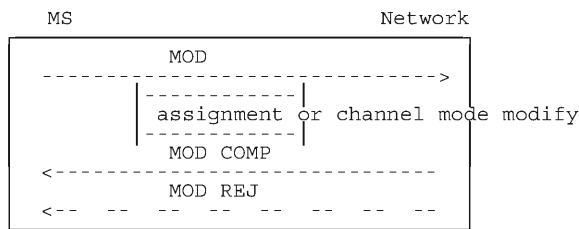


Figure 5.10a/GSM 04.08 In-call modification sequence initiated by MS

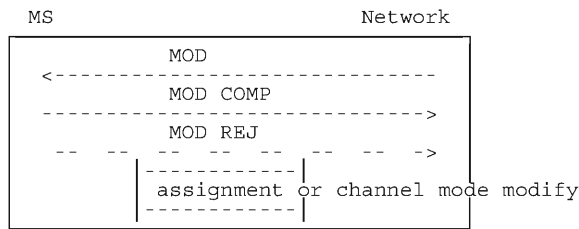


Figure 5.10b/GSM 04.08 In-call modification sequence initiated by network

5.3.5 User initiated service level up- and downgrading

The user initiated service level up- and downgrading is applicable for non-transparent multislot data services, only. By means of this procedure the user can request a change of the "maximum number of traffic channels" and/or "wanted air interface user rate" parameters, to be assigned by the network.

5.3.5.1 Initiation of service level up- and downgrading

The procedure is initiated by the mobile station in the "active" state of the call. It shall:

- send a MODIFY message including the wanted value of the "maximum number of traffic channels" and/or the "wanted air interface user rate" parameters;
- not change any of the other, possibly negotiated, parameters of the bearer capability information element;
- start timer T323; and
- enter the "mobile originating modify" state.

Any internal resources necessary to support the next service parameters shall be reserved. If a dual service was negotiated at call setup, the mobile station shall initiate the service level up- or down-grading only during the data phase of the dual service.

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Upon receipt of the MODIFY message, the network shall check if the indicated maximum number of traffic channels can be supported and enter the "mobile originating modify" state.

5.3.5.2 Successful completion of service level up- and downgrading

The network may upon reception of the MODIFY message initiate a change of the channel configuration assigned to the mobile station.

As a response to the MODIFY message the network sends a MODIFY COMPLETE message including the bearer capability negotiated at call setup and enters the "active" state.

Upon receipt of the MODIFY COMPLETE message the mobile station shall stop timer T323 and enter the "active" state.

5.3.5.3 Rejection of service level up- and downgrading

If a change of bearer service is requested together with a change of the "maximum number of traffic channels" and/or the "wanted air interface user rate", or if the current used service is not a data service where up- and downgrading is applicable, or if the receiver chooses not to grant the request, the network shall:

- send a MODIFY REJECT message with bearer capability negotiated at call setup and with cause #58 "bearer capability not presently available";
- enter the "active" state.

Upon receipt of the MODIFY REJECT message with the bearer capability negotiated at call setup, the mobile station shall: stop timer T323 and enter the "active" state.

5.3.5.4 Time-out recovery

Upon expiration of T323 in the mobile station the procedures for call clearing shall be initiated with cause #102 "recovery on timer expiry".

5.4 Call clearing

5.4.1 Terminology

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

- A traffic channel (see GSM 04.03) is "connected" when the channel is part of a circuit-switched connection established according to this Technical Specification.
- 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, the call control entity of the mobile station or of the network initiates call clearing by sending a DISCONNECT message to its peer entity; then both entities follow the procedures defined in sections 5.4.3 and 5.4.4 respectively.

As an exception to the above rule, the call control entity of the mobile station or of the network, in response to a SETUP or START CC or CC-ESTABLISHMENT CC-

ESTABLISHMENT CONFIRMED or RECALL message, can reject a call by stopping all running call control timers, responding with a RELEASE COMPLETE message, releasing the MM connection, and returning to the "null" state, provided no other response has previously been sent.

As a further exception, the call control entity of the network may initiate call clearing by stopping all running call control timers, sending a RELEASE message, starting timer T308, and entering the "release request" state.

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NOTE: This way to initiate call clearing by sending a RELEASE message should not be used by the network:

- if in-band tones/announcements are provided and the network decides to use the procedure described in section 5.4.4.1.1.1 or 5.4.4.2.1;
- if the network wants to have the opportunity to respond to information sent by the mobile station during call clearing, e.g. when the network indicates that "CCBS activation is possible".

A call control entity shall accept an incoming RELEASE COMPLETE message used to initiate the call clearing even though the cause information element is not included.

A control entity shall accept an incoming RELEASE message used to initiate the call clearing even though the cause information element is not included.

Furthermore, a call control entity shall regard an incoming RELEASE COMPLETE message as consistent with any of its states; a call control entity shall regard an incoming RELEASE message as consistent with any of its states except the null state; a call control entity of the mobile station shall regard an incoming DISCONNECT message as consistent with any of its call control states except the "null" state, the "release request" state, and the "disconnect indication" state; a call control entity of the network shall regard an incoming DISCONNECT message as consistent with any of its call control states except the "null" state and the "release request" state.

NOTE: This allows the introduction of shorter call clearing procedures in the future.

5.4.3 Clearing initiated by the mobile station

5.4.3.1 Initiation of call clearing

Apart from the exceptions identified in section 5.4.2, the call control entity of the mobile station shall initiate clearing by: stopping all running call control timers, sending a DISCONNECT message; starting timer T305; and entering the "disconnect request" state.

5.4.3.2 Receipt of a DISCONNECT message from the mobile station.

The call control entity in the network in any state except the "null" state and the "release request" state shall, upon receipt of a DISCONNECT message:

- Stop all running call control timers;
- initiate procedures to clear the network connection and the call to the remote user;
- send a RELEASE message to its peer entity;
- start timer T308; and
- enter the "release request" state.

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

5.4.3.3 Receipt of a RELEASE message from the network

The call control entity of the mobile station in any state except the "null" state and the "release request" state, shall, upon receipt of a RELEASE message: stop all running call control timers; send a RELEASE COMPLETE message; release the MM connection; and return to the "null" state.

5.4.3.4 Receipt of a RELEASE COMPLETE message from the mobile station

A call control entity of the network in any call control state shall, upon receipt of a RELEASE COMPLETE message from its peer entity in the mobile station: stop all running call control timers; release the MM connection; and return to the "null" state.

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5.4.3.5 Abnormal cases

The call control entity of the mobile station in the "disconnect request" state, shall upon expiry of timer T305: send a RELEASE message to the network with the cause number originally contained in the DISCONNECT message and optionally, a second cause information element with cause #102 "recovery on timer expiry", start timer T308, and enter the "release request" state.

The call control entity of the network in the "release request" state, shall, at first expiry of timer T308, retransmit the RELEASE message, start timer T308, and stay in the "release request" state. At second expiry of timer T308, the call control entity of 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 section 5.4.2, the call control entity of 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, the procedures described in sections 5.4.3., 5.4.3.4 and 5.4.3.5 are followed.

A mobile station that does not support the "Prolonged Clearing Procedure" shall comply with the requirements of section 5.4.4.1 and shall ignore section 5.4.4.2. A mobile station that supports the "Prolonged Clearing Procedure" shall comply with the requirements of sections 5.4.4.2 and shall ignore section 5.4.4.1.

5.4.4.1 Clearing initiated by the network: mobile does not support "Prolonged Clearing Procedure"

Section 5.4.4.1 only applies to mobile stations that do not support the "Prolonged Clearing Procedure" option.

5.4.4.1.1 Clearing when tones/announcements provided

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

5.4.4.1.1.1 Receipt of a DISCONNECT message with progress indicator #8 from the network

The call control entity of the MS in any state except the "null" state, the "disconnect indication" state, and the "release request" state, shall, upon receipt of a DISCONNECT message with progress indicator #8:

- i) if an appropriate speech traffic channel is not connected, continue clearing as defined in section 5.4.4.1.2.1 without connecting to the in-band tone/announcement;
- ii) if an appropriate speech traffic channel is connected, attach the user connection for speech if it is not yet attached and enter the "disconnect indication" state. In that state, if upper layers request the clearing of the call, the call control entity of the MS shall proceed as defined in section 5.4.4. 1.2.1.

5.4.4.1.1.2 Expiry of timer T306

The call control entity of the network, having entered the "disconnect indication" state after sending a disconnect message with the progress indicator #8, shall, upon expiry of timer T306, continue clearing by sending a RELEASE message with the cause number originally contained in the DISCONNECT message; starting timer T308; and entering the "release request" state.

5.4.4.1.2 Clearing when tones/announcements not provided

When in-band tones and announcements are not provided, the call control entity of the network shall initiate call clearing by stopping all running call control timers, sending a DISCONNECT message without progress indicator, starting timer T305 and entering the "disconnect indication" state.

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5.4.4.1.2.1 Receipt of a DISCONNECT message without progress indicator or with progress indicator different from #8 from the network

The call control entity of the mobile station in any state except the "null" state, the "disconnect indication" state, and the "release request" state, shall, upon the receipt of a DISCONNECT message without progress indicator information element or with progress indicator different from #8:

- stop all running call control timers;
- send a RELEASE message;
- start timer T308; and
- enter the "release request" state.

5.4.4.1.2.2 Receipt of a RELEASE message from the mobile station

The call control entity of the network in any state except the "null" state and the "release request" state, shall, upon receipt of a RELEASE message: stop all running call control timers; send a RELEASE COMPLETE message; release the MM connection; and return to the "null" state.

5.4.4.1.2.3 Abnormal cases

The call control entity of the network, having entered the "disconnect indication" state after sending a DISCONNECT message without progress indicator or with progress indicator different from #8, shall upon expiry of timer T305: 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".

5.4.4.1.3 Completion of clearing

A call control entity of the mobile station in any call control state shall, upon receipt of a RELEASE COMPLETE message from its peer entity in the network: stop all running call control timers; release the MM connection; and return to the "null" state.

5.4.4.1.3.1 Abnormal cases

The call control entity of the mobile station in the "release request" state shall at first expiry of timer T308 retransmit the RELEASE message and restart timer T308. At second expiry of timer T308, the call control entity of the mobile station shall: release the MM connection; and return to the "null" state.

5.4.4.2 Clearing initiated by the network: mobile supports "Prolonged Clearing Procedure"

Section 5.4.4.2 only applies to mobile stations that support the "Prolonged Clearing Procedure" option.

5.4.4.2.1 Clearing when tones/announcements provided and the network does not indicate that "CCBS activation is possible"

When in-band tones/announcements are provided (see section 5.5.1) and CCBS is not applicable, the call control entity of the network may initiate clearing by sending a DISCONNECT message containing progress indicator #8 "in-band information or appropriate pattern now available", either not containing an *Allowed Actions* IE or containing an *Allowed Actions* IE indicating "CCBS activation is not possible", starting timer T306, and entering the "disconnect indication" state.

5.4.4.2.1.1 Receipt of a DISCONNECT message

The call control entity of the MS in any state except the "null" state, the "disconnect indication" state, and the "release request" state, shall, upon receipt of a DISCONNECT message with progress indicator #8 and, either not containing an *Allowed Actions* IE or containing an *Allowed Actions* IE indicating "CCBS activation is not possible":

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- i) if an appropriate speech traffic channel is not connected,
 - stop all running call control timers;
 - send a RELEASE message;
 - start timer T308; and
 - enter the "release request" state.
 - not connect to the in-band tone/announcement;
- ii) if an appropriate speech traffic channel is connected, attach the user connection for speech if it is not yet attached and enter the "disconnect indication" state. In that state, if upper layers request the clearing of the call, the call control entity of the MS shall:
 - stop all running call control timers;
 - send a RELEASE message;
 - start timer T308; and
 - enter the "release request" state.

5.4.4.2.1.2 Expiry of timer T306

The call control entity of the network, having entered the "disconnect indication, shall, upon expiry of timer T306, continue clearing by sending a RELEASE message with the cause number originally contained in the DISCONNECT message; starting timer T308; and entering the "release request" state.

5.4.4.2.2 Clearing when the network indicates that "CCBS activation is possible"

When Activation of CCBS is possible, the call control entity of the network may initiate clearing by sending a DISCONNECT message containing the *Allowed Actions* IE with an indication that "Activation of CCBS is possible" and starting T338. Optionally, progress indicator #8 "in-band information or appropriate pattern now available" may also be contained in the DISCONNECT message (in which case, T338 shall not be greater than T306).

5.4.4.2.2.1 Receipt of a DISCONNECT

The call control entity of the MS in any state except the "null" state, the "disconnect indication" state, and the "release request" state, shall, upon receipt of a DISCONNECT message with an *Allowed Actions* IE indicating "Activation of CCBS is possible" pass the "Activation of CCBS is possible" indication to the upper layer, enter the "disconnect indication" state, stop all running call control timers and await a response from the upper layers.

If the DISCONNECT message contained the progress indicator #8 "in-band information or appropriate pattern now available" and an appropriate speech traffic channel is connected, then the MS shall attach the user connection for speech if it is not yet attached. If the DISCONNECT message did not contain the progress indicator #8 "in-band information or appropriate pattern now available" any connected speech traffic channel shall be disconnected.

Response from the upper layers:

- i) If the upper layers request the clearing of the call, the call control entity of the MS shall:
 - stop all running call control timers;
 - send a RELEASE message;
 - start timer T308; and
 - enter the "release request" state.
- ii) If the upper layers request that the "CCBS activation is to be attempted" then the MS shall
 - send a RELEASE message containing a *Facility* IE including an

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Invoke=CCBSRequest to the network;

- stop all running call control timers;
- start timer T308; and
- enter the "release request" state.

If an appropriate speech traffic channel is connected, transmission of this RELEASE message shall not cause it to be disconnected.

5.4.4.2.2 Expiry of timer T338

The call control entity of the network, having entered the "disconnect indication" state after sending a DISCONNECT message with an *Allowed Actions* IE indicating "Activation of CCBS is possible" shall, upon expiry of timer T338, continue clearing by sending a RELEASE message with the cause number originally contained in the DISCONNECT message; starting timer T308; and entering the "release request" state.

5.4.4.2.3 Clearing when tones/announcements are not provided and the network does not indicate that "CCBS activation is possible"

When in-band tones and announcements are not provided, and, the network does not wish to indicate in the *Allowed Actions* IE that "CCBS is possible", the call control entity of the network shall initiate call clearing by stopping all running call control timers, sending a DISCONNECT message without progress indicator, either without the *Allowed Actions* IE or with the *Allowed Actions* IE indicating that "CCBS is not possible", starting timer T305 and entering the "disconnect indication" state.

5.4.4.2.3.1 Receipt of a DISCONNECT message

The call control entity of the mobile station in any state except the "null" state, the "disconnect indication" state, and the "release request" state, shall, upon the receipt of a DISCONNECT message either without progress indicator information element or with progress indicator different from #8, and, either without the *Allowed Actions* IE or with the *Allowed Actions* IE indicating that "CCBS is not possible":

- stop all running call control timers;
- send a RELEASE message;
- start timer T308; and
- enter the "release request" state.

5.4.4.2.3.2 Abnormal cases

The call control entity of the network, having entered the "disconnect indication", shall upon expiry of timer T305: 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.

5.4.4.2.4 Receipt of a RELEASE message from the mobile station

5.4.4.2.4.1 Release, CCBS not requested

For a network that does not support the "CCBS activation" option:

The call control entity of the network in any state except the "null" state and the "release request" state, shall, upon receipt of a RELEASE message: stop all running call control timers; send a RELEASE COMPLETE message; release the MM connection; and return to the "null" state.

For a network that does support the "CCBS activation" option:

The call control entity of the network in any state except the "null" state and the "release request" state, shall, upon receipt of a RELEASE message without a *Facility* IE including an Invoke=CCBSRequest: stop all running

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call control timers; send a RELEASE COMPLETE message; release the MM connection; and return to the "null" state.

5.4.4.2.4.2 Release, CCBS Requested

For a network that does not support the "CCBS activation" option:

The call control entity of the network in any state except the "null" state and the "release request" state, shall, upon receipt of a RELEASE message: stop all running call control timers; send a RELEASE COMPLETE message; release the MM connection; and return to the "null" state.

For a network that does support the "CCBS activation" option:

The call control entity of the network in any state except the "null" state and the "release request" state, shall, upon receipt of a RELEASE message containing a *Facility* IE including an Invoke=CCBSRequest: stop all running call control timers; then attempt to activate the recall; then send a RELEASE COMPLETE message indicating the success or failure of the recall activation attempt; release the MM connection; and return to the "null" state.

5.4.4.2.5 Completion of clearing

A call control entity of the mobile station in any call control state shall, upon receipt of a RELEASE COMPLETE message from its peer entity in the network: stop all running call control timers; release the MM connection; and return to the "null" state.

5.4.4.2.5.1 Abnormal cases

The call control entity of the mobile station in the "release request" state shall at first expiry of timer T308 retransmit the RELEASE message and restart timer T308. At second expiry of timer T308, the call control entity of 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.

The behaviour of the network call control entity receiving a DISCONNECT message whilst in the "disconnect indication" state is specified in section 5.4.3. The behaviour of the MS call control entity receiving a DISCONNECT message whilst in the "disconnect request" state is defined in section 5.4.4.

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 the network wants to make the mobile station attach the user connection (e.g. in order to provide in-band tones/announcement) before the mobile station has reached the "active" state of a call, the network may include a *progress indicator* IE indicating user attachment in a suitable CC message:

- Either it includes the IE in a SETUP, CALL PROCEEDING, ALERTING, or CONNECT message that is sent during call establishment
- it sends a PROGRESS message containing the IE.

A *progress indicator* IE indicates user attachment if it specifies a progress description in the set {1, 2, 3} or in the set {6, 7, 8, ..., 20}.

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On reception of a SETUP, CALL PROCEEDING, ALERTING, CONNECT, or PROGRESS message the mobile station shall proceed as specified elsewhere in section 5; if the *progress indicator* IE indicated user attachment and a speech mode traffic channel is appropriate for the call the mobile station shall in addition: attach the user connection for speech as soon as an appropriate channel in speech mode is available. (If a new order to attach the user connection is received before the attachment has been performed, the new order shall supersede the previous one.)

Under certain conditions the MS will have to attach the user connection before the CONNECT message. It is up to the network to ensure that no undesired end-to-end through connection takes place during the establishment of a MT call.

NOTE: This allows the use of *progress indicator* IEs independently from the channel modes appropriate for the call.

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.

5.5.3 Status procedures

5.5.3.1 Status enquiry procedure

Whenever a call control entity wishes to check the call state of its peer entity, it may initiate the status enquiry procedure.

NOTE: This may, in particular, apply to procedural error conditions described in section 8.

A call control entity initiates the status enquiry procedure by sending the STATUS ENQUIRY message and starting timer T322. While timer T322 is running, the call control entity shall not send further STATUS ENQUIRY messages.

Upon receipt of a STATUS ENQUIRY message, the receiver shall respond with a STATUS message, reporting the current call state and cause value #30 "response to STATUS ENQUIRY". Receipt of the STATUS ENQUIRY shall not result in a state change relating to any protocol and connection of the receiver.

If a STATUS message is received that contains cause value #30 "response to status enquiry", timer T322 shall be stopped and further appropriate actions taken, based on the information in that STATUS message, relative to the current state of the receiver of the STATUS message. These further "appropriate actions" are implementation dependent. However, the actions prescribed in section 5.5.3.2 shall apply.

If a clearing message is received while timer T322 is running, timer T322 shall be stopped, and call clearing shall continue.

If timer T322 expires, the STATUS ENQUIRY message may be retransmitted maximally once. If T322 expires after the STATUS ENQUIRY has been transmitted the maximum number of times, clearing of the call shall be initiated with cause value #41, "temporary failure", in the first call clearing message.

5.5.3.2 Reception of a STATUS message by a CC entity

5.5.3.2.1 STATUS message with incompatible state

On receipt of a STATUS message reporting an incompatible call control state, the receiving entity shall clear the call by sending a RELEASE COMPLETE message with cause # 101 "message not compatible with protocol state". The reported call control state is incompatible if the combination of call control states at the sender and receiver side cannot occur, do not match or cannot be aligned by actions of the receiver; the exact definition is implementation dependent.

5.5.3.2.2 STATUS message with compatible state

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

95 "semantically incorrect message"; or

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- # 96 "invalid mandatory information"; or
- # 97 "message type non-existent or not implemented"; or
- # 98 "message type not compatible with protocol state"; or
- # 99 "information element non-existent or not implemented"; or
- # 100 "conditional IE error",

This indicates that the transmitter of the STATUS message was unable to accept some information sent by the recipient of the STATUS message. This allows the recipient to retransmit some or all of the information. Other actions are possible and are implementation dependent; they may include releasing the call.

5.5.4 Call re-establishment, mobile station side

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 is active, 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

Call Control is notified when the MM connection is re-established and shall then resume the transmission of possibly suspended messages and resume user data exchange when an appropriate channel is available.

5.5.4.4 Unsuccessful outcome

If the attempt to re-establish the connection was unsuccessful, the MM connection will be released and a release indication will be given to call control, see 4.5.1.6.

5.5.5 Call re-establishment, network side

This section describes the handling in the network as far as call control is concerned.

5.5.5.1 State alignment

After a successful call re-establishment it is a network responsibility to identify (e.g. by using the status enquiry procedure, if needed, and resolve, if possible, any call state or auxiliary state mismatch between the network and the mobile station.

5.5.6 Progress

At any time during the establishment or release of a call and during an active call the network may send a PROGRESS message to the mobile station.

On receipt of a PROGRESS message during the establishment or release of a call the mobile station shall stop all call control timers related to that call.

NOTE: If the PROGRESS has been received before the receipt of a CALL PROCEEDING message, the mobile station will not start timer T310 on receipt of a CALL PROCEEDING message, see section 5.2.1.1.3.



Figure 5.11/GSM 04.08 Progress

5.5.7 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 telecommunication networks. The support of DTMF in the network is described in GSM 03.14.

The mobile station shall be capable of transmitting DTMF messages if and only if the mobile station has the user connection for speech attached and an appropriate channel is available.

The transaction identifier used by the DTMF messages shall be that of the attached speech call.

NOTE 1: This specification means that DTMF messages can generally be sent in the active state of a call in speech transmission mode or when a traffic channel is available during setup or release and the *progress indicator* IE has been received.

NOTE 2: 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 or quality of the channels.

NOTE 3: The procedures described in this paragraph support DTMF only in the direction mobile station to network.

5.5.7.1 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 mobile station. 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, ..., 9, A, B, C, D, *, #).

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

5.5.7.2 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 to the mobile station.

5.5.7.3 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.

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5.5.7.4 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.

5.5.7.5 Sequencing of subsequent start DTMF requests by the mobile station

The minimum length of tone generated by the network 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 normally 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.

The appropriate sequencing of DTMF control messages is shown in figures 5.8 and 5.9.

NOTE 1: 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.

NOTE 2: The transmission time of the messages over the radio interface on FACCH/F or FACCH/H, see GSM 05.02, ensures that the minimum length of tones and minimum gap between tones according to T/CS 46-02 are fulfilled.

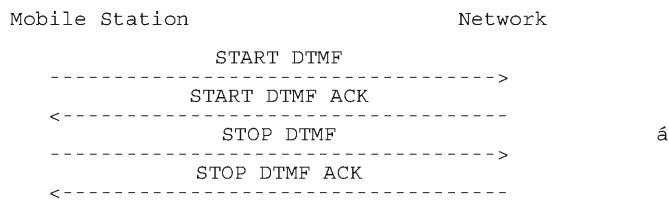


Figure 5.8/GSM 04.08 Single DTMF transmission

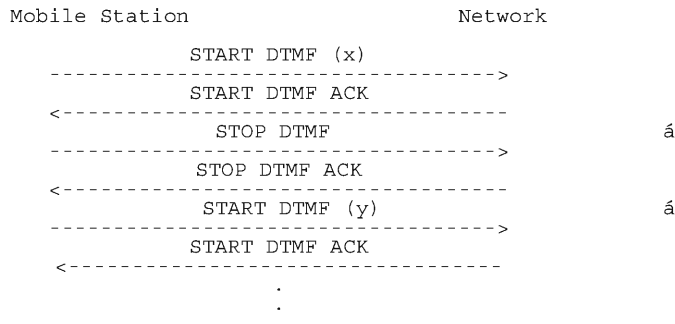


Figure 5.9/GSM 04.08 Multiple DTMF transmission

6 Support for packet services

This chapter contains the description of the procedures for the session management of GPRS point-to-point data services at the radio interface (Reference point U_m).

6.1 GPRS Session management

6.1.1 General

The main function of the session management (SM) is to support PDP context handling of the user terminal. The SM comprises procedures for

- identified PDP context activation, deactivation and modification; and
- anonymous PDP context activation and deactivation.

SM procedures for identified access can only be performed if a GMM context has been established between the MS and the network. If no GMM context has been established, the MM sublayer has to initiate the establishment of a GMM context by use of the GMM procedures as described in chapter 4. After GMM context establishment, SM uses services offered by GMM (see GSM 04.07 [20]). Ongoing SM procedures are suspended during GMM procedure execution.

For anonymous access no GMM context is established.

6.1.1.1 Radio resource sublayer address handling for anonymous access

In the case of anonymous access, no P-TMSI shall be used by the MS or by the network. The MS shall use a randomly selected random TLLI for transmission of the ACTIVATE AA PDP CONTEXT REQUEST message in order to activate the AA PDP context.

Upon receipt of the ACTIVATE AA PDP CONTEXT REQUEST message, the network assigns an auxiliary TLLI (A-TLLI) to the AA PDP context and transmits the assigned A-TLLI to the MS. After receipt of the assigned A-TLLI, the MS shall use it for further data transmission to the network for the lifetime of the AA PDP context.

6.1.2 Session management states

In this section, the SM states are described for one SM entity (see GSM 04.07 [20]). Each SM entity is associated with one PDP context. Section 6.1.2.1 describes the SM states in the MS and section 6.1.2.2 describes the SM states on the network side.

6.1.2.1 Session management states in the MS

In this section, the possible states of an SM entity in the mobile station are described. As illustrated in figure 6.1/GSM 04.08 there are four SM states in the MS.

6.1.2.1.1 PDP-INACTIVE

This state indicates that no PDP context exists.

6.1.2.1.2 PDP-ACTIVE-PENDING

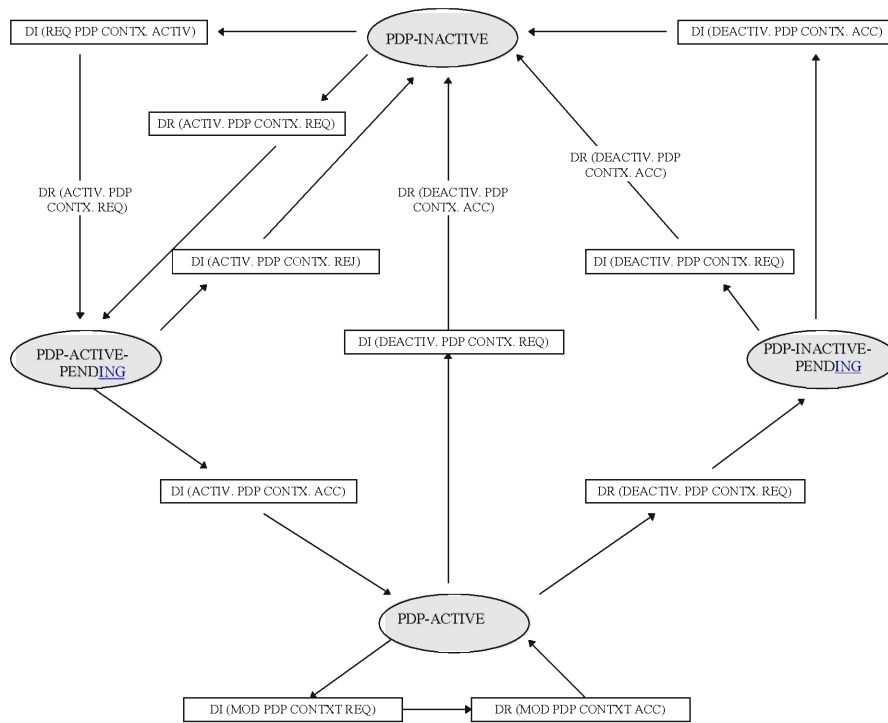
This state exists when PDP context activation was requested by the MS.

6.1.2.1.3 PDP-INACTIVE-PENDING

This state exists when deactivation of the PDP contexts was requested by the MS.

6.1.2.1.4 PDP-ACTIVE

This state indicates that the PDP context is active.



DR: GMM-SM-DATA-REQUEST (Message), i.e. message sent by an MS
 DI: GMM-SM-DATA-INDICATION (Message), i.e. message received by an MS

Figure 6.1/GSM 0408: Session management states in the MS (overview)

6.1.2.2 Session management states on the network side

In this section, the possible states of an SM entity on the network side are described. As illustrated in figure 6.2/GSM 04.08 there are five SM states on the network side.

6.1.2.2.1 PDP-INACTIVE

This state indicates that the PDP context is not active.

6.1.2.2.2 PDP-ACTIVE-PENDING

This state exists when the PDP context activation was initiated by the network.

6.1.2.2.3 PDP-INACTIVE-PENDING

This state exists when deactivation of the PDP context was requested by the network.

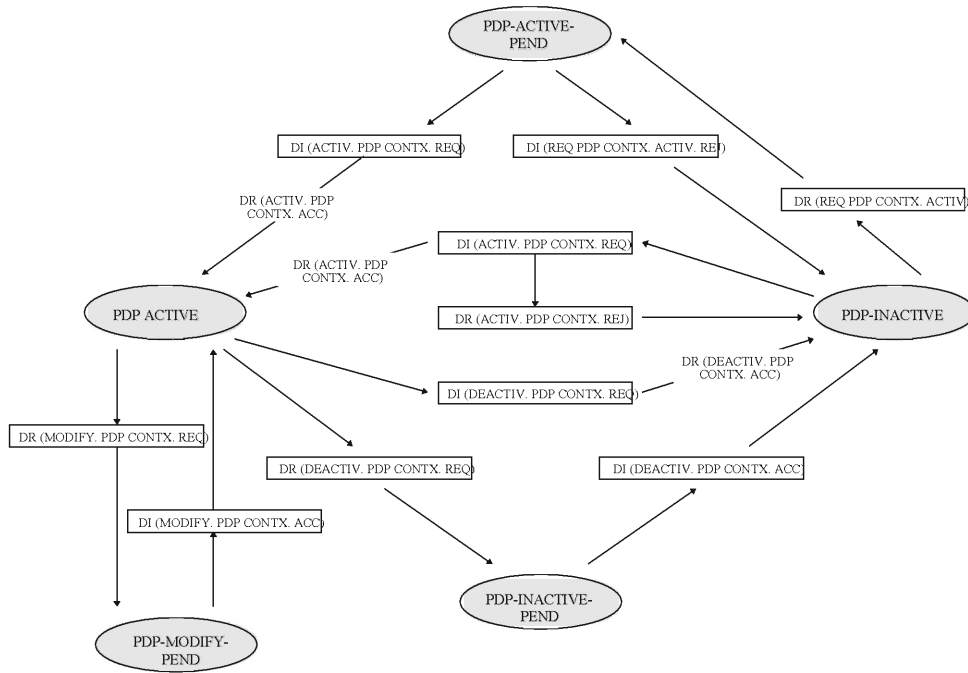
6.1.2.2.4 PDP-ACTIVE

This state indicates that the PDP context is active.

6.1.2.2.5 PDP-MODIFY-PENDING

This state exists when modification of the PDP context was requested by the network.

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DR: GMM-Data-Request (Message), i.e. message sent by network
 DI: GMM-Data-Indication (Message), i.e. message received by the network

Figure 6.2/GSM 04.08: Session management states on the network side (overview)

6.1.3 Session Management procedures

6.1.3.1 PDP context activation

The purpose of this procedure is to establish a PDP context between the MS and the network for a specific QoS on a specific NSAPI. The PDP context activation may be initiated by the MS or the initiation may be requested by the network.

6.1.3.1.1 Successful PDP context activation initiated by the mobile station

In order to request a PDP context activation, the MS sends an ACTIVATE PDP CONTEXT REQUEST message to the network, enters the state PDP-ACTIVE-PENDING and starts timer T3380. The message contains the selected NSAPI. The MS shall ensure that the selected NSAPI is not currently being used by another Session Management entity in the MS.

Upon receipt of an ACTIVATE PDP CONTEXT REQUEST message, the network selects a radio priority level based on the QoS negotiated and may reply with an ACTIVATE PDP CONTEXT ACCEPT message. Upon receipt of the message ACTIVATE PDP CONTEXT ACCEPT the MS shall stop timer T3380, shall enter the state PDP-ACTIVE and shall initiate establishment of the logical link for the LLC SAPI indicated by the network with the offered QoS and selected radio priority level if no logical link has been already established for that SAPI. If the offered QoS parameters received from the network differ from the QoS requested by the MS, the MS shall either accept the negotiated QoS or initiate the PDP context deactivation procedure. If the LLC SAPI indicated by the network can not be supported by the MS, the MS shall initiate the PDP context deactivation procedure.

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6.1.3.1.2 Successful PDP context activation requested by the network

In order to request a PDP context activation, the network sends a REQUEST PDP CONTEXT ACTIVATION message to the MS and starts timer T3385.

Upon receipt of a REQUEST PDP CONTEXT ACTIVATION message, the MS shall then either initiate the PDP context activation procedure as described in the previous section or shall reject the activation request by sending a REQUEST PDP CONTEXT ACTIVATION REJECT message as described in section 6.1.3.1.4. The value of the reject cause IE of the REQUEST PDP CONTEXT ACTIVATION REJECT message shall indicate the reason for rejection, e.g. "insufficient resources to activate another context".

The ACTIVATE PDP CONTEXT REQUEST message sent by the MS in order to initiate the PDP context activation procedure shall contain the PDP address requested by the network in the REQUEST PDP CONTEXT ACTIVATION message.

Upon receipt of the ACTIVATE PDP CONTEXT REQUEST message, the network shall stop timer T3385.

The same procedures apply as described for MS initiated PDP context activation.

6.1.3.1.3 Unsuccessful PDP context activation initiated by the MS

Upon receipt of an ACTIVATE PDP CONTEXT REQUEST message the network may reject the MS initiated PDP context activation by sending an ACTIVATE PDP CONTEXT REJECT message to the MS. The message shall contain a cause code that typically indicates one of the following causes:

- # 26: insufficient resources;
- # 27: missing or unknown APN;
- # 28: unknown PDP address or PDP type;
- # 29: user authentication failed;
- # 30: activation rejected by GGSN;
- # 31: activation rejected, unspecified;
- # 32: service option not supported;
- # 33: requested service option not subscribed; or
- # 34: service option temporarily out of order;
- # 35: NSAPI already used; or
- # 950 - 111: protocol errors.

Upon receipt of an ACTIVATE PDP CONTEXT REJECT message, the MS shall stop timer T3380 and enter/remain in state PDP-INACTIVE.

6.1.3.1.4 Unsuccessful PDP context activation requested by the network

Upon receipt of the REQUEST PDP CONTEXT ACTIVATION message, the MS may reject the network requested PDP context activation by sending the REQUEST PDP CONTEXT ACTIVATION REJECT message to the network. The message contains all parameter of the REQUEST PDP CONTEXT ACTIVATION and an additional cause code that typically indicates one of the following causes:

- # 26: insufficient resources;
- # 31: activation rejected, unspecified;
- # 32: service option not supported; or
- # 95 - 111: protocol errors.

The network shall stop timer T3385 and enter state PDP-INACTIVE.

6.1.3.1.5 Abnormal cases

The following abnormal cases can be identified:

- a) Expiry of timers

In the mobile station:

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On the first expiry of the timer T3380, the MS shall resend the PDP CONTEXT ACTIVATION REQUEST and shall reset and restart timer T3380. This retransmission is repeated until the timer has expired four times, i.e. on the fifth expiry of timer T3380, the MS shall release all resources possibly allocated for this invocation and shall abort the procedure; no automatic PDP context activation re-attempt shall be performed.

On the network side:

On the first expiry of the timer T3385, the network shall resend the message REQUEST PDP CONTEXT ACTIVATION and shall reset and restart timer T3385. This retransmission is repeated until the timer has expired four times, i.e. on the fifth expiry of timer T3385, the network shall release possibly allocated resources for this activation and shall abort the procedure.

b) Collision of MS initiated and network requested PDP context activation

In the mobile station:

A collision of an MS initiated and a network requested PDP context activation procedure is identified by the MS if a REQUEST PDP CONTEXT ACTIVATION message is received from the network after the MS has sent a PDP CONTEXT ACTIVATION REQUEST message, and both messages contain the same PDP address and the MS has not yet received a PDP CONTEXT ACTIVATION ACCEPT or REJECT message.

On the network side:

A collision is detected by the network in case a PDP CONTEXT ACTIVATION REQUEST message is received from the MS with the same PDP address as the REQUEST PDP CONTEXT ACTIVATION message sent to the MS.

In the case of such a collision, the MS initiated PDP context activation shall take precedence over the network requested PDP context activation. The network shall terminate the network requested PDP context activation procedure and shall proceed with the MS initiated PDP context activation procedure by sending an ACTIVATE PDP CONTEXT ACCEPT message. The MS shall discard the REQUEST PDP CONTEXT ACTIVATION message and shall wait for an ACTIVATE PDP CONTEXT ACCEPT message.

c) MS initiated PDP context activation for an already activated PDP context

On the network side:

If all parameters of the new PDP CONTEXT ACTIVATION REQUEST message match the original requested parameters of the activated PDP context, the network shall reply with a PDP CONTEXT ACTIVATION ACCEPT message.

Otherwise the network shall reject the activation request.

The mobile station shall ignore activation reject messages received in states other than PDP-ACTIVE-PENDING.

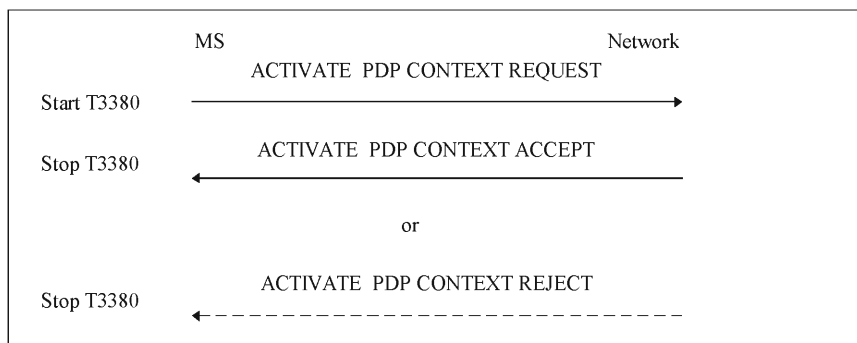


Figure 6.3/GSM 0408: MS initiated PDP context activation procedure

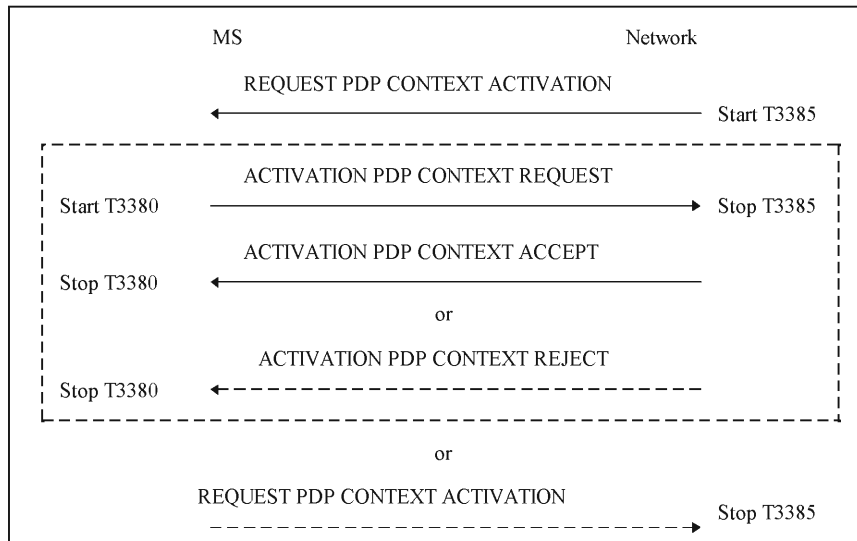


Figure 6.4/GSM 0408: Network initiated PDP context activation procedure

6.1.3.2 PDP context modification procedure

The PDP context modification procedure is invoked by the network in order to change the QoS negotiated during the PDP context activation procedure or at previously performed PDP context modification procedures. The procedure shall be initiated by the network only during an inter-SGSN routing area updating procedure when a PDP context is active.

In order to initiate the procedure, the network sends the message MODIFY PDP CONTEXT REQUEST message to the MS and starts timer T3386. The message shall contain an NSAPI, the new QoS for that NSAPI and the radio priority level that shall be used by the MS at the lower layers for the transmission of data related to the PDP context.

Upon receipt of this message the MS shall reply with the MODIFY PDP CONTEXT ACCEPT message, if the MS accepts the new QoS and the indicated LLC SAPI.

If the MS does not accept the new QoS or the indicated LLC SAPI, the MS shall initiate the PDP context deactivation procedure for the NSAPI that has been indicated in the message MODIFY PDP CONTEXT REQUEST - the reject cause IE value of the DEACTIVATE PDP CONTEXT REQUEST message shall indicate "QoS not accepted".

The network shall upon receipt of the MODIFY PDP CONTEXT ACCEPT message stop the timer T3386 and shall establish, reconfigure or continue using the logical link with the new QoS for the LLC SAPI and the NSAPI indicated in the message MODIFY PDP CONTEXT REQUEST.

6.1.3.2.1 Abnormal cases

On the first expiry of timer T3386, the network shall resend the MODIFY PDP CONTEXT REQUEST message and reset timer T3386. This retransmission is repeated until the timer has expired four times, i.e. on the fifth expiry of timer T3386, the network may continue to use the previously negotiated QoS or it may initiate the PDP context deactivation procedure.

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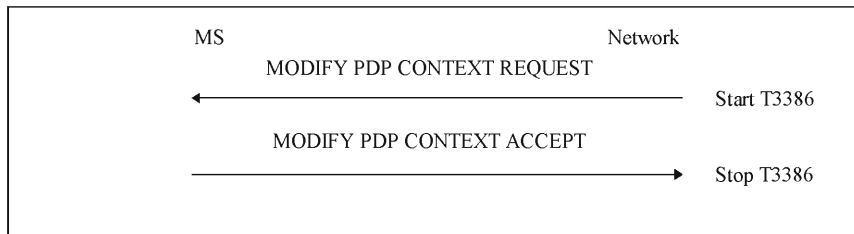


Figure 6.5/GSM 0408: PDP context modification procedure

6.1.3.3 PDP context deactivation procedure

The purpose of this procedure is to deactivate an existing PDP context between the MS and the network. The PDP context deactivation may be initiated by the MS or by the network.

6.1.3.3.1 PDP context deactivation initiated by the MS

In order to deactivate a PDP context, the MS sends a DEACTIVATE PDP CONTEXT REQUEST message to the network, enters the state PDP-INACTIVE-PENDING and starts timer T3390. The message contains the NSAPI in use for the PDP context to be deactivated and a cause code that typically indicates one of the following causes:

- # 36: regular PDP context deactivation; or
- # 37: QoS not accepted.

The network shall reply with the DEACTIVATE PDP CONTEXT ACCEPT message. Upon receipt of the DEACTIVATE PDP CONTEXT ACCEPT message, the MS shall stop timer T3390 and shall initiate the release of the logical link if it is not used by another PDP context.

6.1.3.3.2 PDP context deactivation initiated by the network

In order to deactivate a PDP context, the network sends a DEACTIVATE PDP CONTEXT REQUEST message to the MS and starts timer T3395. The message contains the NSAPI in use for the PDP context to be deactivated and a cause code that typically indicates one of the following causes:

- # 36: regular PDP context deactivation;
- # 38: network failure; or
- # 39: reactivation requested.

The MS shall, upon receipt of this message, reply with a DEACTIVATE PDP CONTEXT ACCEPT message. Upon receipt of the DEACTIVATE PDP CONTEXT ACCEPT message, the network shall stop the timer T3395 and shall initiate the release of the logical link if it is not used by another PDP context.

6.1.3.3.3 Abnormal cases

The following abnormal cases can be identified:

a) Expiry of timers

In the mobile station:

On the first expiry of timer T3390, the MS shall resent the message DEACTIVATE PDP CONTEXT REQUEST and shall reset and restart the timer T3390. This retransmission is repeated until the timer has expired four times, i.e. on the fifth expiry of timer T3390, the MS shall release all resources allocated and shall erase the PDP context related data.

On the network side:

On the first expiry of timer T3395, the network shall resent the message DEACTIVATE PDP CONTEXT REQUEST and shall reset and restart timer T3395. This retransmission is repeated until the timer has expired

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four times, i.e. on the fifth expiry of timer T3395, the network shall erase the PDP context related data for that MS.

b) Collision of MS and network initiated PDP context deactivation requests

If the MS and the network initiated PDP context deactivation requests collide, the MS and the network shall each reply with the messages DEACTIVATE PDP CONTEXT ACCEPT and shall stop timer T3390 and T3395, respectively.

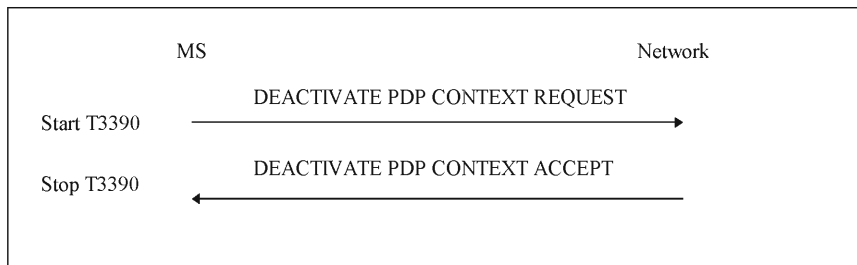


Figure 6.6/GSM 0408: MS initiated PDP context deactivation procedure

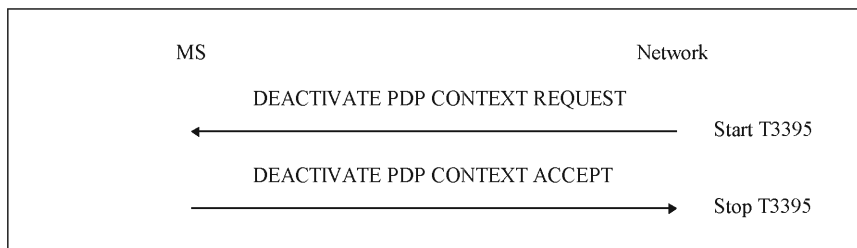


Figure 6.7/GSM 0408: Network initiated PDP context deactivation procedure

6.1.3.4 AA PDP context activation

The purpose of this procedure is to anonymously establish a PDP context between the MS and the network for a specific QoS on a specific NSAPI. The AA PDP context activation shall only be initiated by the MS.

6.1.3.4.1 Successful AA PDP context activation initiated by the mobile station

In order to activate an anonymous PDP context, the MS sends an ACTIVATE AA PDP CONTEXT REQUEST message to the network, enters the state PDP-ACTIVE-PENDING and starts timer T3380. As long as no auxiliary TLLI is allocated to the MS, a random TLLI is used for addressing on lower layers.

Upon receipt of an ACTIVATE AA PDP CONTEXT REQUEST message, the network selects a radio priority level based on the QoS negotiated, assigns a AA-TID to the PDP context and sends an ACTIVATE AA PDP CONTEXT ACCEPT message to the MS. The message shall contain a the selected radio priority level and negotiated QoS allocated by the network. If the offered QoS parameters received from the network differ from the QoS requested by the MS, the MS shall accept the QoS offered by the network. Upon receipt of the message ACTIVATE AA PDP CONTEXT ACCEPT, the MS shall stop timer T3380, shall enter the state PDP-ACTIVE and shall initiate establishment of the logical link with the negotiated QoS.

The AA-READY timer value may be negotiated between the MS and the network as described in section 4.7.11. The AA-READY timer shall be started in the GMM-AA entity. The AA-READY timer shall be reset and restarted by the MS when an indication is received from lower layers that data has been sent. It shall be reset and restarted by the network when an indication is received from lower layers that data has been received. When the AA-READY timer expires, the AA PDP context is implicitly deactivated, i.e. it is deleted.

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6.1.3.4.2 Unsuccessful AA PDP context activation

Upon receipt of the ACTIVATE AA PDP CONTEXT REQUEST message the network may indicate the failure of the MS initiated AA PDP context activation by sending the ACTIVATE AA PDP CONTEXT REJECT message to the MS. The message contains a cause code that typically indicates one of the following causes:

- # 32: service option not supported;
- # 34: service option temporarily out of order;
- # 90 - 111: protocol errors.

The MS shall stop the timer T3380.

6.1.3.4.3 Abnormal cases

a) Expiry of timers

On the first expiry of timer T3380, the MS shall retransmit the ACTIVATE AA PDP CONTEXT REQUEST message and shall reset and restart timer T3380.

This retransmission is repeated until the timer has expired four times, i.e. on the fifth expiry of timer T3380, the MS shall indicate the failure of the AA PDP context activation procedure to the register functions, shall release all resources possibly allocated for this invocation and shall abort the procedure; no automatic AA PDP context activation re-attempt shall be performed.

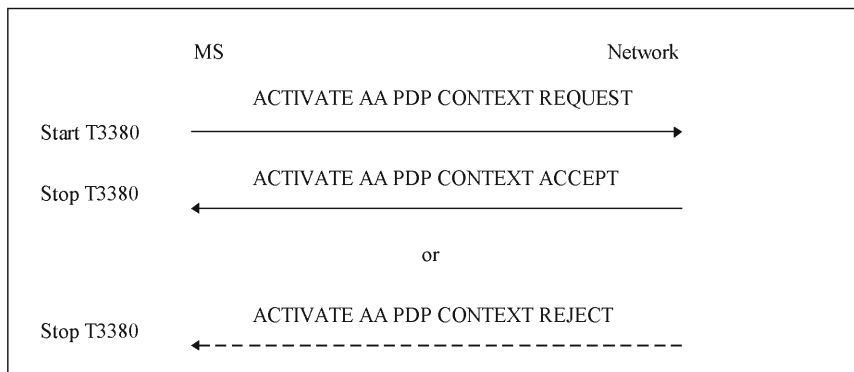


Figure 6.8 GSM 0408: MS initiated AA PDP context activation procedure

6.1.3.5 AA PDP context deactivation

6.1.3.5.1 Implicit AA PDP context deactivation

The implicit deactivation is performed without signalling message exchange as specified below.

The AA PDP context on the network side shall be deactivated when:

- the READY timer expires in the GMM-AA entity.

The AA PDP context in the MS shall be deactivated when:

- the READY timer expires in the GMM-AA entity; or
- the MS changes the routing area; or
- user requested.

6.1.3.5.2 Explicit AA PDP context deactivation

An explicit AA PDP context deactivation shall only be initiated by the network. The procedure shall be performed when a misuse of the anonymous PDP context has been detected.

In order to deactivate the AA PDP context, the network sends the message DEACTIVATE AA PDP CONTEXT REQUEST and starts timer T3397. The message shall contain the NSAPI in use for the AA PDP context to be deactivated. After sending the message the network initiates the release of the logical link.

The MS shall, upon receipt of this message, reply with the DEACTIVATE AA PDP CONTEXT ACCEPT message after the logical link has been released.

Upon receipt of the DEACTIVATE AA PDP CONTEXT ACCEPT message, the network shall stop the timer T3397.

6.1.3.5.3 Abnormal cases

a) Expiry of timers

On the first expiry of timer T3397, the network shall retransmit the message DEACTIVATE AA PDP CONTEXT REQUEST and shall reset and restart timer T3397.

This retransmission is repeated until the timer has expired four times, i.e. on the fifth expiry of timer T3397, the network shall release all resources allocated for that MS and shall erase the AA PDP context related data for that MS.

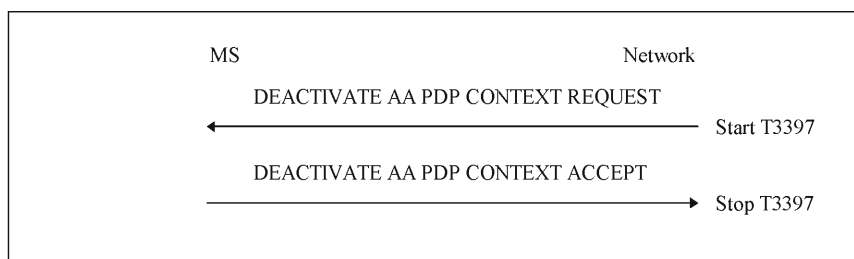


Figure 6.9/GSM 0408: Network initiated AA PDP context deactivation procedure

b) Lower layer failure

If a lower layer failure is indicated before the DEACTIVATE AA PDP CONTEXT ACCEPT message is received, the MS shall abort the procedure and shall locally de-allocate the P-TMSI from the LLC sublayer.

If a lower layer failure is indicated before the DEACTIVATE AA PDP CONTEXT ACCEPT message is received, the network shall abort the procedure and shall locally de-allocate the P-TMSI from the LLC sublayer. 7 Examples of structured procedures

Section 7 is informative.

6.1.3.6 Receiving a SM STATUS message by a SM entity.

If the SM entity of the MS receives a SM 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 SM STATUS message in the network are an implementation dependent option.

7 Examples of structured procedures

Section 7 is informative.

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7.1 General

Section 7 contains examples of how the network may group together the elementary procedures (i.e. the procedures defined in sections 3 to 5) in order to provide normal service.

The layer 3 signalling at the radio interface may be divided into so-called structured procedures which consist of specific combinations of elementary procedures. In section 7.3, selected examples of structured procedures are described. A structured procedure consists of (not necessarily all) components shown in figure 7.1. These components are characterized by the purpose of their use in structured procedures and their message flow in the following sections 7.1.1 to 7.1.7.

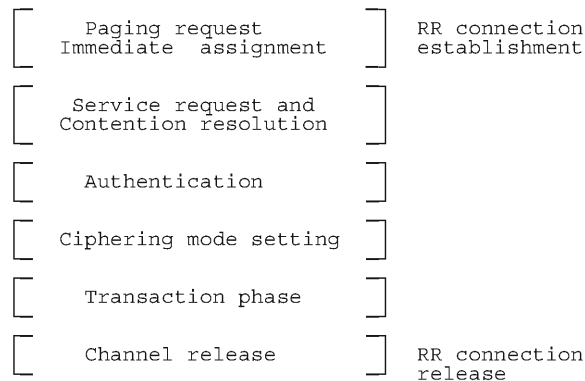


Figure 7.1/GSM 04.08 Components of structured procedures

7.1.1 Paging request

The paging procedure is used to locate a mobile station to which a connection shall be established.

Upon receipt of a PAGING REQUEST message the addressed mobile station initiates the immediate assignment procedure.

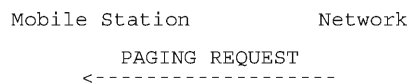


Figure 7.2/GSM 04.08 Paging request

7.1.2 Immediate assignment

The immediate assignment procedure is always initiated by the mobile station. It may be triggered by a paging request or by a mobile originating service request.

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.

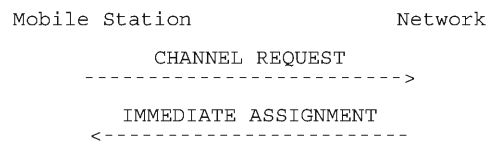


Figure 7.3/GSM 04.08: Immediate assignment

7.1.3 Service request and contention resolution

The initial service request message (a PAGING RESPONSE, LOCATION UPDATING REQUEST, IMSI DETACH, CM SERVICE REQUEST, or CM RE-ESTABLISHMENT REQUEST message) is sent by the mobile station to the network piggy-backed in the L2 SABM frames establishing the main signalling link. Its purpose is

- to provide non-confidential information relevant to the service requested for the RR and MM sublayer in the network;
- in particular to identify the user in the network without jeopardising the confidentiality of the user's identity; this is achieved by using as mobile identity the TMSI, which was never before transmitted un-encrypted over the radio interface;
- to allow for contention resolution.
- optionally, in the CM SERVICE REQUEST message to inform the network of the priority level associated with the call.

Contention resolution provides a resolution process when more than one MS try to seize a channel allocated during the immediate assignment procedure (because they happened to use the same random reference at the same time during random access). This is achieved by the network including in a L2 UA frame the same information field as that one received in the L2 SABM frame to which the UA frame responds. By comparing the two information fields the MS can verify whether it was the originator of the L2 establishment, because the service request contains the mobile identity.

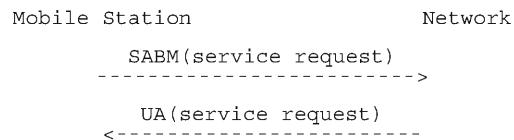


Figure 7.4/GSM 04.08 Service request and contention resolution

7.1.4 Authentication

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

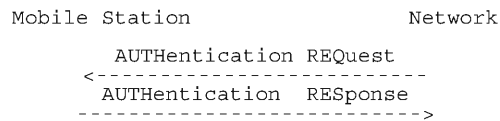


Figure 7.5/GSM 04.08 Authentication

7.1.5 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 and which algorithm to use.

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

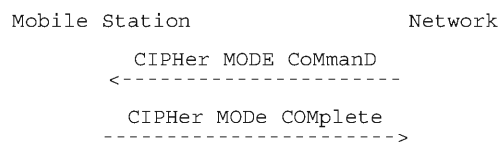


Figure 7.6/GSM 04.08 Ciphering mode setting

7.1.6 Transaction phase

A variety of elementary procedures described in sections 3 to 5 may be performed during the transaction phase. In this section, only the channel mode modify procedure is characterized.

7.1.6.1 Channel mode modify

The channel mode modify procedure may be used when a traffic channel has been assigned e.g.:

- during the in-call modification procedure in order that the channel mode of the TCH be changed to that one requested by call control;
- during call establishment with very early assignment in order that the channel mode of the TCH be changed from signalling only to the mode requested by call control;
- during the active phase of a data call in order that the speed of the data transmission be changed.

The channel mode modify procedure is initiated by the network sending a CHANNEL MODE MODIFY message and completed by the mobile station changing the mode of the TCH and sending back a CHANNEL MODE MODIFY ACKNOWLEDGE message.

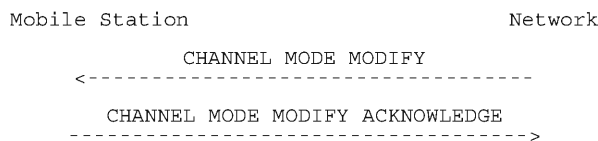


Figure 7.7/GSM 04.08 Channel mode change

7.1.7 Channel release

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

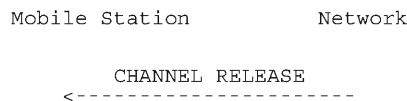


Figure 7.8/GSM 04.08 Channel release

7.2 Abnormal cases

Abnormal cases are not described in the examples of section 7. They may arise from:

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

7.3 Selected examples

The following examples are considered:

- location updating
- mobile originating call establishment

- a) without OACSU (early assignment)
- b) with OACSU
- c) with very early assignment
- 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
- network initiated MO call, e.g. CCBS Recall \$(CCBS)\$:
 - a) assignment before A party alerting
 - b) assignment before B party alerting
 - c) assignment after A and B party alerting

7.3.1 Location updating

The location updating procedure is always initiated by the mobile station e.g. when it finds itself in a different location area from the one in which it was registered before. The cases where the procedure is triggered are described in section 4.

The procedure is shown in figure 7.9/GSM 04.08. The network may decide whether to allocate a new TMSI during location updating, and this option is reflected in this example.

The mobile station initiates immediate assignment, service request using the LOCATION UPDATING REQUEST message, and contention resolution.

The network requires authentication (this again is an option).

As the network intends to allocate a new TMSI, it should activate ciphering. The network includes the new TMSI in the LOCATION UPDATING ACCEPT message (it could also use the explicit TMSI reallocation procedure, see section 4). The mobile station sends a TMSI REALLOCATION COMPLETE message to the network to acknowledge the receipt of the new TMSI. Upon receipt of the TMSI REALLOCATION COMPLETE message the network initiates the channel release if no further transactions are scheduled.

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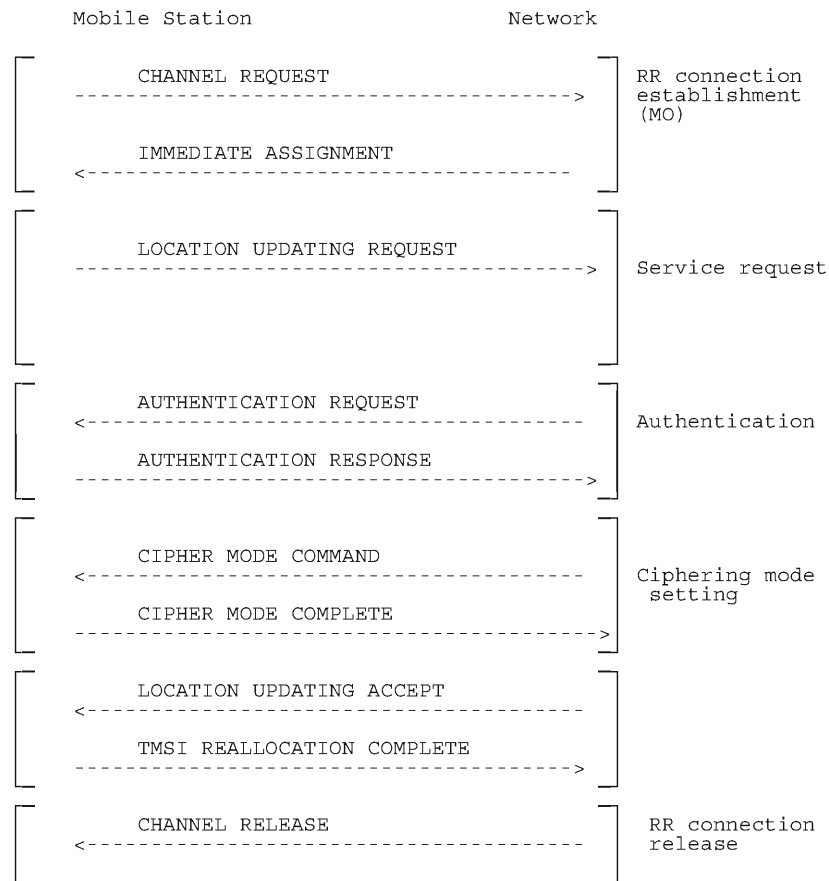


Figure 7.9/GSM 04.08 Location updating: successful case

7.3.2 Mobile originating call establishment

The mobile station initiates immediate assignment, service request using the CM SERVICE REQUEST message, and contention resolution. The network may initiate authentication and may start the ciphering mode setting.

After sending the CIPHERING MODE COMPLETE message, the mobile station initiates call establishment by sending the SETUP message to the network. The network answers with a CALL PROCEEDING message.

a) Non-OACSU option (early assignment)

With this option the network allocates 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 alerting 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 or #8 (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 originating call setup with early assignment is shown in figure 7.10a/GSM 04.08.

b) OACSU option (late assignment)

The network determines when the traffic channel is to be assigned. The assignment may be performed at any time after call establishment has been initiated in the fixed network. In the following the 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. If the ringing tone is needed, it has to be generated locally at the mobile station 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. The CONNECT ACKNOWLEDGE message will complete the call setup.

The mobile originating call setup with late assignment is shown in figure 7.10b/GSM 04.08.

c) Very early assignment

The network assigns the traffic channel at the earliest possible moment, i.e. in the immediate assignment procedure. The mode of the traffic channel is changed from signalling only to the mode necessary for the call by means of the channel mode change procedure. An appropriate moment for that change is after the network has sent the CALL PROCEEDING message, when the call is established towards the called user.

With this option, call queuing is never applied.

The further establishment of the call is as in a).

The mobile originating call setup with very early assignment is shown in figure 7.10c/GSM 04.08.

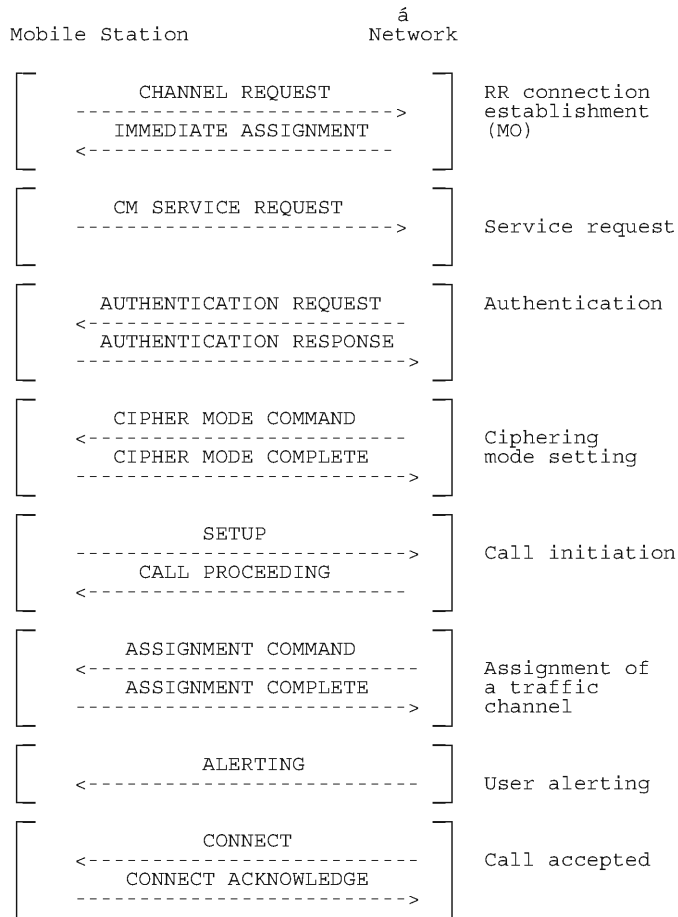


Figure 7.10a/GSM 04.08: Mobile originating call establishment without OACSU (early assignment)

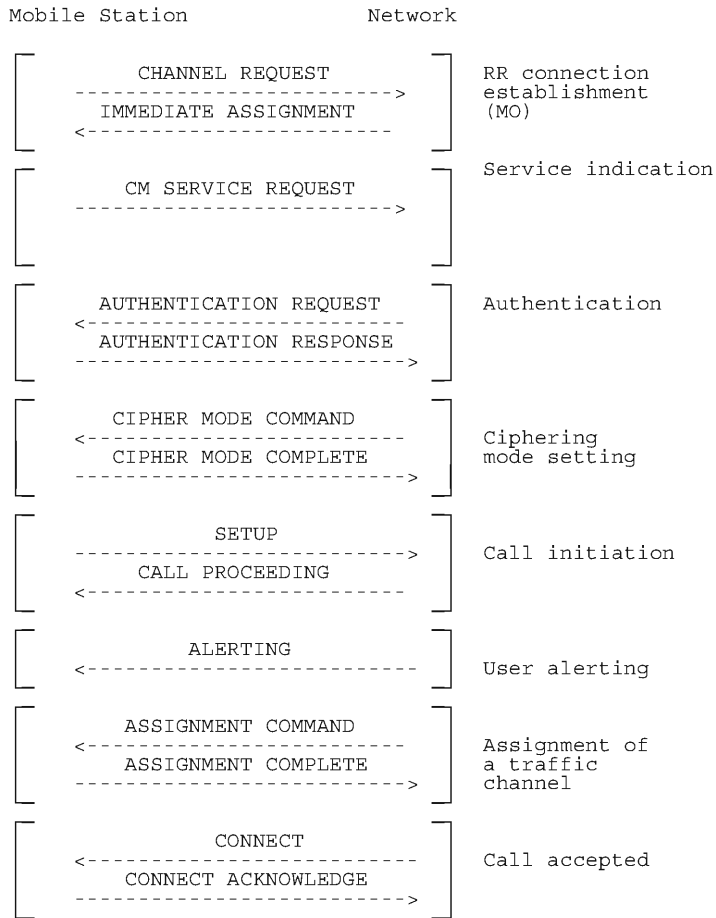


Figure 7.10b/GSM 04.08: Mobile originating call establishment with OACSU (late assignment)

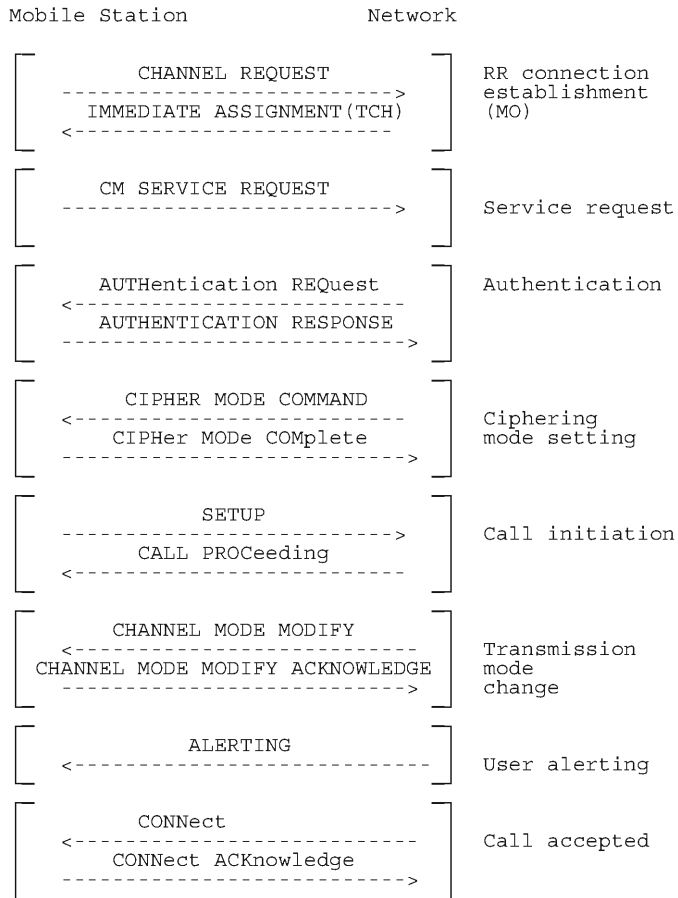


Figure 7.10c/GSM 04.08: Mobile originating call establishment with very early assignment

7.3.3 Mobile terminating call establishment

Mobile terminating call establishment is initiated by the network sending a PAGING REQUEST message (see figure 7.11a/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 network returns a layer 2 UA frame containing the same information field as was sent in the SABM frame.

Authentication and ciphering are treated by the network in the same way as defined for the mobile originating call establishment (section 7.3.2). After ciphering has been started, 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.

The signal IE is not included in the SETUP message, therefore user alerting is initiated only after a traffic channel has been allocated. An ALERTING message will be sent to the network.

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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 (late assignment)

In that option, the signalling IE is included in the SETUP message. Consequently, user alerting is initiated as soon as the MS has accepted the call.

The network determines when the traffic channel is to be assigned. The assignment may be performed at any time after user alerting has been initiated. In the following the 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 figure 7.11b).

Upon receiving the ASSIGNMENT COMPLETE 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.

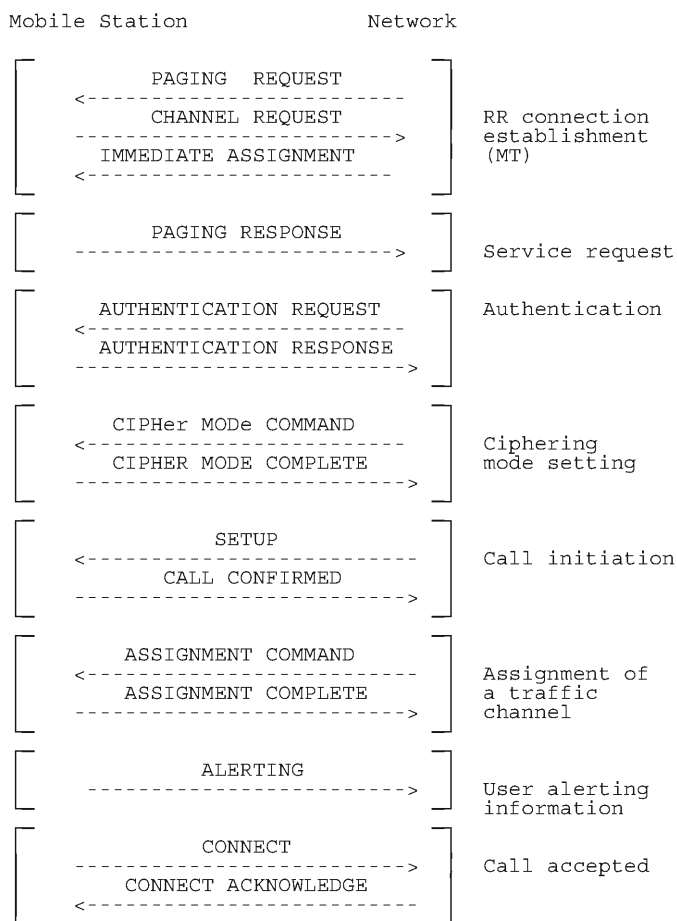


Figure 7.11a/GSM 04.08 - Mobile terminating: call establishment without OACSU (early assignment)

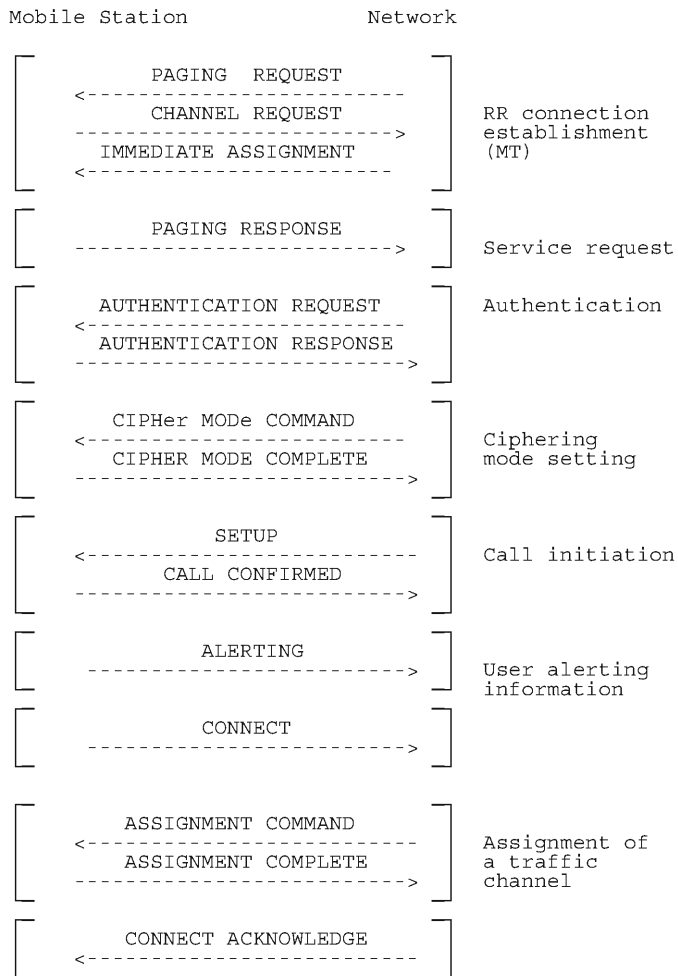


Figure 7.11b/GSM 04.08 - Mobile terminating: call establishment with OACSU (late assignment)

7.3.4 Call clearing

a) initiated by the network

The network initiates the clearing of a call by sending a DISCONNECT message to the mobile station (see also section 5.4.4).

Upon receiving the DISCONNECT message from the network the mobile station sends a RELEASE message to the network.

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 longer needed (e.g. last activity on the traffic channel), performs the channel release procedure as described in section 7.1.7.

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.

Call clearing initiated by the network is shown in figure 7.12a.

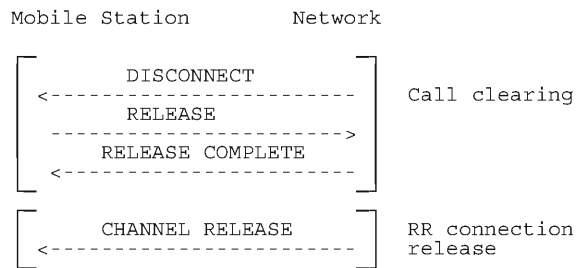
b) initiated by the mobile station

The mobile station initiates the clearing of a call by sending a DISCONNECT message to the network (see also section 5.4.3).

Upon receiving the DISCONNECT message from the mobile station the network sends a RELEASE message to the mobile station.

Upon receiving the RELEASE message from the network, the mobile station sends a RELEASE COMPLETE to the network, which, if the traffic channel is no longer needed (e.g. last activity on the traffic channel), performs the channel release procedure as described in section 7.1.6.

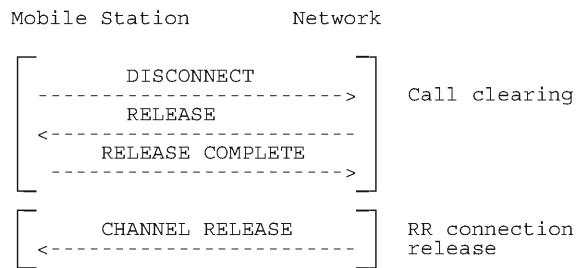
Call clearing initiated by the mobile station is shown in figure 7.12b.



a) Call clearing initiated by the network

Figure 7.12a/GSM 04.08 Call clearing

a)



b) Call clearing initiated by the MS

Figure 7.12b/GSM 04.08 Call clearing

7.3.5 DTMF protocol control

Figure 7.13 shows the structured procedure for DTMF protocol control.

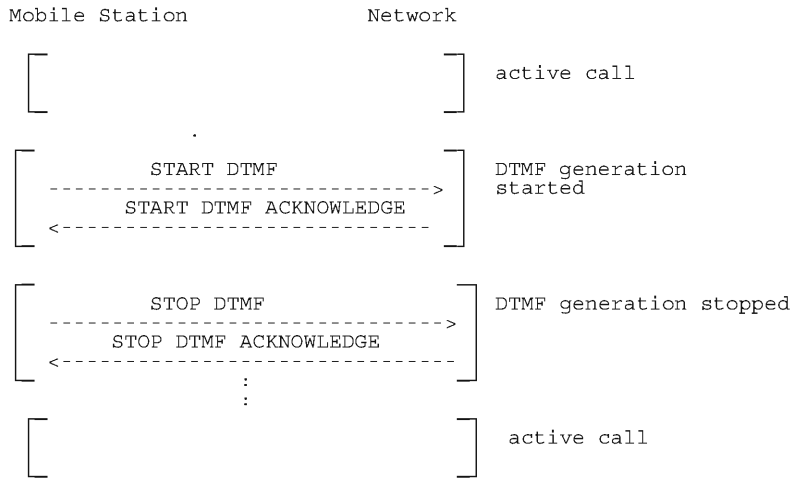


Figure 7.13/GSM 04.08 DTMF protocol control

7.3.6 Handover

Figure 7.14 shows the structured procedure for handover to a finely synchronized cell, successful case.

Figure 7.15 shows the structured procedure for handover to a non-synchronized cell, successful case.

Figure 7.16 shows the structured procedure for handover failure, and reconnection to the old traffic channel.

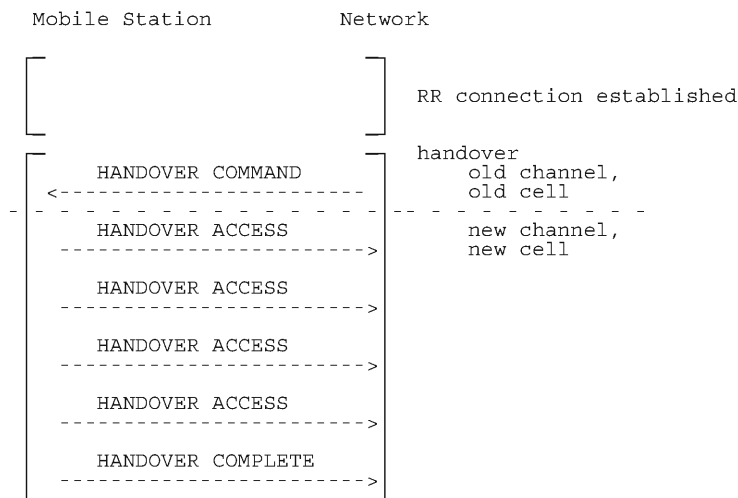


Figure 7.14/GSM 04.08: Handover to a finely synchronized cell, successful case

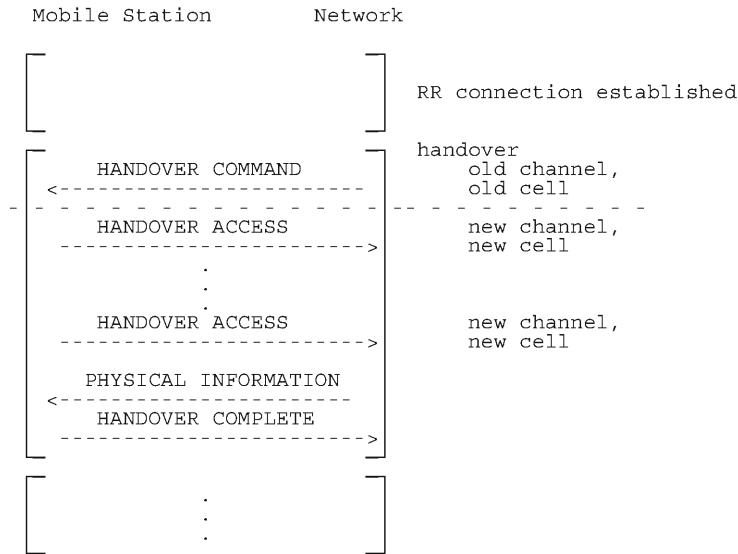


Figure 7.15/GSM 04.08: Handover to a non-synchronized cell, successful case

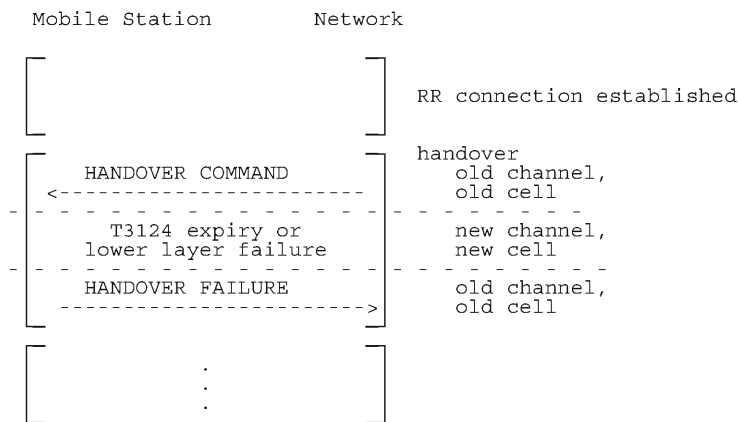


Figure 7.16/GSM 04.08: Handover failure, reconnection to the old traffic channel

7.3.7 In-call modification

Figure 7.17/GSM 04.08 shows the structured procedure for in-call modification.

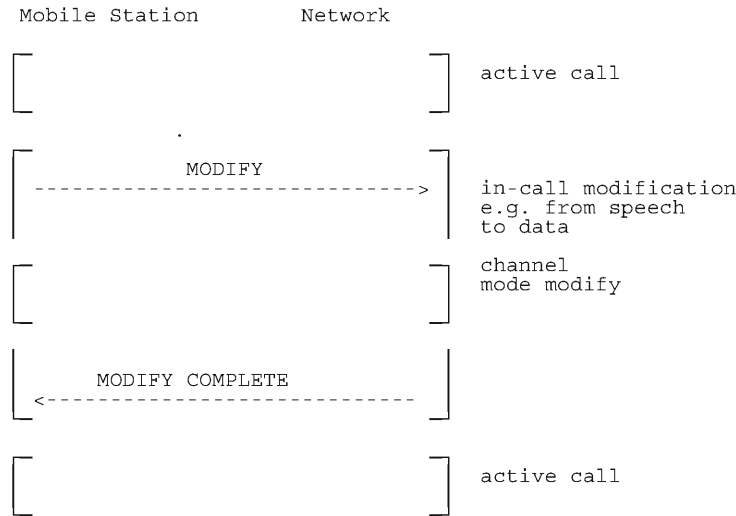


Figure 7.17/GSM 04.08: In-call modification

7.3.8 Call re-establishment

Figure 7.18/GSM 04.08 shows the structured procedure for call re-establishment.

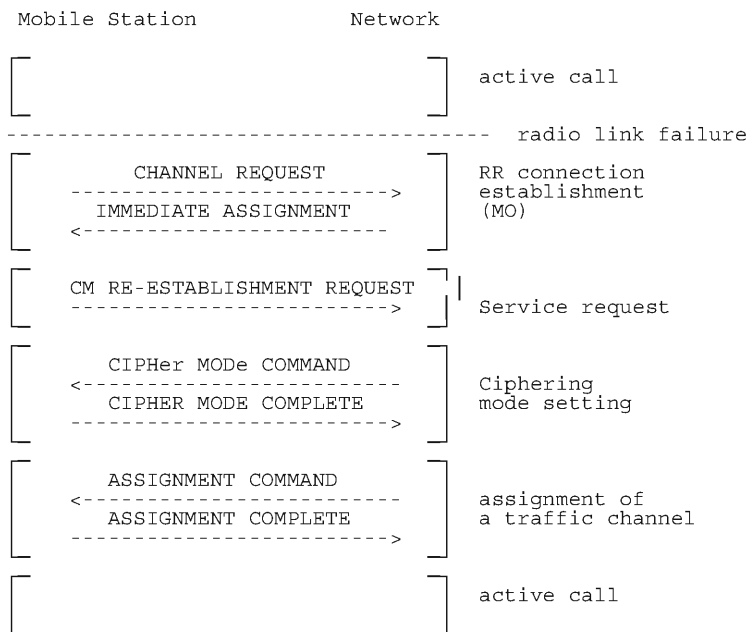


Figure 7.18/GSM 04.08: Call re-establishment

7.3.9 Network initiated mobile originating call \$(CCBS)\$

Network initiated mobile originating call establishment (which is used, for example, for CCBS Service) is initiated by the network sending a PAGING REQUEST message. 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 network returns a layer 2 UA frame containing the same information field as was sent in the SABM frame.

Authentication and ciphering are treated by the network in the same way as defined for the mobile originating call establishment (section 7.3.2). After ciphering has been started, the network sends a CM SERVICE PROMPT message, indicating that the CM protocol is to be started, to the mobile station. The basic capability of the mobile station to accept any form of recall service is confirmed when the mobile station returns a START CC message to the network.

a) assignment before A party alerting

With this option the network allocates a traffic channel to the mobile station before the mobile station alerts its user.

The network responds to the START CC message with a CC-ESTABLISHMENT message. The MS answers with a CC-ESTABLISHMENT CONFIRMED message indicating the wanted channel characteristics. The network then initiates traffic channel assignment.

When the traffic channel has been assigned, the network indicates a pending recall by sending a RECALL message.

If the calling user accepts the recall, a SETUP message is sent to the network. The network responds with a CALL PROCEEDING message and initiates call establishment in the fixed network.

When user alerting 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 or #8 (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 network initiated mobile originating call establishment with assignment before A part alerting is shown in figure 7.19/GSM 04.08.

b) assignment before B party alerting

With this option the network allocates a traffic channel to the mobile station after the mobile station has alerted its user and after its user has accepted the recall but before the network initiates call establishment in the fixed network.

The network responds to the START CC message with a CC-ESTABLISHMENT message. The MS answers with a CC-ESTABLISHMENT CONFIRMED message indicating the wanted channel characteristics.

The network indicates a pending recall by sending a RECALL message. If the calling user accepts the recall, a SETUP message is sent to the network. The network responds with a CALL PROCEEDING message and initiates traffic channel assignment.

When the traffic channel has been assigned, the network initiates call establishment in the fixed network.

When user alerting 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 or #8 (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.

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The network initiated mobile originating call establishment with assignment before B party alerting is shown in figure 7.20/GSM 04.08.

c) assignment after A and B party alerting

With this option, the network determines when the traffic channel is to be assigned. The assignment may be performed at any time after call establishment has been initiated in the fixed network. In the following, the case is considered where the network will only allocate a traffic channel after the called party has answered the call (late assignment).

The network responds to the START CC message with a CC-ESTABLISHMENT. The MS answers with a CC-ESTABLISHMENT CONFIRMED message indicating the wanted channel characteristics.

The network indicates a pending recall by sending a RECALL message. If the calling user accepts the recall, a SETUP message is sent to the network. The network responds with a CALL PROCEEDING message and initiates call establishment in the fixed network.

As in a) and b) an ALERTING message is sent to the mobile station when user alerting has been initiated at the called side. If the ringing tone is needed, it has to be generated locally at the mobile station 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. 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. The CONNECT ACKNOWLEDGE message will complete the call setup.

The network initiated mobile originating call establishment with assignment after A and B party alerting is shown in figure 7.21/GSM 04.08.

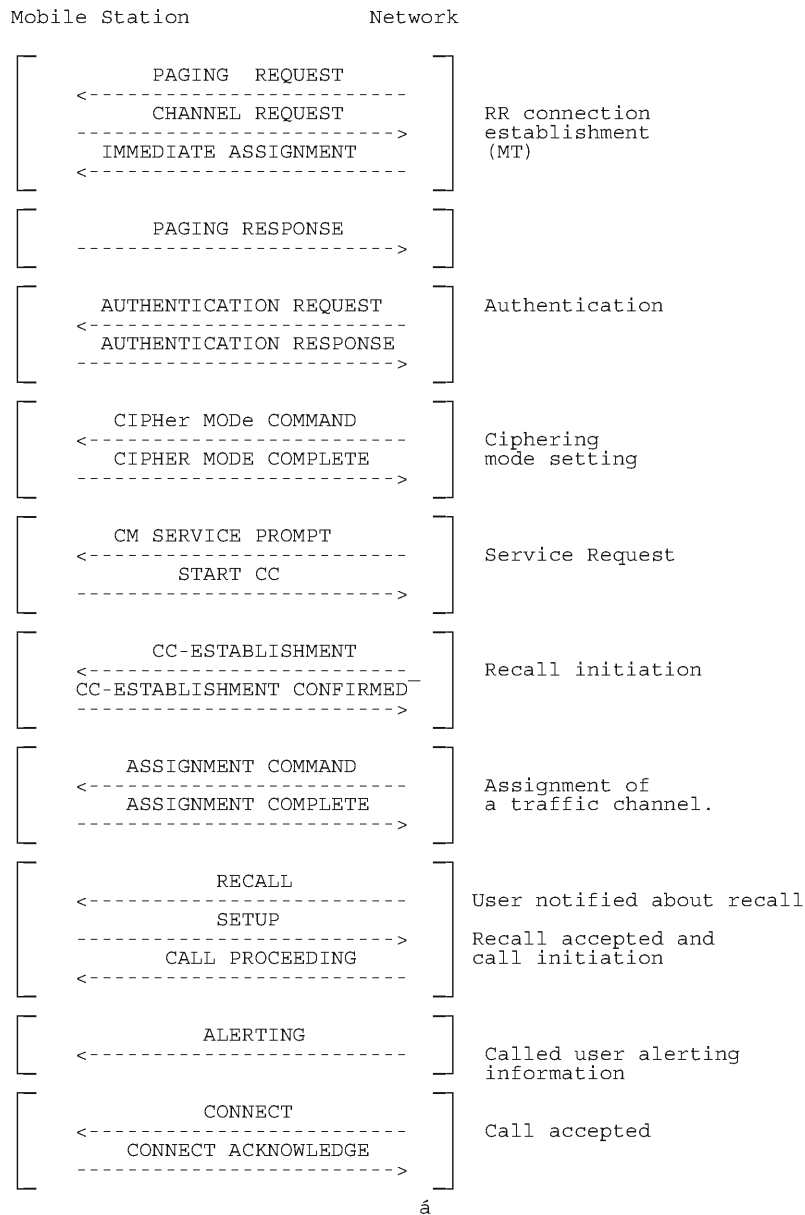


Figure 7.19/GSM 04.08 Network initiated mobile originating call establishment with assignment before A party alerting

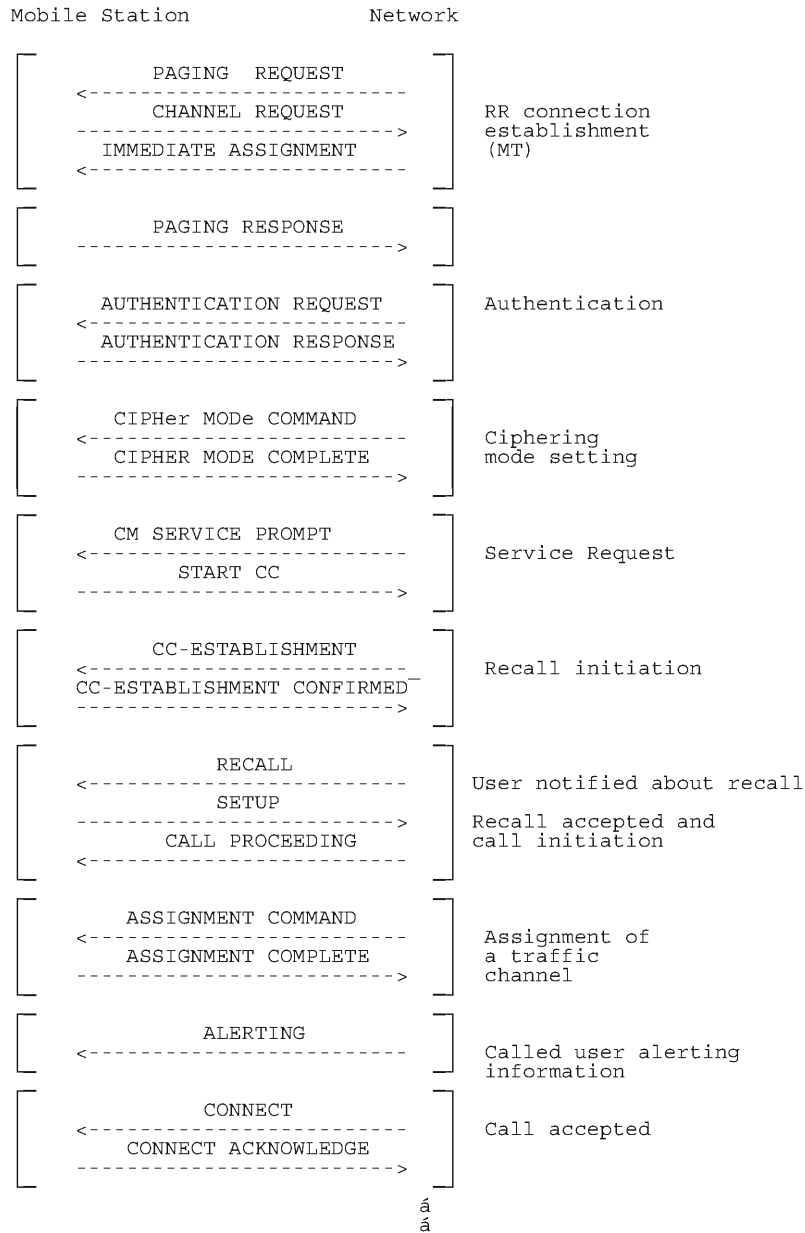


Figure 7.20/GSM 04.08 Network initiated mobile originating call establishment with assignment before B party alerting

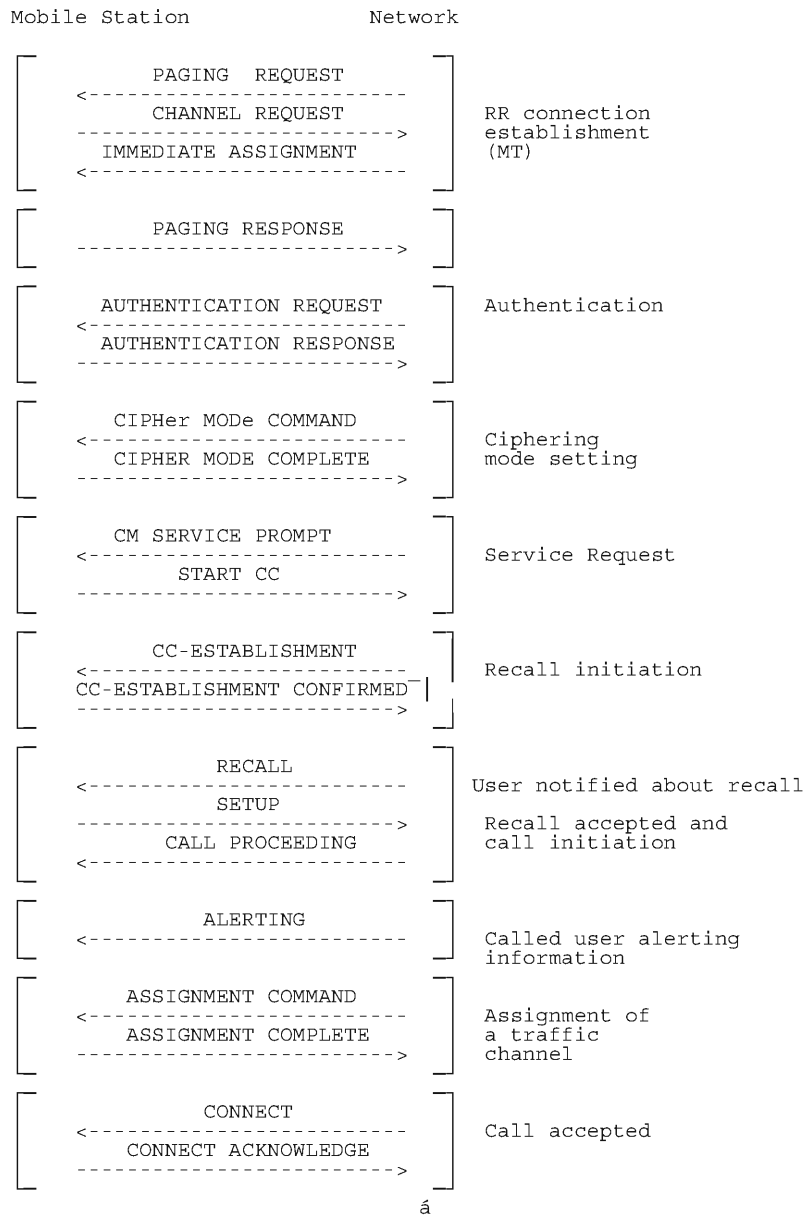


Figure 7.21/GSM 04.08 Network initiated mobile originating call establishment with assignment after A and B party alerting

8 Handling of unknown, unforeseen, and erroneous protocol data

8.1 General

The procedures specified in GSM 04.08 and call-related supplementary service handling in GSM 04.10 apply to those messages which pass the checks described in this section.

This section also specifies procedures for the handling of unknown, unforeseen, and erroneous protocol data by the receiving entity. These procedures are called "error handling procedures", but in addition to providing recovery mechanisms for error situations they define a compatibility mechanism for future extensions of the protocols.

Error handling concerning the value part of the Facility IE and of the SS Version Indicator IE are not in the scope of this technical specification. It is defined in GSM 04.10 and the GSM 04.8x series.

Subsections 8.1 to 8.8 shall be applied in order of precedence.

Most error handling procedures are mandatory for the mobile station.

Detailed error handling procedures in the network are implementation dependent and may vary from PLMN to PLMN. However, when extensions of this protocol are developed, networks will be assumed to have the error handling that is indicated in this section as mandatory ("shall") and that is indicated as strongly recommended ("should"). Sections 8.2, 8.3, 8.4, 8.5 and 8.7.2 do not apply to the error handling in the network applied to the receipt of initial layer 3 message: If the network diagnoses an error described in one of these sections in the initial layer 3 message received from the mobile station, it shall either:

- try to recognize the classmark and then take further implementation dependent actions; or
- release the RR-connection.

Also, the error handling of the network is only considered as mandatory or strongly recommended when certain thresholds for errors are not reached during a dedicated connection.

In this section the following terminology is used:

- An IE is defined to be syntactically incorrect in a message if it contains at least one value defined as "reserved" in section 10, or if its value part violates rules of section 10. However it is not a syntactical error that a type 4 IE specifies in its length indicator a greater length than defined in section 10.
- A message is defined to have semantically incorrect contents if it contains information which, possibly dependent on the state of the receiver, is in contradiction to the resources of the receiver and/or to the procedural part (i.e. sections 3, 4, 5) of GSM 04.08, GSM 04.10, or relevant GSM 04.8X series.

8.2 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, cf. GSM 04.07.

8.3 Unknown or unforeseen transaction identifier

8.3.1 Call Control

The mobile station and network shall ignore a call control message received with TI value "111". For a call control message received with TI different from "111", the following procedures shall apply:

- a) For a network that does not support the "Network initiated MO call" option and for all mobile stations:

Whenever any call control message except EMERGENCY SETUP, SETUP or RELEASE COMPLETE 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.

For a network that does support the "Network initiated MO call" option \$(CCBS)\$:

Whenever any call control message except EMERGENCY SETUP, SETUP, START CC or RELEASE COMPLETE 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) For a network that does not support the "Network initiated MO call" option and for all mobile stations:

When an EMERGENCY SETUP or, 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.

For a network that does support the "Network initiated MO call" option \$(CCBS)\$:

When an EMERGENCY SETUP, a START CC or, a SETUP message is received specifying a transaction identifier which is not recognised 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 by the mobile station 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) For a network that does not support the "Network initiated MO call" option:

When an EMERGENCY SETUP message or a SETUP message is received by the network specifying a transaction identifier which is recognized as relating to an active call or to a call in progress, this message need not be treated and the network may perform other actions.

For a network that does support the "Network initiated MO call" option \$(CCBS)\$:

When an EMERGENCY SETUP message or a START CC message is received by the network specifying a transaction identifier which is recognised as relating to an active call or to a call in progress, this message need not be treated and the network may perform other actions.

The same applies to a SETUP message unless the transaction has been established by a START_CC message and the network is in the "recall present" state (N0.6).

8.3.2 Session Management

The mobile station and network shall reject a session management message other than SM-STATUS received with TI value "111" by immediately sending an SM-STATUS message with TI value "111". For a session management message received with TI different from "111", the following procedures shall apply:

- a) Whenever any session management message except ACTIVATE PDP CONTEXT REQUEST, ACTIVATE AA PDP CONTEXT REQUEST or SM-STATUS is received by the network specifying a transaction identifier which is not recognized as relating to an active context or to a context that is in the process of activation or deactivation or has been [recently] deactivated, the network should send a SM-STATUS message with cause #81 "invalid transaction identifier value" using the received transaction identifier value and remain in the PDP-INACTIVE state.
- b) Whenever any session management message except REQUEST PDP CONTEXT ACTIVATION or SM-STATUS is received by the MS specifying a transaction identifier which is not recognized as relating to an active context or to a context that is in the process of activation or deactivation or has been [recently] deactivated, the MS shall send a SM-STATUS message with cause #81 "invalid transaction identifier value" using the received transaction identifier value and remain in the PDP-INACTIVE state.

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- c) When an ACTIVATE AA PDP CONTEXT REQUEST or REQUEST PDP CONTEXT ACTIVATION message is received with a transaction identifier flag set to "1", this message shall be ignored.
- d) When an ACTIVATE PDP CONTEXT REQUEST message is received specifying a transaction identifier which is not recognized as relating to a context that is in the process of activation, and with a transaction identifier flag set to "1", this message shall be ignored.

8.4 Unknown or unforeseen message type

If a mobile station receives a message with message type not defined for the PD or not implemented by the receiver in unacknowledged mode, it shall ignore the message.

If a mobile station receives a message with message type not defined for the PD or not implemented by the receiver in acknowledged mode, it shall return a status message (STATUS, RR STATUS or MM STATUS or GMM STATUS depending on the protocol discriminator) with cause # 97 "message type non-existent or not implemented".

If the network receives an RR message or MM message with message type not defined for the PD or not implemented by the receiver in a protocol state where reception of an unsolicited message with the given PD from the mobile station is not foreseen in the protocol, the network actions are implementation dependent. Otherwise, if the network receives a message with message type not defined for the PD or not implemented by the receiver, it shall ignore the message except that it should return a status message (STATUS, RR STATUS or MM STATUS or GMM STATUS depending on the protocol discriminator) with cause #97 "message type non-existent or not implemented".

NOTE: A message type not defined for the PD in the given direction is regarded by the receiver as a message type not defined for the PD, see GSM 04.07 [20].

If the mobile station receives a message not compatible with the protocol state, the mobile station shall ignore the message except for the fact that, if an RR connection exists, it returns a status message (STATUS, RR STATUS or MM STATUS depending on the protocol discriminator) with cause #98 "Message type not compatible with protocol state". When the message was a GMM message the GMM-STATUS message with cause #98 "Message type not compatible with protocol state" shall be returned.

If the network receives a message not compatible with the protocol state, the network actions are implementation dependent.

8.5 Non-semantic mandatory information element errors

When on receipt of a message,

- an "imperative message part" error; or
- a "missing mandatory IE" error

is diagnosed or when a message containing:

- a syntactically incorrect mandatory IE; or
- an IE unknown in the message, but encoded as "comprehension required" (see section 10.5); or
- an out of sequence IE encoded as "comprehension required" (see section 10.5)

is received,

- the mobile station shall proceed as follows:

When the message is not one of the messages listed in sections 8.5.1, 8.5.2, and 8.5.3, the mobile station shall ignore the message except for the fact that, if an RR connection exists, it shall return a status message (STATUS, RR STATUS or MM STATUS depending on the protocol discriminator) with cause # 96 "invalid mandatory information". When the message was a GMM message the GMM-STATUS message with cause #98 "Message type not compatible with protocol state" shall be returned.

- the network shall proceed as follows:

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When the message is not one of the messages listed in section 8.5.3 b), c), d) or e), the network shall either

- try to treat the message (the exact further actions are implementation dependent), or
- ignore the message except that it should return a status message (STATUS, RR STATUS or MM STATUS, or GMM STATUS depending on the protocol discriminator) with cause # 96 "invalid mandatory information".

8.5.1 Radio resource management

For the mobile station the following procedures shall apply:

- a) If the message is a CHANNEL RELEASE message, the actions taken shall be the same as specified in 3.5 "RR connection release".
- b) If the message is a PARTIAL RELEASE message, the reactions of the MS are for further study.

8.5.2 Mobility management

No exceptional cases are described for mobility management messages.

8.5.3 Call control

- a) If the message is a SETUP message, a RELEASE COMPLETE message with cause # 96 "invalid mandatory information" shall be returned.
- b) If the message is a DISCONNECT message, a RELEASE message shall be returned with cause value # 96 "invalid mandatory information" and section 5.4. "call clearing" applies as normal.
- c) If the message is a RELEASE message, a RELEASE COMPLETE message shall be returned with cause value # 96 "invalid mandatory information".
- d) If the message is a RELEASE COMPLETE message, it shall be treated as a normal RELEASE COMPLETE message.
- e) If the message is a HOLD REJECT or RETRIEVE REJECT message, it shall be treated as a normal HOLD REJECT or RETRIEVE REJECT message.
- f) If the message is a STATUS message and received by the network, a RELEASE COMPLETE message may be returned with cause value # 96 "invalid mandatory information".

8.5.4 Session management

- a) If the message is a DEACTIVATE PDP CONTEXT REQUEST, a DEACTIVATE PDP CONTEXT ACCEPT message with cause # 96 "invalid mandatory information" shall be returned. All resources allocated for that context shall be released.
- b) If the message is a DEACTIVATE AA PDP CONTEXT REQUEST, a DEACTIVATE AA PDP CONTEXT ACCEPT message with cause # 96 "invalid mandatory information" shall be returned. All resources allocated for that context shall be released.
- c) If the message is a REQUEST PDP CONTEXT ACTIVATION, a REQUEST PDP CONTEXT REJECT message with cause # 96 "invalid mandatory information" shall be returned.

8.6 Unknown and unforeseen IEs in the non-imperative message part

8.6.1 IEs unknown in the message

The MS shall ignore all IEs unknown in a message which are not encoded as "comprehension required".

The network shall take the same approach.

8.6.2 Out of sequence IEs

The MS shall ignore all out of sequence IEs in a message which are not encoded as "comprehension required".

The network should take the same approach.

8.6.3 Repeated IEs

If an information element with format T, TV, or TLV is repeated in a message in which repetition of the information element is not specified in section 9 of this technical specification, 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 specified, only the contents of specified repeated 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 network should follow the same procedures.

8.7 Non-imperative message part errors

This category includes:

- syntactically incorrect optional IEs;
- conditional IE errors.

8.7.1 Syntactically incorrect optional IEs

The MS shall treat all optional IEs that are syntactically incorrect in a message as not present in the message.

The network shall take the same approach.

8.7.2 Conditional IE errors

When the MS upon receipt of a message diagnoses a "missing conditional IE" error or an "unexpected conditional IE" error or when it receives a message containing at least one syntactically incorrect conditional IE, it shall ignore the message except for the fact that, if an RR connection exists, it shall return a status message (STATUS, RR STATUS, or MM STATUS depending on the PD) with cause value # 100 "conditional IE error".

When the network receives a message and diagnose a "missing conditional IE" error or an "unexpected conditional IE" error or when it receives a message containing at least one syntactically incorrect conditional IE, the network shall either

- try to treat the message (the exact further actions are implementation dependent), or
- ignore the message except that it should return a status message (STATUS, RR STATUS or MM STATUS depending on the protocol discriminator) with cause # 100 "conditional IE error".

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8.8 Messages with semantically incorrect contents

When a message with semantically incorrect contents is received, the foreseen reactions of the procedural part of GSM 04.08 (i.e. of sections 3, 4, 5) are performed. If however no such reactions are specified, the MS shall ignore the message except for the fact that, if an RR connection exists, it returns a status message (STATUS, RR STATUS, or MM STATUS depending on the PD) with cause value # 95 "semantically incorrect message".

The network should follow the same procedure except that a status message is not normally transmitted.

Semantic checking of the Facility information element value part (defined in GSM 04.80) is the subject of the technical specifications GSM 04.10 and the GSM 04.8x series.

9 Message functional definitions and contents

This section defines the structure of the messages of those layer 3 protocols defined in GSM 04.08. These are standard L3 messages as defined in GSM 04.07 with the exception of those sent on the SCH, RACH, and the HANDOVER ACCESS message.

Each definition given in the present section 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 known in the message and their order of their appearance in the message. In messages for circuit-switched call control also a *shift* information element shall be considered as known even if not included in the table. All information elements that may be repeated are explicitly indicated. (V and LV formatted IEs, which compose the imperative part of the message, occur before T, TV, and TLV formatted IEs which compose the non-imperative part of the message, cf. GSM 04.07.) In a (maximal) sequence of consecutive information elements with half octet length, the first information element with half octet length 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. Such a sequence always has an even number of elements.

For each information element the table indicates:

1. the information element identifier, in hexadecimal notation, if the IE has format T, TV, or TLV. Usually, there is a default IEI for an information element type; default IEIs of different IE types of the same protocol are different. If the IEI has half octet length, it is specified by a notation representing the IEI as a hexadecimal digit followed by a "-" (example: B-).

NOTE The same IEI may be used for different information element types in different messages of the same protocol.

2. the name of the information element (which may give an idea of the semantics of the element). The name of the information element (usually written in italics) followed by "IE" or "information element" is used in GSM 04.08 as reference to the information element within a message.

3. the name of the type of the information element (which indicates the coding of the value part of the IE), and generally, the referenced subsection of section 10 of GSM 04.08 describing the value part of the information element.
4. the presence requirement indication (M, C, or O) for the IE as defined in GSM 04.07.
5. The format of the information element (T, V, TV, LV, TLV) as defined in GSM 04.07.
6. The length of the information element (or permissible range of lengths), in octets, in the message, where "?" means that the maximum length of the IE is only constrained by link layer protocol, and in the case of the Facility IE by possible further conditions specified in GSM 04.10. This indication is non-normative.

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- c) subsections specifying, where appropriate, conditions for IEs with presence requirement C or O in the relevant message which together with other conditions specified in GSM 04.08 define when the information elements shall be included or not, what non-presence of such IEs means, and - for IEs with presence requirement C - the static conditions for presence and/or non-presence of the IEs (cf. GSM 04.07).

9.1 Messages for Radio Resources management

Table 9.1/GSM 04.08 summarizes the messages for Radio Resources management.

Table 9.1/GSM 04.08: Messages for Radio Resources management

Channel establishment messages:	Reference
ADDITIONAL ASSIGNMENT	9.1.1
IMMEDIATE ASSIGNMENT	9.1.18
IMMEDIATE ASSIGNMENT EXTENDED	9.1.19
IMMEDIATE ASSIGNMENT REJECT	9.1.20
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
PDCH ASSIGNMENT COMMAND	9.1.13a
HANDOVER ACCESS	9.1.14
HANDOVER COMMAND	9.1.15
HANDOVER COMPLETE	9.1.16
HANDOVER FAILURE	9.1.17
RR-CELL CHANGE ORDER	9.1.21e
PHYSICAL INFORMATION	9.1.28
RR INITIALISATION REQUEST	9.1.28a
HANDOVER ACCESS	9.1.14
HANDOVER COMMAND	9.1.15
HANDOVER COMPLETE	9.1.16
HANDOVER FAILURE	9.1.17
PHYSICAL INFORMATION	9.1.28
Channel release messages:	Reference
CHANNEL RELEASE	9.1.7
PARTIAL RELEASE	9.1.26
PARTIAL RELEASE COMPLETE	9.1.27
Paging messages:	Reference
PAGING REQUEST TYPE 1	9.1.22
PAGING REQUEST TYPE 2	9.1.23
PAGING REQUEST TYPE 3	9.1.24
PAGING RESPONSE	9.1.25

(continued...)

Table 9.1/GSM 04.08 (concluded): Messages for Radio Resources management

System information messages:	Reference
SYSTEM INFORMATION TYPE 1	9.1.31
SYSTEM INFORMATION TYPE 2	9.1.32
SYSTEM INFORMATION TYPE 2bis	9.1.33
SYSTEM INFORMATION TYPE 2ter	9.1.34
SYSTEM INFORMATION TYPE 3	9.1.35
SYSTEM INFORMATION TYPE 4	9.1.36
SYSTEM INFORMATION TYPE 5	9.1.37
SYSTEM INFORMATION TYPE 5bis	9.1.38
SYSTEM INFORMATION TYPE 5ter	9.1.39
SYSTEM INFORMATION TYPE 6	9.1.40
SYSTEM INFORMATION TYPE 7	9.1.41
SYSTEM INFORMATION TYPE 8	9.1.42
SYSTEM INFORMATION TYPE 9	9.1.43
SYSTEM INFORMATION TYPE 13	9.1.43a
SYSTEM INFORMATION TYPE 14	9.1.43b
SYSTEM INFORMATION TYPE 15	9.1.43c
Specific messages for VBS/VGCS:	Reference
NOTIFICATION/FACCH	9.1.21a
NOTIFICATION/NCH	9.1.21b
TALKER INDICATION	9.1.44
UPLINK ACCESS	9.1.45
UPLINK BUSY	9.1.46
UPLINK FREE	9.1.47
UPLINK RELEASE	9.1.48
VGCS UPLINK GRANT	9.1.49
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
CLASSMARK ENQUIRY	9.1.12
FREQUENCY REDEFINITION	9.1.13
MEASUREMENT REPORT	9.1.21
SYNCHRONIZATION CHANNEL INFORMATION	9.1.30
RR STATUS	9.1.29
GPRS SUSPENSION REQUEST	9.1.13b
Configuration Change messages:	Reference
CONFIGURATION CHANGE COMMAND	9.1.12b
CONFIGURATION CHANGE ACKNOWLEDGE	9.1.12c
CONFIGURATION CHANGE REJECT	9.1.12d

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

Table 9.2/GSM 04.08: ADDITIONAL ASSIGNMENT message content

IEI	Information element	Type / Reference	Presence	Format	length
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	½
	Skip Indicator	Skip Indicator 10.3.1	M	V	½
	Additional Assignment Message Type	Message Type 10.4	M	V	1
	Channel Description	Channel Description 10.5.2.5	M	V	3
72	Mobile Allocation	Mobile Allocation 10.5.2.21	C	TLV	3-10
7C	Starting Time	Starting Time 10.5.2.38	O	TV	3

9.1.1.1 Mobile Allocation

This information element shall appear if the *Channel Description* information element indicates frequency hopping.

If the *Channel Description* IE does not indicate frequency hopping and the information element is present it shall be considered as an IE unnecessary in the message.

9.1.1.2 Starting Time

This information element appears in particular if e.g., a change of frequency is planned.

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, when no timing adjustment is needed. See table 9.3/GSM 04.08

Message type: ASSIGNMENT COMMAND

Significance: dual

Direction: network to mobile station

Table 9.3/GSM 04.08: ASSIGNMENT COMMAND message content

IEI	Information element	Type / Reference	Presence	Format	length
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	½
	Skip Indicator	Skip Indicator 10.3.1	M	V	½
	Assignment command Message Type	Message Type 10.4	M	V	1
	Description of the First Channel, after time	Channel Description 2 10.5.2.5a	M	V	3
	Power Command	Power Command 10.5.2.28	M	V	1
05	Frequency List, after time	Frequency List 10.5.2.13	C	TLV	4-132
62	Cell Channel Description	Cell Channel Description 10.5.2.1b	O	TV	17
10	Description of the multislot configuration	Multislot Allocation 10.5.2.21b	C	TLV	3-12
63	Mode of the First Channel (Channel Set 1)	Channel Mode 10.5.2.6	O	TV	2

(continued)

Table 9.3/GSM 04.08 (concluded): ASSIGNMENT COMMAND message content

11	Mode of Channel Set 2	Channel Mode 10.5.2.6	O	TV	2
13	Mode of Channel Set 3	Channel Mode 10.5.2.6	O	TV	2
14	Mode of Channel Set 4	Channel Mode 10.5.2.6	O	TV	2
15	Mode of Channel Set 5	Channel Mode 10.5.2.6	O	TV	2
16	Mode of Channel Set 6	Channel Mode 10.5.2.6	O	TV	2
17	Mode of Channel Set 7	Channel Mode 10.5.2.6	O	TV	2
18	Mode of Channel Set 8	Channel Mode 10.5.2.6	O	TV	2
64	Description of the Second Channel, after time	Channel Description 10.5.2.5	O	TV	4
66	Mode of the Second Channel	Channel Mode 2 10.5.2.7	O	TV	2
72	Mobile Allocation, after time	Mobile Allocation 10.5.2.21	C	TLV	3-10
7C	Starting Time	Starting Time 10.5.2.38	O	TV	3
19	Frequency List, before time	Frequency List 10.5.2.13	C	TLV	4-132
1C	Description of the First Channel, before time	Channel Description 2 10.5.2.5a	O	TV	4
1D	Description of the Second Channel, before time	Channel Description 10.5.2.5	O	TV	4
1E	Frequency channel sequence before time	Frequency channel sequence 10.5.2.12	C	TV	10
21	Mobile Allocation, before time	Mobile Allocation 10.5.2.21	C	TLV	3-10
9-	Cipher Mode Setting	Cipher Mode Setting 10.5.2.9	O	TV	1
01	VGCS target mode Indication	VGCS target mode Indication 10.5.2.42c	O	T	2

9.1.2.1 Mode of the First Channel (Channel Set 1) and Mode of Channel Set "X" (2=<X=<8)

If this information element is not present the channel mode of the previously allocated channel or channels for Channel Set "X" (1=<X=<8) shall be assumed.

If Channel Set "X" is not defined for the configuration, the *Mode of Channel Set "X"* IE shall be considered as an IE unnecessary in the message.

NOTE: Clause 3.4.3.1 defines cases when one or several *Mode of Channel Set "X"* IEs shall be included in the message.

9.1.2.2 Description of the Second Channel

These information elements appear in the case of an assignment occurring if the mobile station carries two connections (on two dedicated channels, for the TCH/H + TCH/H configuration).

The connection using the channel previously defined in the *Description of the First Channel* IEs of an ASSIGNMENT COMMAND or HANDOVER COMMAND message shall use the channel defined in the *Description of the First Channel* IEs of the ASSIGNMENT COMMAND message defining the new configuration.

The channel described in the *Description of the First Channel* IEs carries the main DCCH. The SACCH used is the one associated with that channel.

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9.1.2.3 Mode of the Second Channel

If no *Description of the Second Channel* IE is present but the information element is present it shall be considered as an IE unnecessary in the message.

This information element appears at least when the channel mode is changed for the channel defined in the second channel description information elements.

9.1.2.4 Mobile Allocation and Frequency List, after the starting time

If at least one of the channel descriptions for the starting time indicates frequency hopping, one and only one of the following information elements shall be present and apply to all assigned channels

- *Mobile Allocation, after time*
- *Frequency List, after time.*

If neither of the Channel Description IEs for after time indicate frequency hopping, if decoding of Channel Description IEs for before time does not require a frequency list for after time (see next section), and one or both of the two information elements are present they shall be considered as IEs unnecessary in the message.

9.1.2.5 Starting Time

The *starting time* information element is included when the network wants the mobile station to change the frequency parameters of the channels more or less at the moment a change of channel occurs. In this case a number of information elements may be included to give the frequency parameters to be used before the starting time.

If the *starting time* information element is present and none of the information elements referring to before the starting time are present, the mobile station waits and accesses the channels at the indicated time.

If the *starting time* information element is present and at least one of the information elements referring to before the starting time is present, the mobile station does not wait for the indicated time and accesses the channel using the frequency parameters for before the starting time.

If the *starting time* information element is not present and at some of the information elements referring to before the starting time is present, these information elements shall be considered as IEs unnecessary in the message.

If the *description of the first channel, before time* IE is not present, the channel description to apply for before the time, if needed, is given by the *description of the first channel, after time* IE.

If the *description of the second channel, after time* IE is present, the *description of the second channel, before time* IE not present, and a description of the configuration for before the time needed, the channel configuration before the starting time is nevertheless of two traffic channels, and the channel description to apply to the second channel before the starting time is given by the *description of the second channel, after time* IE.

If the *starting time* IE is present and at least one of the channel descriptions for before the starting time indicates frequency hopping, one and only one of the following information elements may be present and applies before the starting time to all assigned channels

- *Mobile Allocation, before time* IE;
- *Frequency list, before time* IE;
- *Frequency channel sequence, before time* IE.

If the *starting time* IE is present and at least one of the channel descriptions for before the starting time indicates frequency hopping, and none of the above mentioned IE is present, a frequency list for after the starting time must be present (see 9.1.2.4), and this list applies also for the channels before the starting time.

9.1.2.6 Reference cell frequency list

If any of the *mobile allocation* information elements is present, then the network must ensure that either the mobile station has received in a previous message the proper reference cell frequency list (CA), or that the *cell channel description* IE is present.

If the *cell channel description* IE is present, it is used to decode the *mobile allocation* IEs in the message, as well as in later messages until reception of a new reference cell frequency list or the cell is left.

9.1.2.7 Cell Channel Description

If present, this information element shall be used to decode the *Mobile Allocation* IE in the same message and in subsequent messages.

9.1.2.8 Cipher Mode Setting

If this information element is omitted, the mode of ciphering is not changed after the mobile station has switched to the assigned channel.

9.1.2.9 VGCS target mode Indication

This information element is identified as "comprehension required". Only mobile stations supporting « VGCS talking » are required to accept the presence of the element. The presence of the element shall trigger an exception handling if received by a mobile station not supporting « VGCS talking ».

This IE indicates which mode is to be used on the new channel (i.e. dedicated mode or group transmit mode). If this information element is not present, the mode shall be the same as on the previous channel.

The IE also indicates the group cipher key number for the group cipher key to be used on the new channel or if the new channel is non ciphered. If the information element is not present, the ciphering mode shall be the same as on the previous channel.

NOTE: A mobile station supporting VGCS talking shall not consider a syntactical error when this IE is present and the channel mode is not speech.

9.1.2.10 Description of the multislots allocation

This information element is included if so indicated by the channel type and TDMA offset field in the *Channel Description* information element and is used to assign channels that do not carry a main signalling link in a multislots configuration. It indicates how the used timeslots are divided into separate channel sets.

If the *Channel Description* IE does not require the presence of the information element the *Description of the multislots allocation* IE shall be considered as an IE unnecessary in the message.

If multislots configuration is indicated by the *Channel Description* IE but the *Multislots Allocation* IE is not present, all channels in the configuration belong to one channel set, "Channel Set 1".

NOTE: As a change of timeslot number cannot occur for the channel described after the starting time, the *Multislots Allocation* IE does not have to be included more than once.

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

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Table 9.4/GSM 04.08: ASSIGNMENT COMPLETE message content

IEI	Information element	Type / Reference	Presence	Format	length
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Assignment Complete Message Type	Message Type 10.4	M	V	1
	RR Cause	RR Cause 10.5.2.31	M	V	1

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

Table 9.5/GSM 04.08: ASSIGNMENT FAILURE message content

IEI	Information element	Type / Reference	Presence	Format	length
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Assignment Failure Message Type	Message Type 10.4	M	V	1
	RR cause	RR Cause 10.5.2.31	M	V	1

9.1.5 Channel mode modify

This message is sent on the main DCCH by the network to the mobile station to request the setting of the mode for the indicated channel(s). The message can be used to change the channel mode of a Multislot Configuration which only contains one channel set. See table 9.6/GSM 04.08.

Message type: CHANNEL MODE MODIFY

Significance: local

Direction: network to mobile station

Table 9.6/GSM 04.08: CHANNEL MODE MODIFY message content

IEI	Information element	Type / Reference	Presence	Format	length
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Channel Mode Modify Message Type	Message Type 10.4	M	V	1
	Channel Description	Channel Description 2 10.5.2.5a	M	V	3
	Channel Mode	Channel Mode 10.5.2.6	M	V	1
01	VGCS target mode Indication	VGCS target mode Indication 10.5.2.42c	O	T	2

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9.1.5.1 Channel Description

This is sufficient to identify the channel in the case of a TCH/H + TCH/H configuration. If used for a multislot configuration, the IE shall describe the present channel configuration with TN indicating the main channel. The IE shall not indicate a new channel configuration when included in the Channel Mode Modify message.

9.1.5.2 VGCS target mode Indication

This information element is identified as "comprehension required". Only mobile stations supporting « VGCS talking » are required to accept the presence of the element. The presence of the element shall trigger an exception handling if received by a mobile station not supporting « VGCS talking ».

This IE indicates which RR mode is to be used with the new channel mode (i.e. dedicated mode or group transmit mode). If this information element is not present, the RR mode shall be the same as with the previous channel mode.

The IE also indicates the group cipher key number for the group cipher key to be used on the new channel or if the new channel is non ciphered. If the information element is not present, the ciphering mode shall be the same as with the previous channel mode.

NOTE: A mobile station supporting VGCS Talking shall not consider a syntactical error if this IE is present and the channel mode is not speech.

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 successful or unsuccessful 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

Table 9.7/GSM 04.08: CHANNEL MODE MODIFY ACKNOWLEDGE message content

IEI	Information element	Type / Reference	Presence	Format	length
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Channel Mode Modify Acknowledge Message Type	Message Type 10.4	M	V	1
	Channel Description	Channel Description 2 10.5.2.5a	M	V	3
	Channel Mode	Channel Mode 10.5.2.6	M	V	1

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

Table 9.8/GSM 04.08: CHANNEL RELEASE message content

IEI	Information element	Type / Reference	Presence	Format	length
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Channel Release Message Type	Message Type 10.4	M	V	1
	RR Cause	RR Cause 10.5.2.31	M	V	1
73	BA Range	BA Range 10.5.2.1	O	TLV	6 - ?
74	Group Channel Description	Group Channel Description 10.5.2.14b	O	TLV	4-13
8x	Group Cipher Key Number	Group Cipher Key Number 10.5.1.10	C	TV	1
Cx	GPRS Resumption	GPRS Resumption 10.5.2.14c	O	TV	1

9.1.7.1 Channel description and mobile allocation

If a CHANNEL RELEASE is send to a mobile station which is in dedicated mode and which is involved in a voice group call or has responded to a notification to a voice group call or voice broadcast call, a group channel description may be included, describing the voice group call channel or voice broadcast channel to which the mobile station shall go after the channel release procedure.

Mobile stations not supporting VGCS listening or VBS listening shall consider this information element as unnecessary.

9.1.7.2 Group Cipher Key Number

This IE may be present only if the Group channel description IE is provided. The presence of this IE indicates that the mobile station shall use the Group Cipher Key indicated by the Group Cipher Key Number IE for deciphering on the VGCS or VBS channel. If this IE is not present, no ciphering is applied on the VGCS or VBS channel.

Mobile stations not supporting VGCS listening or VBS listening shall ignore this information element.

9.1.8 Channel request

This message is sent in random mode on the RACH. It does not follow the basic format. The possible formats are presented directly below, without reference to information fields. The order of bit transmission is defined in 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.

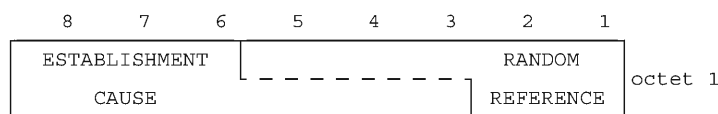


Figure 9.1/GSM 04.08: CHANNEL REQUEST message content

ESTABLISHMENT CAUSE (octet 1)

This information field indicates the reason for requesting the establishment of a connection. This field has a variable length (from 3 bits up to 6 bits).

RANDOM REFERENCE (octet 1)

This is an unformatted field with variable length (from 5 bits down to 2 bits).

The Channel Request message is coded as follows:
(Random Reference field is filled with "x").

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Table 9.9/GSM 04.08: CHANNEL REQUEST message content

MS codes bits 8 1	According to Establishment cause:	
101xxxxx	Emergency call	
110xxxxx	Call re-establishment; TCH/F was in use, or TCH/H was in use but the network does not set NECI bit to 1	
011010xx	Call re-establishment; TCH/H was in use and the network sets NECI bit to 1	
011011xx	Call re-establishment; TCH/H + TCH/H was in use and the network sets NECI bit to 1	
100xxxxx 0010xxxx 0011xxxx 0001xxxx	Answer to paging See table 9.9a/GSM 04.08	
111xxxxx	Originating call and TCH/F is needed, or originating call and the network does not set NECI bit to 1, or procedures that can be completed with a SDCCH and the network does not set NECI bit to 1.	note 1
0100xxxx NECI bit to 1	Originating speech call from dual-rate mobile station when TCH/H is sufficient and supported by the MS for speech calls and the network note 5	sets
0101xxxx bit to 1	Originating data call from dual-rate mobile station when TCH/H is sufficient and supported by the MS for data calls and the network sets note 5	NECI
000xxxxx	Location updating and the network does not set NECI bit to 1	
0000xxxx	Location updating and the network sets NECI bit to 1	
0001xxxx	Other procedures which can be completed with an SDCCH and the network sets NECI bit to 1	note 1
011110xx 01111x0x 01111xx0	One phase packet access with request for single timeslot uplink transmission; one PDCH is needed.	
01110xxx	Single block packet access; one block period on a PDCH is needed for two phase packet access or other RR signalling purpose.	
01100xxx	Reserved for future use	note 2
01111111	Reserved for future use.	note 2a

NOTE 1: Examples of these procedures are: IMSI detach, Short Message Service (SMS), Supplementary Service management.

NOTE 2: If such messages are received by a network, an SDCCH may be allocated.

NOTE 2a: This value shall not be used by the mobile station on RACH. If such message is received by the network, it may be ignored.

Table 9.9a/GSM 04.08: CHANNEL REQUEST message (when answering to paging for RR connection establishment)

MS Capability (Paging Indication 3)	Full rate only	Dual rate (note 5)	SDCCH only
Any channel	100xxxxx	100xxxxx	100xxxxx
SDCCH	0001xxxx	0001xxxx	0001xxxx
TCH/F	100xxxxx	0010xxxx	0001xxxx
TCH/H or TCH/F	100xxxxx	0011xxxx	0001xxxx

NOTE 3: The Paging Indication is provided by the Channel Needed IE (or the Channel Needed field) associated with the page which triggered the sending of the CHANNEL REQUEST message.

NOTE 4: In some cases the established connection will be used only to allow a default rejection mechanism to take place (typically the mobile station will send a RELEASE COMPLETE message with cause #88 "incompatible destination" as an answer to the incoming SETUP message).

NOTE 5: In this section, "dual rate capability" means that the MS supports both full rate and half-rate channels at least for the signalling channel mode. In addition, it may support either speech channel mode, or data channel modes, or both on half-rate channels.

9.1.9 Cipherng 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 cipherng will not be performed. See table 9.10/GSM 04.08.

Message type: CIPHERING MODE COMMAND

Significance: dual

Direction: network to mobile station

Table 9.10/GSM 04.08: CIPHERING MODE COMMAND message content

IEI	Information element	Type / Reference	Presence	Format	length
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Cipher Mode Command Message Type	Message Type 10.4	M	V	1
	Cipherng Mode Setting	Cipher Mode Setting 10.5.2.9	M	V	1/2
	Cipher Response	Cipher Response 10.5.2.10	M	V	1/2

9.1.10 Cipherng 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 MS. See table 9.11/GSM 04.08.

Message type: CIPHERING MODE COMPLETE

Significance: dual

Direction: mobile station to network

ETSI

Table 9.11/GSM 04.08: CIPHERING MODE COMPLETE message content

IEI	Information element	Type / Reference	Presence	Format	length
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Cipher Mode Complete Message Type	Message Type 10.4	M	V	1
17	Mobile Equipment Identity	Mobile Identity 10.5.1.4	O	TLV	3-11

9.1.10.1 Mobile Equipment Identity

This information element is included if and only if the mobile station shall include its IMEISV (see section 3.4.7). This information element shall only refer to IMEISV.

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 or as a response to a classmark enquiry. See table 9.12/GSM 04.08.

Message type: CLASSMARK CHANGE

Significance: dual

Direction: mobile station to network

Table 9.12/GSM 04.08: CLASSMARK CHANGE message content

IEI	Information element	Type / Reference	Presence	Format	length
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Classmark Change Message Type	Message Type 10.4	M	V	1
	Mobile Station Classmark	Mobile Station Classmark 2 10.5.1.6	M	LV	4
20	Additional Mobile Station Classmark Information	Mobile Station Classmark 3 10.5.1.7	C	TLV	3-14

9.1.11.1 Additional Mobile Station Classmark Information

This IE shall be included if and only if the CM3 bit in the *Mobile Station Classmark* IE is set to 1.

9.1.11.2 Mobile Station Classmark

This IE shall include for multiband MS the Classmark 2 corresponding to the frequency band in use.

9.1.12 Classmark enquiry

This message is sent on the main DCCH by the network to the mobile station to request classmark information. See table 9.12a/GSM 04.08.

Message type: CLASSMARK ENQUIRY

Significance: dual

Direction: network to mobile station

ETSI

Table 9.12a/GSM 04.08: CLASSMARK ENQUIRY message content

IEI	Information element	Type / Reference	Presence	Format	length
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Classmark Enquiry Message Type	Message Type 10.4	M	V	1

9.1.12a Spare

9.1.12b Configuration change command

This message is sent on the main DCCH from the network to the mobile station to change the channel configuration of a multislot configuration. See table 9.12b/GSM 04.08.

Message type: CONFIGURATION CHANGE COMMAND

Significance: dual

Direction: network to mobile station

Table 9.12b/GSM 04.08: CONFIGURATION CHANGE COMMAND message contents

IEI	Information element	Type/Reference	Presence	Format	length
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Configuration change Message Type	Message Type 10.4	M	V	1
	Description of the multislot configuration	Multislot Allocation 10.5.2.21b	M	LV	2-11
63	Mode of Channel Set 1	Channel Mode 10.5.2.6	O	TV	2
11	Mode of Channel Set 2	Channel Mode 10.5.2.6	O	TV	2
13	Mode of Channel Set 3	Channel Mode 10.5.2.6	O	TV	2
14	Mode of Channel Set 4	Channel Mode 10.5.2.6	O	TV	2
15	Mode of Channel Set 5	Channel Mode 10.5.2.6	O	TV	2
16	Mode of Channel Set 6	Channel Mode 10.5.2.6	O	TV	2
17	Mode of Channel Set 7	Channel Mode 10.5.2.6	O	TV	2
18	Mode of Channel Set 8	Channel Mode 10.5.2.6	O	TV	2

9.1.12b.1 Description of the multislot allocation

This information element is used to assign channels that do not carry the main signalling link in a multislot configuration. It indicates if multiple channel sets are used.

9.1.12b.2 Mode of Channel Set "X" (1=<X<=8)

If this information element is not present the channel mode of the previously allocated channel or channels for Channel Set "X" shall be assumed.

If Channel Set "X" is not defined for the configuration, the *Mode of Channel Set "X"* IE shall be considered as an IE unnecessary in the message.

ETSI

NOTE: Clause 3.4.16.1 defines cases when one or several *Mode of Channel Set* "X" IEs shall be included in the message.

9.1.12c Configuration change acknowledge

This message is sent on the main DCCH from the mobile station to the network to indicate that the mobile station has changed to the ordered channel configuration successfully. See table 9.12c/GSM 04.08.

Message type: CONFIGURATION CHANGE ACKNOWLEDGE

Significance: dual

Direction: mobile station to network

Table 9.12c/GSM 04.08: CONFIGURATION CHANGE ACKNOWLEDGE message contents

IEI	Information element	Type/Reference	Presence	Format	length
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Configuration Change Acknowledge Message Type	Message Type 10.4	M	V	1

9.1.12d Configuration change reject

This message is sent on the main DCCH from the mobile station to the network to indicate that the mobile station has not managed to switch to the channel configuration ordered by the configuration change command and is still using the previous configuration. See table 9.12d/GSM 04.08.

Message type: CONFIGURATION CHANGE REJECT

Significance: dual

Direction: mobile station to network

Table 9.12d/GSM 04.08: CONFIGURATION CHANGE REJECT message contents

IEI	Information element	Type/Reference	Presence	Format	length
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Configuration Change Reject Message Type	Message Type 10.4	M	V	1
	RR Cause	RR Cause 10.5.2.31	M	V	1

9.1.13 Frequency redefinition

This message is sent on the main DCCH from the network to the MS 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 MS

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Table 9.13/GSM 04.08: FREQUENCY REDEFINITION message content

IEI	Information element	Type / Reference	Presence	Format	length
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Frequency Redefinition Message Type	Message Type 10.4	M	V	1
	Channel Description	Channel Description 10.5.2.5	M	V	3
	Mobile Allocation	Mobile Allocation 10.5.2.21	M	LV	1-9
	Starting Time	Starting Time 10.5.2.38	M	V	2
62	Cell Channel Description	Cell Channel Description 10.5.2.1b	O	TV	17

9.1.13.1 Cell Channel Description

If it does not appear, the cell channel description is assumed to be unchanged.

9.1.13a PDCH Assignment command

This message is sent on the main DCCH by the network to the mobile station to change the channel configuration to a PDCH, when no timing adjustment is needed. See table 9.13a/GSM 04.08.

A mobile station that does not support the <<GRPS>> option shall regard this message as an unknown message.

Message type: PDCH ASSIGNMENT COMMAND

Significance: dual

Direction: network to mobile station

Table 9.13a/GSM 04.08: PDCH ASSIGNMENT COMMAND message content

IEI	Information element	Type / Reference	Presence	Format	length
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	PDCH Assignment command Message Type	Message Type 10.4	M	V	1
	Description of the Channel, after time	Channel Description 10.5.2.5	M	V	3
62	Cell Channel Description	Cell Channel Description 10.5.2.1b	O	TV	17
05	Frequency List, after time	Frequency List 10.5.2.13	C	TLV	4-132
62	Cell Channel Description	Cell Channel Description 10.5.2.1b	O	TV	17
72	Mobile Allocation, after time	Mobile Allocation 10.5.2.21	C	TLV	3-10
7C	Starting Time	Starting Time 10.5.2.38	O	TV	3
19	Frequency List, before time	Frequency List 10.5.2.13	C	TLV	4-132
1C	Description of the Channel, before time	Channel Description 10.5.2.5	O	TV	4
1E	Frequency channel sequence before time	Frequency channel sequence 10.5.2.12	C	TV	10
21	Mobile Allocation, before time	Mobile Allocation 10.5.2.21	C	TLV	3-10
22	RR Packet Uplink Assignment	RR Packet Uplink Assignment 10.5.2.25a	C	TLV	3-?
23	RR Packet Downlink Assignment	RR Packet Downlink Assignment 10.5.2.25b	C	TLV	3-?

9.1.13a.1 Mobile Allocation and Frequency List, after the starting time

If the channel description for after the starting time indicates frequency hopping, one and only one of the following information elements shall be present

- *Mobile Allocation, after time*
- *Frequency List, after time.*

If the Channel Description IE for after time does not indicate frequency hopping, if decoding of Channel Description IE for before time does not require a frequency list for after time (see next section), and one or both of the two information elements are present they shall be considered as IEs unnecessary in the message.

9.1.13a.2 Starting Time

The *starting time* information element is included when the network wants the mobile station to change the frequency parameters of the channels more or less at the moment the change to a TBF occurs. In this case a number of information elements may be included to give the frequency parameters to be used before the starting time.

If the *starting time* information element is present and none of the information elements referring to before the starting time are present, the mobile station waits and uses the TBF from the indicated time.

If the *starting time* information element is present and at least one of the information elements referring to before the starting time is present, the mobile station does not wait for the indicated time and uses the TBF using the frequency parameters for before the starting time.

If the *starting time* information element is not present and some of the information elements referring to before the starting time is present, these information elements shall be considered as IEs unnecessary in the message.

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If the *description of the channel, before time* IE is not present, the channel description to apply for before the time, if needed, is given by the *description of the channel, after time* IE.

If the *starting time* IE is present and the channel description for before the starting time indicates frequency hopping, one and only one of the following information elements may be present and applies before the starting time

- *Mobile Allocation, before time* IE;
- *Frequency list, before time* IE;
- *Frequency channel sequence, before time* IE.

If the *starting time* IE is present and the channel description for before the starting time indicates frequency hopping, and none of the above mentioned IE is present, a frequency list for after the starting time must be present (see 9.1.2.4), and this list applies also for the TBF before the starting time.

9.1.13a.3 Reference cell frequency list

If any of the *mobile allocation* information elements are present, then the network shall ensure that either the mobile station has received in a previous message the proper reference cell frequency list (CA), or that the *cell channel description* IE is present.

If the *cell channel description* IE is present, it is used to decode the *mobile allocation* IEs in the message, as well as in later dedicated mode messages until reception of a new reference cell frequency list or the cell is left.

9.1.13a.4 Cell Channel Description

If present, this information element shall be used to decode the *Mobile Allocation* IE in the same message and in subsequent messages.

9.1.13a.5 Packet Assignment

One and only one of the following information elements shall be present:

- *RR Packet Uplink Assignment*
- *RR Packet Downlink Assignment*.

9.1.13b GPRS suspension request

This message is sent on the main DCCH by the mobile station to the network to request a suspension of GPRS services. See table 9.13b/GSM 04.08.

Message type: GPRS SUSPENSION REQUEST

Significance: dual

Direction: mobile station to network

Table 9.13b/GSM 04.08: GPRS SUSPENSION REQUEST message content

IEI	Information element	Type / Reference	Presence	Format	length
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	GPRS Suspension Request Message Type	Message Type 10.4	M	V	1
	Temporary Logical Link Identity	TLLI 10.5.2.41a	M	V	4
	Routing Area Identification	Routing Area Identification 10.5.5.15	M	V	6

9.1.14 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 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.

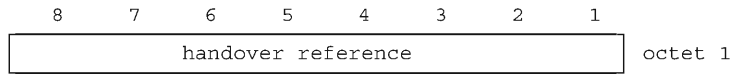


Figure 9.2/GSM 04.08: HANOVER ACCESS message content

Table 9.14/GSM 04.08: HANOVER ACCESS message content

<p>HANOVER REFERENCE This is an unformatted 8 bit field. (also described in section 10.5.2.15)</p>
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9.1.15 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: HANOVER COMMAND

Significance: dual

Direction: network to mobile station

Table 9.15/GSM 04.08: HANDOVER COMMAND message content

IEI	Information element	Type / Reference	Presence	Format	length
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Handover Command Message Type	Message Type 10.4	M	V	1
	Cell Description	Cell description 10.5.2.2	M	V	2
	Description of the first channel, after time	Channel Description 2 10.5.2.5a	M	V	3
	Handover Reference	Handover Reference 10.5.2.15	M	V	1
	Power Command and Access type	Power Command and Access type 10.5.2.28a	M	V	1
D-	Synchronization Indication	Synchronization Indication 10.5.2.39	O	TV	1
02	Frequency Short List, after time	Frequency Short List 10.5.2.14	C	TV	10
05	Frequency List, after time	Frequency List 10.5.2.13	C	TLV	4-131
62	Cell Channel Description	Cell Channel Description 10.5.2.1b	C	TV	17
10	Description of the multislot configuration	Multislot Allocation 10.5.2.21b	C	TLV	3-12
63	Mode of the First Channel(Channel Set 1))	Channel Mode 10.5.2.6	O	TV	2
11	Mode of Channel Set 2	Channel Mode 10.5.2.6	O	TV	2
13	Mode of Channel Set 3	Channel Mode 10.5.2.6	O	TV	2
14	Mode of Channel Set 4	Channel Mode 10.5.2.6	O	TV	2
15	Mode of Channel Set 5	Channel Mode 10.5.2.6	O	TV	2
16	Mode of Channel Set 6	Channel Mode 10.5.2.6	O	TV	2
17	Mode of Channel Set 7	Channel Mode 10.5.2.6	O	TV	2
18	Mode of Channel Set 8	Channel Mode 10.5.2.6	O	TV	2
64	Description of the Second Channel, after time	Channel Description 10.5.2.5	O	TV	4
66	Mode of the Second Channel	Channel Mode 2 10.5.2.7	O	TV	2
69	Frequency Channel Sequence, after time	Frequency Channel Sequence 10.5.2.12	C	TV	10
72	Mobile Allocation, after time	Mobile Allocation 10.5.2.21	C	TLV	3-10
7C	Starting Time	Starting Time 10.5.2.38	O	TV	3
7B	Real Time Difference	Time Difference 10.5.2.41	C	TLV	3
7D	Timing Advance	Timing Advance 10.5.2.40	C	TV	2
12	Frequency Short List, before time	Frequency Short List 10.5.2.14	C	TV	10
19	Frequency List, before time	Frequency List 10.5.2.13	C	TLV	4-131
(continued)					

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Table 9.15/GSM 04.08 (concluded): HANDOVER COMMAND message content

IEI	Information element	Type / Reference	Presence	Format	length
1C	Description of the First Channel, before time	Channel Description 2 10.5.2.5a	O	TV	4
1D	Description of the Second Channel, before time	Channel Description 10.5.2.5	O	TV	4
1E	Frequency channel sequence before time	Frequency channel sequence 10.5.2.12	C	TV	10
21	Mobile Allocation, before time	Mobile Allocation 10.5.2.21	C	TLV	3-10
9-	Cipher Mode Setting	Cipher Mode Setting 10.5.2.9	O	TV	1
01	VGCS target mode Indication	VGCS target mode Indication 10.5.2.42c	O	TLV	3

9.1.15.1 Synchronization Indication

If this information element does not appear, the assumed value is "non-synchronized".

9.1.15.2 Mode of the First Channel (Channel Set 1) and Mode of Channel Set "X" ($2 \leq X \leq 8$)

If this information element is not present the channel mode of the previously allocated channel or channels for Channel Set "X" ($1 \leq X \leq 8$) shall be assumed.

If Channel Set "X" is not defined for the configuration, the *Mode of Channel Set "X"* IE shall be considered as an IE unnecessary in the message.

NOTE: Clause 3.4.4.1 defines cases when one or several *Mode of Channel Set "X"* IEs shall be included in the message.

9.1.15.3 Description of the Second Channel

These information element appear if the mobile station carries two connections (on two dedicated channels, for the TCH/H+TCH/H configuration).

The connection using the channel previously defined in the *Description of the First Channel* IE of an ASSIGNMENT COMMAND or HANDOVER COMMAND message shall use the channel defined in the first channel description IE of the HANDOVER COMMAND message defining the new configuration.

The channel described in the *Description of the First Channel* IE carries the main DCCH. The SACCH used is the one associated with that channel.

9.1.15.4 Mode of the Second Channel

If the *Description of the Second Channel* IE is not present and the information element is present it shall be considered as an IE unnecessary in the message.

This element appears at least when the channel mode is changed for the channel defined in the Description of the Second Channel information element.

9.1.15.5 Frequency Channel Sequence, Frequency List, Frequency short list and Mobile Allocation, after time.

If at least one of the channel descriptions for after time indicates frequency hopping, one and only one of the following information elements shall be present:

- *Frequency Channel Sequence, after time;*
- *Frequency list, after time;*
- *Frequency Short List, after time;*

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- *Mobile Allocation, after time.*

If neither of the Channel Description IEs indicate frequency hopping, if they are not required for the decoding of Channel Description IEs for before time, and if any of the four information elements are present they shall be considered as IEs unnecessary in the message.

The *Frequency Channel Sequence* information element shall not be used unless all the ARFCNs that it indicates are in the P-GSM band.

9.1.15.6 Starting Time

The *starting time* information element is included when the network wants the mobile station to change the frequency parameters of the channels more or less at the moment a change of channel occurs. In this case a number of information elements may be included to give the frequency parameters to be used before the starting time.

The *starting time* information element refers to the new cell time.

If the *starting time* information element is present and none of the information elements referring to before the starting time are present, the mobile station waits and accesses the channels at the indicated time.

If the *starting time* information element is present and at least one of the information elements referring to before the starting time is present, the mobile station does not wait for the indicated time and accesses the channel using the frequency parameters for before the starting time.

If the *starting time* information element is not present and some of the information elements referring to before the starting time is present, these information elements shall be considered as IEs unnecessary in the message.

If the *description of the first channel, before time* IE is not present, the channel description to apply for before the time, if needed, is given by the *description of the first channel, after time* IE.

If the *description of the second channel, after time* IE is present, the *description of the second channel, before time* IE not present, and a description of the configuration for before the time needed, the channel configuration before the starting time is nevertheless of two traffic channels, and the channel description to apply to the second channel before the starting time is given by the *description of the second channel, after time* IE.

If the *starting time* IE is present and at least one of the channel descriptions for before the starting time indicates frequency hopping, one and only one of the following information elements may be present and applies before the starting time to all assigned channels:

- *Mobile Allocation, before time* IE;
- *Frequency Short list, before time* IE;
- *Frequency list, before time* IE;
- *Frequency channel sequence, before time* IE.

If the *starting time* IE is present and at least one of the channel descriptions for before the starting time indicates frequency hopping, and none of the above mentioned IE is present, a frequency list for after the starting time must be present (see 9.1.2.4), and this list applies also for the channels before the starting time.

9.1.15.7 Reference cell frequency list

If any of the *mobile allocation* information elements is present, then the *cell channel description* IE must be present. It is used to decode the *mobile allocation* IEs in the message.

In addition, if no information elements pertaining to before the starting time is present in the message, the frequency list defined by the *cell channel description* IE is used to decode the *mobile allocation* IEs in later messages received in the new cell until reception of a new reference cell frequency list or the new cell is left.

9.1.15.8 Real Time Difference

This information element shall appear if the *Synchronization Indication* information element indicates a pseudo-synchronous handover otherwise it shall be considered as an unnecessary information element.

9.1.15.9 Timing Advance

This information element shall appear if the "synchronization indication" element indicates a presynchronized handover. If not included for a presynchronized handover, then the default value as defined in GSM 05.10 shall be used. For other types of handover it shall be considered as an unnecessary information element.

9.1.15.10 Cipher Mode Setting

If this information element is omitted, the mode of ciphering is not changed after the mobile station has switched to the assigned channel.

Only applicable for mobile stations supporting VGCS talking:

The cipher mode setting IE shall not be included if a HANOVER COMMAND message is sent on a VGCS channel or in a HANOVER COMMAND message on a dedicated channel for a handover to a VGCS channel.

9.1.15.11 VGCS target mode indication

This information element is identified as "comprehension required". Only mobile stations supporting « VGCS talking » are required to accept the presence of the element. The presence of the element shall trigger an exception handling if received by a mobile station not supporting « VGCS talking ».

This IE indicates which mode is to be used on the new channel (i.e. dedicated mode or group transmit mode). If this information element is not present, the mode shall be the same as on the previous channel.

The IE also indicates the group cipher key number for the group cipher key to be used on the new channel or if the new channel is non ciphered. If the information element is not present, the ciphering mode shall be the same as on the previous channel.

NOTE: A mobile station supporting VGCS Talking shall not consider a syntactical error if this IE is present and the channel mode is not speech.

9.1.15.12 Description of the multislot allocation

This information element is included if so indicated by the channel type and TDMA offset field in the *Channel Description* information element and is used to assign channels that do not carry a main signalling link in a multislot configuration. It indicates how the used timeslots are divided into separate channel sets.

If the *Channel Description* IE does not require the presence the information element it shall be considered as an IE unnecessary in the message.

If multislot configuration is indicated by the *Channel Description* IE but the *Multislot Allocation* IE is not present, all channels in the configuration belong to one channel set, "Channel Set 1".

NOTE: As a change of timeslot number cannot occur for the channel described for after the starting time, the *Multislot Allocation* IE does not have to be included more than once.

9.1.16 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: HANOVER COMPLETE

Significance: dual

Direction: mobile station to network

ETSI

Table 9.16/GSM 04.08: HANDOVER COMPLETE message content

IEI	Information element	Type / Reference	Presence	Format	length
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Handover Complete Message Type	Message Type 10.4	M	V	1
	RR Cause	RR Cause 10.5.2.31	M	V	1
77	Mobile Observed Time Difference	Mobile Time Difference 10.5.2.21a	O	TLV	5

9.1.16.1 Mobile Observed Time Difference

This information element is included if and only if the Synchronization Indication IE in the HANDOVER COMMAND message requests it to be sent.

9.1.17 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

Table 9.17/GSM 04.08: HANDOVER FAILURE message content

IEI	Information element	Type / Reference	Presence	Format	length
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Handover Failure Message Type	Message Type 10.4	M	V	1
	RR Cause	RR Cause 10.5.2.31	M	V	1

9.1.18 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 or to the mobile station in packet idle mode to change the channel configuration to either an uplink or a downlink packet data channel configuration in the cell. See table 9.18/GSM 04.08.

The L2 pseudo length of this message is the sum of lengths of all information elements present in the message except the *IA Rest Octets* and *L2 Pseudo Length* information elements.

Message type: IMMEDIATE ASSIGNMENT

Significance: dual

Direction: network to mobile station

Table 9.18/GSM 04.08: IMMEDIATE ASSIGNMENT message content

IEI	Information element	Type / Reference	Presence	Format	length
	L2 Pseudo Length	L2 Pseudo Length 10.5.2.19	M	V	1
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Immediate Assignment Message Type	Message Type 10.4	M	V	1
	Page Mode	Page Mode 10.5.2.26	M	V	1/2
	Packet Response Type and Dedicated mode or TBF	Packet Response Type and Dedicated mode or TBF 10.5.2.25b	M	V	1/2
	Channel Description	Channel Description 10.5.2.5	C	V	3
	Packet Channel Description	Packet Channel Description10.5.2.25a	C	V	3
	Request Reference	Request Reference 10.5.2.30	M	V	3
	Timing Advance	Timing Advance 10.5.2.40	M	V	1
	Mobile Allocation	Mobile Allocation 10.5.2.21	M	LV	1-9
7C	Starting Time	Starting Time 10.5.2.38	O	TV	3
	IA Rest Octets	IA Rest Octets 10.5.2.16	M	V	0-11

9.1.18.0a Packet Response Type

This information element shall only be analyzed by a mobile station supporting GPRS.

A mobile station not supporting GPRS shall treat this message as if this information element indicates an immediate assignment procedure for RR connection establishment.

9.1.18.0b Channel Description

This information element shall be present in the message if:

- the *Packet Response Type* IE indicates an immediate assignment procedure for RR connection establishment; or
- the *Packet Response Type* IE indicates a packet immediate assignment or a packet downlink assignment using the *Channel Description* IE.

This information element shall not be present in the message if the *Packet Channel Description* IE is present in the message.

9.1.18.0c Packet Channel Description

This information element shall be present in the message if:

- the *Packet Response Type* IE indicates a packet immediate assignment or a packet downlink assignment using the *Packet Channel Description* IE.

This information element shall not be present in the message if the *Channel Description* IE is present in the message.

9.1.18.0d Request Reference

If this message is used in a packet downlink assignment procedure, the network shall code this information element, e.g. by using a suitably offset frame number, such that the resource reference cannot be confused with any CHANNEL REQUEST message sent by a mobile station.

ETSI

9.1.18.1 Mobile Allocation

If the *Channel Description* IE does not indicate frequency hopping or if the *Channel Description* IE is not present in the message, the length indicator of this information element shall be set to zero, and the mobile station shall consider the IE as an unnecessary IE.

9.1.18.2 Starting Time

This information element appears if e.g. a frequency change is in progress.

9.1.18.3 IA Rest Octets (Frequency parameters, before time)

The sum of the length of this IE and the L2 Pseudo Length of the message equals 22.

If the *starting time* IE is present but not the *frequency parameters, before time* construction, the mobile stations must wait until the starting time before accessing the channel.

If the *starting time* IE is present and the *Channel Description* IE does not indicate frequency hopping the mobile station shall consider the *frequency parameters, before time* construction as unnecessary in the message and the mobile must wait until the starting time before accessing the channel.

If the *starting time* IE is not present, the mobile station shall consider the *frequency parameters, before time* construction as unnecessary in the message.

9.1.18.4 IA Rest Octets (Packet Immediate Assignment or Packet Downlink Assignment)

If the *Packet Access Indication* IE indicates a packet immediate assignment or a packet downlink assignment procedure, this information element shall contain a corresponding *packet uplink assignment* or *packet downlink assignment* construction.

If the *Packet Access Indication* IE indicates an immediate assignment procedure for RR connection establishment, the mobile station shall consider the *Packet Immediate Assignment* and *Packet Downlink Assignment* constructions as unnecessary in the message.

9.1.19 Immediate assignment extended

This message is sent on the CCCH by the network to two mobile stations in idle mode to change their channel configurations to different dedicated configurations while they stay in the same cell. See table 9.19/GSM 04.08

The L2 pseudo length of this message is the sum of lengths of all information elements present in the message except the *IAX Rest Octets* and *L2 Pseudo Length* information elements.

Message type: IMMEDIATE ASSIGNMENT EXTENDED

Significance: dual

Direction: network to mobile station

Table 9.19/GSM 04.08: IMMEDIATE ASSIGNMENT EXTENDED message content

IEI	Information element	Type / Reference	Presence	Format	length
	L2 Pseudo Length	L2 Pseudo Length 10.5.2.19	M	V	1
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Immediate Assignment Ex tended Message Type	Message Type 10.4	M	V	1
	Page Mode	Page Mode 10.5.2.26	M	V	1/2
	Spare Half Octet	Spare Half Octet 10.5.1.8	M	V	1/2
	Channel Description 1	Channel Description 10.5.2.5	M	V	3
	Request Reference 1	Request Reference 10.5.2.30	M	V	3
	Timing Advance 1	Timing Advance 10.5.2.40	M	V	1
	Channel Description 2	Channel Description 10.5.2.5	M	V	3
	Request Reference 2	Request Reference 10.5.2.30	M	V	3
	Timing Advance 2	Timing Advance 10.5.2.40	M	V	1
	Mobile Allocation	Mobile Allocation 10.5.2.21	M	LV	1-5
7C	Starting Time	Starting Time 10.5.2.38	O	TV	3
	IAX Rest Octets	IAX Rest Octets 10.5.2.18	M	V	0-4

NOTE: Index 1 refers to the first mobile station, index 2 refers to the second mobile station.

9.1.19.1 Unnecessary IEs

A mobile station which reacts on the request reference 1 shall consider all information elements as unnecessary IEs except for *Requests Reference 1, Channel Description 1, Timing advance 1, Starting Time* and if *Channel Description 1* IE indicates frequency hopping mobile allocation.

A mobile station which reacts on the request reference 2 shall consider all information elements as unnecessary IE except *Requests Reference 2, Channel Description 2, Timing advance 2, Starting Time* and if *channel description 2* IE indicates frequency hopping mobile allocation.

A mobile station in idle mode shall consider all information elements as unnecessary IEs except for the *Page Mode* IE.

9.1.19.2 Mobile Allocation

If both channel description IE do not indicate frequency hopping, the length indicator shall be set to zero.

9.1.19.3 Starting Time

This information element appears if a frequency change is in progress. If included the starting time is common to the two referenced mobile stations.

9.1.19.4 Maximum message length

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 the value part of the *Mobile Allocation* plus, optionally, the length of the *Starting Time* IE exceeds 5 octets. In this case it is necessary to use the IMMEDIATE ASSIGNMENT message.

ETSI

9.1.19.5 IAX Rest Octets

The sum of the length of this IE and the L2 Pseudo Length of the message equals 22.

9.1.20 Immediate assignment reject

This message is sent on the CCCH by the network to up to four mobile stations to indicate that no channel is available for assignment. See table 9.20/GSM 04.08. This message has L2 pseudo length 19.

Message type: IMMEDIATE ASSIGNMENT REJECT

Significance: dual

Direction: network to mobile station

Table 9.20/GSM 04.08: IMMEDIATE ASSIGNMENT REJECT message content

IEI	Information element	Type / Reference	Presence	Format	length
	L2 Pseudo Length	L2 Pseudo Length 10.5.2.19	M	V	1
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Immediate Assignment Reject Message Type	Message Type 10.4	M	V	1
	Page Mode	Page Mode 10.5.2.26	M	V	1/2
	Spare Half Octet	Spare Half Octet 10.5.1.8	M	V	1/2
	Request Reference 1	Request Reference 10.5.2.30	M	V	3
	Wait Indication 1	Wait Indication 10.5.2.43	M	V	1
	Request Reference 2	Request Reference 10.5.2.30	M	V	3
	Wait Indication 2	Wait Indication 10.5.2.43	M	V	1
	Request Reference 3	Request Reference 10.5.2.30	M	V	3
	Wait Indication 3	Wait Indication 10.5.2.43	M	V	1
	Request Reference 4	Request Reference 10.5.2.30	M	V	3
	Wait Indication 4	Wait Indication 10.5.2.43	M	V	1
	IAR Rest Octets	IAR Rest Octets 10.5.2.17	M	V	3

NOTE: Index 1 refers to the first mobile station, index 2 refers to the second MS and so on.

9.1.20.1 Use of the indexes

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 four channel requests with this message.

9.1.20.2 Filling of the message

If necessary the request reference information element and the wait indication information element should be duplicated to fill the message.

9.1.20.3 IAR Rest Octets

The sum of the length of this IE and the L2 Pseudo Length of the message equals 22.

9.1.21 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

ETSI

Table 9.21/GSM 04.08: MEASUREMENT REPORT message content

IEI	Information element	Type / Reference	Presence	Format	length
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Measurement Report Message Type	Message Type 10.4	M	V	1
	Measurement Results	Measurement Results 10.5.2.20	M	V	16

9.1.21a Notification/FACCH

The understanding of this message is only required for mobile stations supporting VGCS listening or VBS listening.

This message is sent on the main DCCH, in unacknowledged mode using the RR short protocol discriminator by the network to notify the mobile stations in dedicated mode or in on-going voice broadcast calls or voice group calls on other voice broadcast calls or voice group calls in that cell.

Notification/FACCH messages for VBS or VGCS calls are differentiated by a flag in the call reference.

The message shall not exceed a maximum length of 20 octets.

Mobile stations not supporting VGCS listening or VBS listening shall ignore this message.

See table 9.21a/GSM 04.08.

Message type: NOTIFICATION/FACCH

Significance: dual

Direction: network to mobile station

Table 9.21a/GSM 04.08 NOTIFICATION/FACCH message content

<pre> <NOTIFICATION FACCH> ::= <RR short PD : bit> -- See GSM 04.07 <message type : bit(5)> -- See 10.4 <short layer 2 header : bit(2)> -- See GSM 04.06 {0 <Group Call information> 1 <Paging Information>} <spare padding> ; <Group Call information> ::= <Group Call Reference : bit(36)> {0 1 <Group Channel Description>} ; </pre>
--

<Group Call Reference>

This field is syntactically and semantically equivalent to octets 2-5 and bits 5 to 8 of octet 6 of the *Descriptive Group or Broadcast Call Reference* information element.

The <Group Channel Description> field is optionally present. When present only the Channel description is provided in the case of non hopping channels. In the case where the channel is hopping then either a mobile allocation or a frequency short list is provided.

<pre> <Group Channel Description> ::= <Channel Description : bit(24)> {0 -- Non hopping case 1 {0 <Mobile Allocation : <bit string>> 1 <Frequency Short List : bit(64)>}} ; <bit string> ::= null bit <bit string> ; </pre>
--

<Channel Description>

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This field is syntactically and semantically equivalent to octets 2-4 of the *Channel Description* information element. See 10.5.2.5

<Frequency Short List>

This field is syntactically and semantically equivalent to octets 1-8 of the *Frequency Short List 2* information element. See 10.5.2.14a

<Mobile Allocation>

This field is syntactically and semantically equivalent to octet 2 to n+2 of the *Mobile Allocation* information element. See 10.5.2.21

The <Paging Information> field may be used to inform the mobile station in Group Receive or in Group Transmit mode that the corresponding mobile identity is paged in that cell.

```

<Paging Information> ::= <mobile identity : <bit string>>
                        <channel first: bit(2)>
                        {0|1 <eMLPP priority : bit(3)>} ;
<bit string> ::= null | bit <bit string> ;
```

<mobile identity>

This field is syntactically and semantically equivalent to octet 2-n of the *Mobile Identity* information element. See 10.5.1.4

<channel first>

This field is syntactically and semantically equivalent to bits 1 and 2 of the *Channel Needed* information element. See 10.5.2.8

<eMLPP priority>

This field is coded as the <Priority1> field in the *PI Rest Octets* information element. See 10.5.2.23

9.1.21a.1 Spare

9.1.21a.2 Spare

9.1.21a.3 Spare

9.1.21a.4 Spare

9.1.21b Notification/NCH

The understanding of this message is only required for mobile stations supporting VGCS listening or VBS listening.

This message is sent on the NCH by the network to notify mobile stations of VBS or VGCS calls in the current cell. The VBS or VGCS calls are identified by their broadcast call reference or group call reference, respectively. For each reference, the corresponding VBS or VGCS call channel may be indicated. See table 9.21b/GSM 04.08.

Notification/NCH messages for VBS or VGCS calls are differentiated by a flag in the call reference.

The L2 pseudo length of this message has a value one

Mobile stations not supporting VGCS listening or VBS listening shall ignore this message.

Message type: NOTIFICATION/NCH

Significance: dual

ETSI

Direction: network to mobile station

Table 9.21b/GSM 04.08 NOTIFICATION/NCH message content

IEI	Information element	Type / Reference	Presence	Format	length
	L2 Pseudo Length	L2 Pseudo Length 10.5.2.19	M	V	1
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Notification/NCH Message Type	Message Type 10.4	M	V	1
	Group or broadcast call reference 1	Call reference 10.5.1.9	M	V	4 1/2
	NT/N Rest Octets	NT/N Rest Octets 10.5.2.22c	M	V	1-20

9.1.21b.1 Spare

9.1.21b.2 Spare

9.1.21d Spare

9.1.21e RR-Cell Change Order

This message is sent on the main DCCH by the network to the mobile station to order it to reselect a cell. See table 9.21e/GSM 04.08.

A mobile station that does not support the <<GRPS>> option shall regard this message as an unknown message.

Message type: RR-CELL CHANGE ORDER

Significance: dual

Direction: network to mobile station

Table 9.21e/GSM 04.08: RR-CELL CHANGE ORDER message content

IEI	Information element	Type / Reference	Presence	Format	length
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	RR-Cell Change Order Message Type	Message Type 10.4	M	V	1
	Cell Description	Cell description 10.5.2.2	M	V	2
	NC mode for target cell	NC mode 10.5.2.21c	M	V	1/2
	Spare half octet	Spare half octet 10.5.1.8	M	V	1/2

9.1.22 Paging request type 1

This message is sent on the CCCH by the network to up to two mobile stations. It may be sent to a mobile station in idle mode to trigger channel access. It may be sent to a mobile station in packet idle mode to transfer MM information (i.e. trigger of cell update procedure). The mobile stations are identified by their TMSI or IMSI. See table 9.22/GSM 04.08.

The L2 pseudo length of this message is the sum of lengths of all information elements present in the message except the *PI Rest Octets* and *L2 Pseudo Length* information elements.

Message type: PAGING REQUEST TYPE 1

Significance: dual

ETSI

Direction: network to mobile station

Table 9.22/GSM 04.08: PAGING REQUEST TYPE 1 message content

IEI	Information element	Type / Reference	Presence	Format	length
	L2 Pseudo Length	L2 Pseudo Length 10.5.2.19	M	V	1
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Paging Request Type 1 Message Type	Message Type 10.4	M	V	1
	Page Mode	Page Mode 10.5.2.26	M	V	1/2
	Channels Needed for Mobiles 1 and 2	Channel Needed 10.5.2.8	M	V	1/2
	Mobile Identity 1	Mobile Identity 10.5.1.4	M	LV	2-9
17	Mobile Identity 2	Mobile Identity 10.5.1.4	O	TLV	3-10
	P1 Rest Octets	P1 Rest Octets 10.5.2.23	M	V	0-17

9.1.22.1 Unnecessary IE

A mobile station in idle mode shall consider all information elements as unnecessary IEs except for the *Page Mode* IE.

9.1.22.2 Channels needed for Mobiles 1 and 2

The first CHANNEL field of *Channel Needed* IE is associated with *Mobile Identity 1*. The second CHANNEL field of *Channel Needed* IE is associated with *Mobile Identity 2*.

If this message is used in the packet paging procedure, the *Channel Needed* IE associated with the corresponding *Mobile Identity 1 or 2* shall be coded with the value 00 (any channel) by the network. The mobile station receiving a packet paging request shall treat this information element as unnecessary in the message.

9.1.22.3 Mobile Identities

The *Mobile Identity 1 and 2* IEs shall not refer to IMEI.

9.1.22.4 P1 Rest Octets

The sum of the length of this IE and the L2 Pseudo Length of the message equals 22.

This IE may contain a *notification list number* field and/or, referring to each one of the *Mobile Identity 1 and 2* IEs, a *Priority 1 and 2* field and/or a *Packet Page Indication 1 and 2* field.

9.1.23 Paging request type 2

This message is sent on the CCCH by the network to two or three mobile stations. It may be sent to a mobile station in idle mode to trigger channel access. It may be sent to a mobile station in packet idle mode to transfer MM information (i.e. trigger of cell update procedure). 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.

The L2 pseudo length of this message is the sum of lengths of all information elements present in the message except the *P2 Rest Octets* and *L2 Pseudo Length* information elements.

Message type: PAGING REQUEST TYPE 2

Significance: dual

Direction: network to mobile station

ETSI

Table 9.23/GSM 04.08: PAGING REQUEST TYPE 2 message content

IEI	Information element	Type / Reference	Presence	Format	length
	L2 Pseudo Length	L2 Pseudo Length 10.5.2.19	M	V	1
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Paging Request Type 2 Message Type	Message Type 10.4	M	V	1
	Page Mode	Page Mode 10.5.2.26	M	V	1/2
	Channels Needed for Mobiles 1 and 2	Channel Needed 10.5.2.8	M	V	1/2
	Mobile Identity 1	TMSI 10.5.2.42	M	V	4
	Mobile Identity 2	TMSI 10.5.2.42	M	V	4
17	Mobile Identity 3	Mobile Identity 10.5.1.4	O	TLV	3-10
	P2 Rest Octets	P2 Rest Octets 10.5.2.24	M	V	1-11

9.1.23.1 Channels needed for Mobiles 1 and 2

The first CHANNEL field of Channel Needed IE is associated with Mobile Identity 1. The second CHANNEL field of Channel Needed IE is associated with Mobile Identity 2.

If this message is used in the packet paging procedure, the Channel Needed IE associated with the corresponding Mobile Identity 1 or 2 shall be coded with the value 00 (any channel) by the network. The mobile station receiving a packet paging request shall treat this information element as unnecessary in the message.

9.1.23.2 Mobile Identity 3

The Mobile Identity 3 information element shall not refer to IMEI.

9.1.23.3 P2 Rest Octets

The sum of the length of this IE and the L2 Pseudo Length of the message equals 22.

This IE contains the channel needed indication related to the paging of Mobile Identity 3. The treatment of this indication in the case this message is used in a packet paging procedure is specified in section 9.1.23.1.

This IE may further contain a notification list number field and/or, referring to each one of the Mobile Identity 1, 2 and 3 IEs, a Priority 1, 2 and 3 field and/or, referring to the Mobile Identity 3 IE, a Packet Page Indication 3 field.

9.1.24 Paging request type 3

This message is sent on the CCCH by the network to four mobile stations. It may be sent to a mobile station in idle mode to trigger channel access. It may be sent to a mobile station in packet idle mode to transfer MM information (i.e. trigger of cell update procedure). The mobile stations are identified by their TMSIs. See table 9.24/GSM 04.08.

This message has a L2 Pseudo Length of 19.

Message type: PAGING REQUEST TYPE 3

Significance: dual

Direction: network to mobile station

ETSI

Table 9.24/GSM 04.08: PAGING REQUEST TYPE 3 message content

IEI	Information element	Type / Reference	Presence	Format	length
	L2 Pseudo Length	L2 Pseudo Length 10.5.2.19	M	V	1
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Paging Request Type 3 Message Type	Message Type 10.4	M	V	1
	Page Mode	Page Mode 10.5.2.26	M	V	1/2
	Channels Needed for Mobiles 1 and 2	Channel Needed 10.5.2.8	M	V	1/2
	Mobile Identity 1	TMSI 10.5.2.42	M	V	4
	Mobile Identity 2	TMSI 10.5.2.42	M	V	4
	Mobile Identity 3	TMSI 10.5.2.42	M	V	4
	Mobile Identity 4	TMSI 10.5.2.42	M	V	4
	P3 Rest Octets	P3 Rest Octets 10.5.2.25	M	V	3

9.1.24.1 Channels needed for Mobiles 1 and 2

The first CHANNEL field of *Channel Needed* IE is associated with *Mobile Identity 1*. The second CHANNEL field of *Channel Needed* IE is associated with *Mobile Identity 2*.

If this message is used in the packet paging procedure, the *Channel Needed* IE associated with the corresponding *Mobile Identity 1* or *2* shall be coded with the value 00 (any channel) by the network. The mobile station receiving a packet paging request shall treat this information element as unnecessary in the message.

9.1.24.2 P3 Rest Octets

This IE contains the channel needed indication related to the paging of *Mobile Identity 3* and *4*. The treatment of these indications in the case this message is used in a packet paging procedure is specified in section 9.1.24.1.

This IE may further contain a *notification list number* field and/or, referring to each one of the *Mobile Identity 1, 2, 3* and *4* IEs, a *Priority 1, 2, 3* and *4* field.

9.1.25 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

Table 9.25/GSM 04.08: PAGING RESPONSE message content

IEI	Information element	Type / Reference	Presence	Format	length
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Paging Response Message Type	Message Type 10.4	M	V	1
	Ciphering Key Sequence Number	Ciphering Key Sequence Number 10.5.1.2	M	V	1/2
	Spare Half Octet	Spare Half Octet 10.5.1.8	M	V	1/2
	Mobile Station Classmark	Mobile Station Classmark 2 10.5.1.6	M	LV	4
	Mobile Identity	Mobile Identity 10.5.1.4	M	LV	2-9

9.1.25.1 Mobile Station Classmark

This IE shall include for multiband mobile station the Classmark 2 corresponding to the frequency band in use.

9.1.26 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

Table 9.26/GSM 04.08: PARTIAL RELEASE message content

IEI	Information element	Type / Reference	Presence	Format	length
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Partial Release Message Type	Message Type 10.4	M	V	1
	Channel Description	Channel Description 10.5.2.5	M	V	3

9.1.26.1 Channel Description

This information element describes the channel to be released.

9.1.27 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

Table 9.27/GSM 04.08: PARTIAL RELEASE COMPLETE message content

IEI	Information element	Type / Reference	Presence	Format	length
	RR management	Protocol Discriminator	M	V	1/2

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	Protocol Discriminator	10.2			
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Partial release Complete Message Type	Message Type 10.4	M	V	1

9.1.28 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. See table 9.28/GSM 04.08.

Message type: PHYSICAL INFORMATION

Significance: dual

Direction: network to mobile station

Table 9.28/GSM 04.08: PHYSICAL INFORMATION message content

IEI	Information element	Type / Reference	Presence	Format	length
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	Physical Information Message Type	Message Type 10.4	M	V	1
	Timing Advance	Timing Advance 10.5.2.40	M	V	1

9.1.28.a RR Initialisation Request

This message is sent by the mobile station to request establishment of dedicated mode.

Message type: RR Initialisation Request

Significance: local

Direction: mobile station to network

Table 9.28a/GSM 04.08: RR Initialisation Request message content

IEI	Information element	Type / Reference	Presence	Format	length
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	RR Initialisation Request Message Type	Message Type 10.4	M	V	1
	Ciphering Key Sequence Number	Ciphering Key sequence Number 10.5.1.2	M	V	1/2
	MAC Mode and Channel Coding Requested	Channel Coding Requested 10.5.2.4a	M	V	1/2
	Mobile station classmark	Mobile station classmark 2 10.5.1.6	M	LV	4
	TLLI	TLLI 10.5.2.41a	M	V	4
	Channel Request Description	Channel Request Description 10.5.2.8a	M	V	5
	GPRS Measurement Results	GPRS Measurement Results 10.5.2.20a	M	V	2

9.1.29 RR Status

This message is sent by the mobile station or the network at any time to report certain error conditions as described in section 8. See table 9.28a/GSM 04.08.

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Message type: RR STATUS
 Significance: local
 Direction: both

Table 9.28a/GSM 04.08: RR STATUS message content

IEI	Information element	Type / Reference	Presence	Format	length
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	RR Status Message Type	Message Type 10.4	M	V	1
	RR Cause	RR Cause 10.5.2.31	M	V	1

9.1.30 Synchronization channel information

This message is sent on the SCH, which is one of the broadcast channels (ref. GSM 05.02 section 3.3.2). Its purpose is to support the synchronization of a mobile station to a BSS. It does not follow the basic format. Its length is 25 bits. The order of bit transmission is defined in GSM 04.04. See figure 9.3/GSM 04.08 and table 9.29/GSM 04.08.

Message type: SYNCHRONIZATION CHANNEL INFORMATION
 Significance: dual
 Direction: network to mobile station

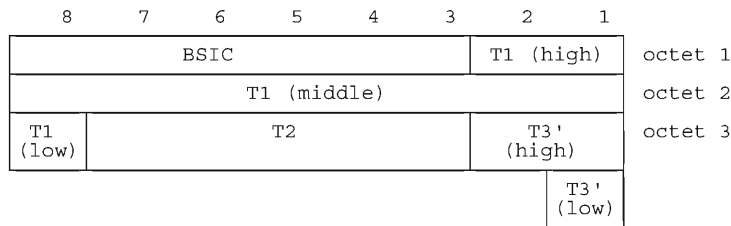


Figure 9.3/GSM 04.08: Frame synchronization information element

Table 9.29/GSM 04.08: Synchronization channel information message contents

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 TS. GSM 05.02 section 3.3.2.

9.1.31 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. Special requirements for the transmission of this message apply, see GSM 05.02. This message has a L2 Pseudo Length of 21.

Message type: SYSTEM INFORMATION TYPE 1
 Significance: dual
 Direction: network to mobile station

Table 9.30/GSM 04.08: SYSTEM INFORMATION TYPE 1 message content

IEI	Information element	Type / Reference	Presence	Format	length
	L2 pseudo length	L2 pseudo length 10.5.2.19	M	V	1
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	System Information Type 1 Message Type	Message Type 10.4	M	V	1
	Cell Channel Description	Cell Channel Description 10.5.2.1b	M	V	16
	RACH Control Parameter	RACH Control Parameters 10.5.2.29	M	V	3
	SI 1 Rest Octets	SI 1 Rest Octets 10.5.2.32	M	V	1

9.1.32 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. Special requirements for the transmission of this message apply, see GSM 05.02. This message has a L2 Pseudo Length of 22.

Message type: SYSTEM INFORMATION TYPE 2

Significance: dual

Direction: network to mobile station

Table 9.31/GSM 04.08: SYSTEM INFORMATION TYPE 2 message content

IEI	Information element	Type / Reference	Presence	Format	length
	L2 Pseudo Length	L2 Pseudo Length 10.5.2.19	M	V	1
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	System Information Type 2 Message Type	Message Type 10.4	M	V	1
	BCCH Frequency List	Neighbour Cell Description 10.5.2.22	M	V	16
	NCC Permitted	NCC permitted 10.5.2.27	M	V	1
	RACH Control Parameter	RACH Control Parameters 10.5.2.29	M	V	3

9.1.33 System information type 2bis

This message is sent optionally on the BCCH by the network to all mobile stations within the cell giving information on control of the RACH and of the extension of the BCCH allocation in the neighbour cells. See table 9.31a/GSM 04.08. Special requirements for the transmission of this message apply, see GSM 05.02.

A GSM 900 mobile station which only supports the primary GSM band P-GSM 900 (cf. GSM 05.05) may ignore this message, see section 3.2.2.1.

This message has a L2 pseudo length of 21.

Message type: SYSTEM INFORMATION TYPE 2bis

Significance: dual

Direction: network to mobile station

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Table 9.31a/GSM 04.08: SYSTEM INFORMATION TYPE 2bis message content

IEI	Information element	Type / Reference	Presence	Format	length
	L2 Pseudo Length	L2 Pseudo Length 10.5.2.19	M	V	1
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	System Information Type 2bis Message Type	Message Type 10.4	M	V	1
	Extended BCCH Frequency List	Neighbour Cell Description 10.5.2.22	M	V	16
	RACH Control Parameters	RACH Control Parameters 10.5.2.29	M	V	3
	SI 2bis Rest Octets	SI 2bis Rest Octets 10.5.2.33	M	V	1

9.1.34 System information type 2ter

This message is sent optionally on the BCCH by the network to all mobile stations within the cell giving information on the extension of the BCCH allocation in the neighbour cells. See table 9.31b/GSM 04.08. Special requirements for the transmission of this message apply, see GSM 05.02.

A mobile station that supports either:

only the primary GSM band P-GSM 900 (cf. GSM 05.05), or

only the DCS 1800 band (cf. GSM 05.05)

may ignore this message, see section 3.2.2.1.

This message has a L2 pseudo length of 18. This message may be sent by the network with either a L2 pseudo length of 18 or some other value. A mobile station that does not ignore this message shall not discard the message due to a received L2 pseudo length different from 18.

Message type: SYSTEM INFORMATION TYPE 2ter

Significance: dual

Direction: network to mobile station

Table 9.31b/GSM 04.08: SYSTEM INFORMATION TYPE 2ter message content

IEI	Information element	Type / Reference	Presence	Format	length
	L2 Pseudo Length	L2 Pseudo Length 10.5.2.19	M	V	1
	RR management Protocol Discriminator	Protocol Discriminator 10.2	M	V	1/2
	Skip Indicator	Skip Indicator 10.3.1	M	V	1/2
	System Information Type 2ter Message Type	Message Type 10.4	M	V	1
	Extended BCCH Frequency List	Neighbour Cell Description 2 10.5.2.22a	M	V	16
	SI 2ter Rest Octets	SI 2ter Rest Octets 10.5.2.33a	M	V	4

9.1.35 System information type 3

This message is sent on the BCCH by the network giving information of control on the RACH, the location area identification, the cell identity and various other information about the cell. See table 9.32/GSM 04.08. Special requirements for the transmission of this message apply, see GSM 05.02. This message has a L2 Pseudo Length of 18.

Message type: SYSTEM INFORMATION TYPE 3

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Significance: dual

Direction: network to mobile station

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