**ETSI/TC SMG**
**Released by : ETSI/PT 12**
**Release date: February 1992**

**RELEASE NOTE**

**Recommendation GSM 04.07**

Mobile Radio Interface Signalling Layer 3 - General Aspects

Previously distributed version : 3.3.2 (Updated Release 1/90)
**New Released version February 92 : 3.3.3 (Release 92, Phase 1)**

## 1. Reason for changes

Only pagenumbering/layout/etc. has been changed since the previously distributed version.

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**ETSI-GSM**
**Technical**
**Specification**

**GSM 04.07**

**Version 3.3.3**

UDC: 621.396.21

**Key words:** European Digital Cellular Telecommunications System, Global System for Mobile Communications (GSM)

# Mobile Radio Interface
# Signalling Layer 3
# General Aspects

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## PREFATORY NOTE

ETSI has constituted stable and consistent documents which give specifications for the implementation of the European Cellular Telecommunications System. Historically, these documents have been identified as "GSM recommendations".

Some of these recommendations may subsequently become Interim European Telecommunications Standards (I-ETSs) or European Telecommunications Standards (ETSs), whilst some continue with the status of ETSI-GSM Technical Specifications. These ETSI-GSM Technical Specifications are for editorial reasons still referred to as GSM recommendations in some current GSM documents.

The numbering and version control system is the same for ETSI-GSM Technical Specifications as for "GSM recommendations".

ETSI/GSM version 3.3.3

**Recommendation** : GSM 04.07
**Title** : Mobile radio interface Signalling layer 3 - general aspects
**Date** : February 1992

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Number of pages : 55 + 7 (figures annexed)
Language of original : English

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# 1 Introduction

## 1.1 General

The signalling layer 3 provides the functions to establish, maintain and terminate circuit-switched connections across a GSM PLMN and other networks to which the GSM PLMN is connected. It provides the necessary supporting functions related to supplementary services control and short messages service control. Furthermore it includes the functions necessary for mobility management and radio resource management.

The term "Layer 3" or "Signalling Layer 3" is a general term used to refer to the procedures described in Recommendation GSM 04.07, 04.08, 04.10 and 04.11.

The layer 3 is composed of three sublayers comprising the connection management (CM) functions, the mobility management (MM) functions and the radio resource management (RR) functions.

## 1.2 Objectives

The objectives of the layer 3 are to provide the means for:

- the establishment, operation and release of a dedicated radio channel connection (radio resource management);
- for register updating, authentication and TMSI reallocation (mobility management);
- for establishment, maintaining and termination of circuit- switched calls (call control);
- supplementary services support;
- short messages service support.

## 1.3 General characteristics

### 1.3.1 Technique of description

The signalling layer 3 is described in terms of:

- services provided by the signalling layer 3;

- services assumed from the signalling layer 2;

- functions of the signalling layer 3.

The functions of the signalling layer 3 are performed by means of the signalling layer 3 protocols between two systems which represent the mobile station side and the network side of the radio interface as viewed by the mobile station. This Recommendation does not consider the distribution of signalling functions among the different entities of the Base Station System. The functions of layer 3 and its supporting lower layers, therefore, provide the Mobile Network Signalling (MNS) Service to the upper layers.

The service interfaces to the upper layers and to the signalling layer 2 are described by means of primitives and parameters as recommended in CCITT Recommendation X.200.

The same technique of description is used for the three sublayers.

### 1.3.2 Primitives

The services provided by the various sublayers are described in this Recommendation. The elementary interactions among adjacent sublayers are described by primitives. The primitives consist of requests, responses, indications and confirmations. The general syntax of a primitive is specified in Recommendation GSM 04.01.

### 1.3.3 Peer to peer communication

Exchange of information between two peers of the signalling layer 3 is performed by means of the three sublayer protocols. A protocol is a set of rules and formats by which the control information and user data are exchanged between the two peers. The protocols are described in Recommendations GSM 04.08, 04.10 and 04.11.

### 1.3.4 Contents of signalling layer 3 related Recommendations

Rec. GSM 04.08 contains the protocols for Call Control, Mobility Management and Radio Resource Management.

Rec. GSM 04.10 contains the protocols for Supplementary Services Support.

Rec. GSM 04.11 contains the protocols for Short Message Services Support.

# 2 Structure of signalling layer 3 functions

## 2.1 Basic groups of functions

Signalling Layer 3 comprises the following groups of signalling functions:

- Call Control (CC)
- Short Message Service Support (SMS)
- Supplementary Services Support (SS)
- Mobility Management (MM)
- Radio Resource Management (RR)

These functional groups are realized by separate protocol control entities.

In addition other functions are contained in layer 3 which are related to the transport of messages, e.g. multiplexing and splitting.

Those functions are defined in Radio Resource and Mobility Management. They have the task to route the messages due to the protocol discriminator (PD) and transaction identifier (TI) which are part of the message header.

In the uplink direction, the MM routing function shall route the messages of the CM-entities as well as of the MM-entity of its own sublayer towards the service access point of RR and multiplex them in case of parallel transactions.

The routing function of Radio Resource Management shall distribute the messages to be sent according to their protocol discriminator and the actual channel configuration.

In the downlink direction the messages provided at the different service access points of layer 2 are splitted by the RR-routing function due to the protocol discriminator. Messages with a PD equal to RR are passed to the RR-entity of the own sublayer, all other messages are provided to the MM-sublayer at the service access point RR-SAP.

The routing function of MM passes the messages due to the protocol discriminator and the transaction identifier (TI) towards the MM entity or towards the CM-entities via the various MM-SAP's.

The message header or parts of it are not removed by the RR- routing function before passing it to the MM-sublayer because further routing has to be done by MM using the same criteria.
This is not in line with the rules of the ISO reference model but it reduces the number of message octets.

## 2.2 Protocol architecture

As shown in Fig. 2.1/GSM 04.07 a hierarchy of 3 sublayers is defined:

- The RR-sublayer provides services to the MM-sublayer and utilizes the services of signalling layer 2.

- The MM-sublayer provides common services to the entities of the Connection Management (CM) sublayer.

- The CM-sublayer includes the CC-, SS-, and SMS-entities, which are independent entities.

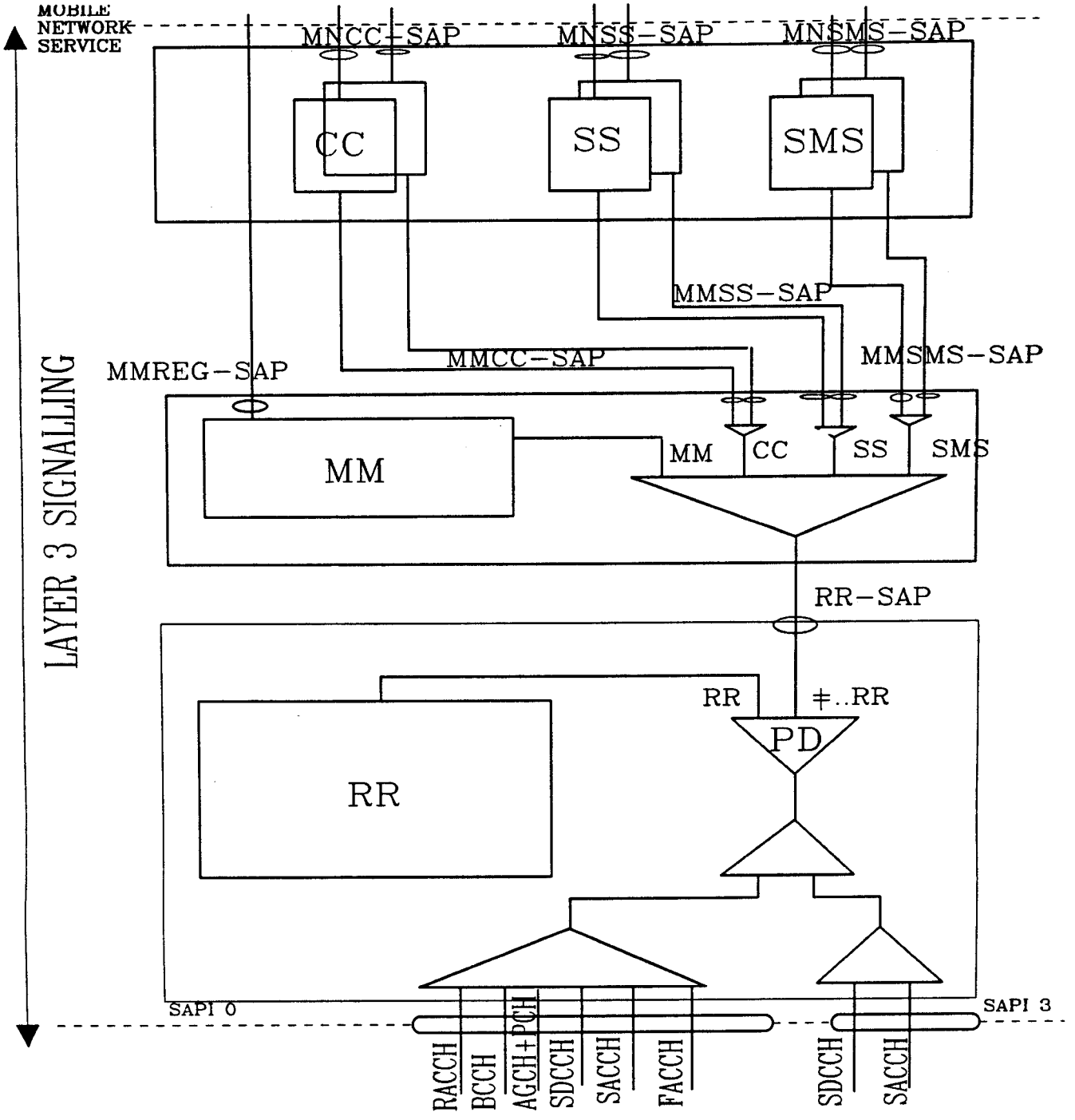



Figure 2.1/GSM 04.07
Protocol Architecture of Signalling Layer 3/MS-side

# 3 Services provided by signalling layer 3 at the MS side

The different classes of services provided by signalling layer 3 at the MS side are accessible at the following service access points:

- Registration services at the MMREG-SAP;
- Call Control services for normal and emergeny calls including call related Supplementary Services Support services at the MNCC-SAP;
- Short Message Services Support services at the MNSMS-SAP;
- Call independent Supplementary Services Support services at the MNSS-SAP.

## 3.1 Registration Services

The Registration services are provided at the service access point MMREG-SAP. The term "Registration" is used to denote the IMSI attach/detach operation defined in Rec. GSM 03.01. As opposed to all other MN-Services, these services are provided by and can be directly accessed at the Mobility Management sublayer.

### 3.1.1 Service state diagram

The registration services provided at the service access point MMREG-SAP are illustrated in the state of figure 3.1/GSM 04.07 below.

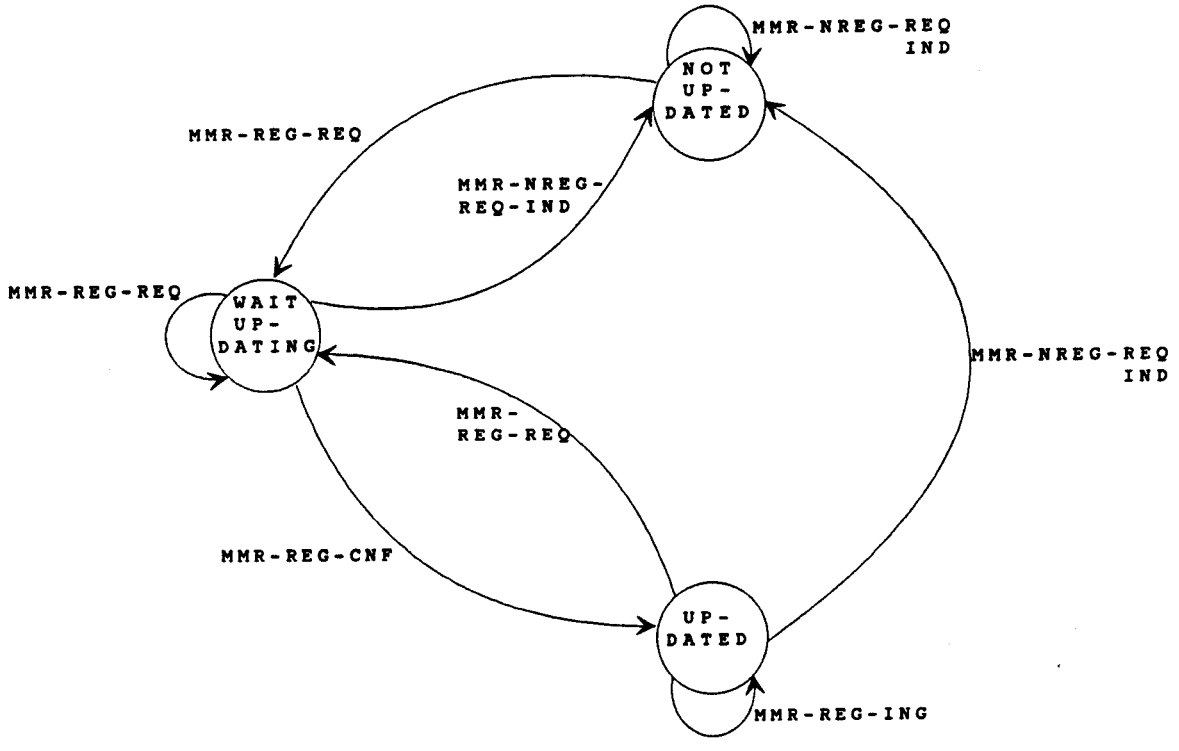



Figure 3.1/GSM 04.07
Registration services provided at MMREG-SAP/MS-side

### 3.1.2 Service Primitives

MMR_REG_REQ
Registration request, triggered in one of three possible ways:
- activation of MS
- insertion of SIM
- "reset button"

MMR_REG_CNF
Registration confirmation. Useful in order to indicate to the user that the Mobile Station is ready to start a transaction.

MMR_REG_IND
Indicates to the user that the Mobile Station is ready to use.

MMR_NREG_REQ
Request to cancel the registration, stimulated either by removing the SIM or automatically in the power off phase.

MMR_NREG_IND
Indication that registration has been cancelled or that registration was not possible. Only emergency services are available to the user.

| PRIMITIVE | | PARAMETER |
|---|---|---|
| GENERIC NAME | SPECIFIC NAME | |
| MMR_REG | REQ | IMSI |
| | CNF | -- |
| | IND | -- |
| MMR_NREG | REQ | -- |
| | IND | cause |

Table 3.1/GSM 04.07
Primitives and Parameters at the MMREG-SAP

## 3.2 Call Control Services

The Call Control Services are provided by multiple CC entities at the service access point MNCC-SAP.

The call control service class consists of the following services:

- MS-originated and MS-terminated call establishment for normal calls;
- MS-originated call establishment for emergency calls;
- call maintaining;
- call termination;
- call related Supplementary Services Support.

### 3.2.1 Service state diagram

The Call Control services provided at the service access point MNCC-SAP are illustrated in the state diagram of figure 3.2/GSM 04.07.

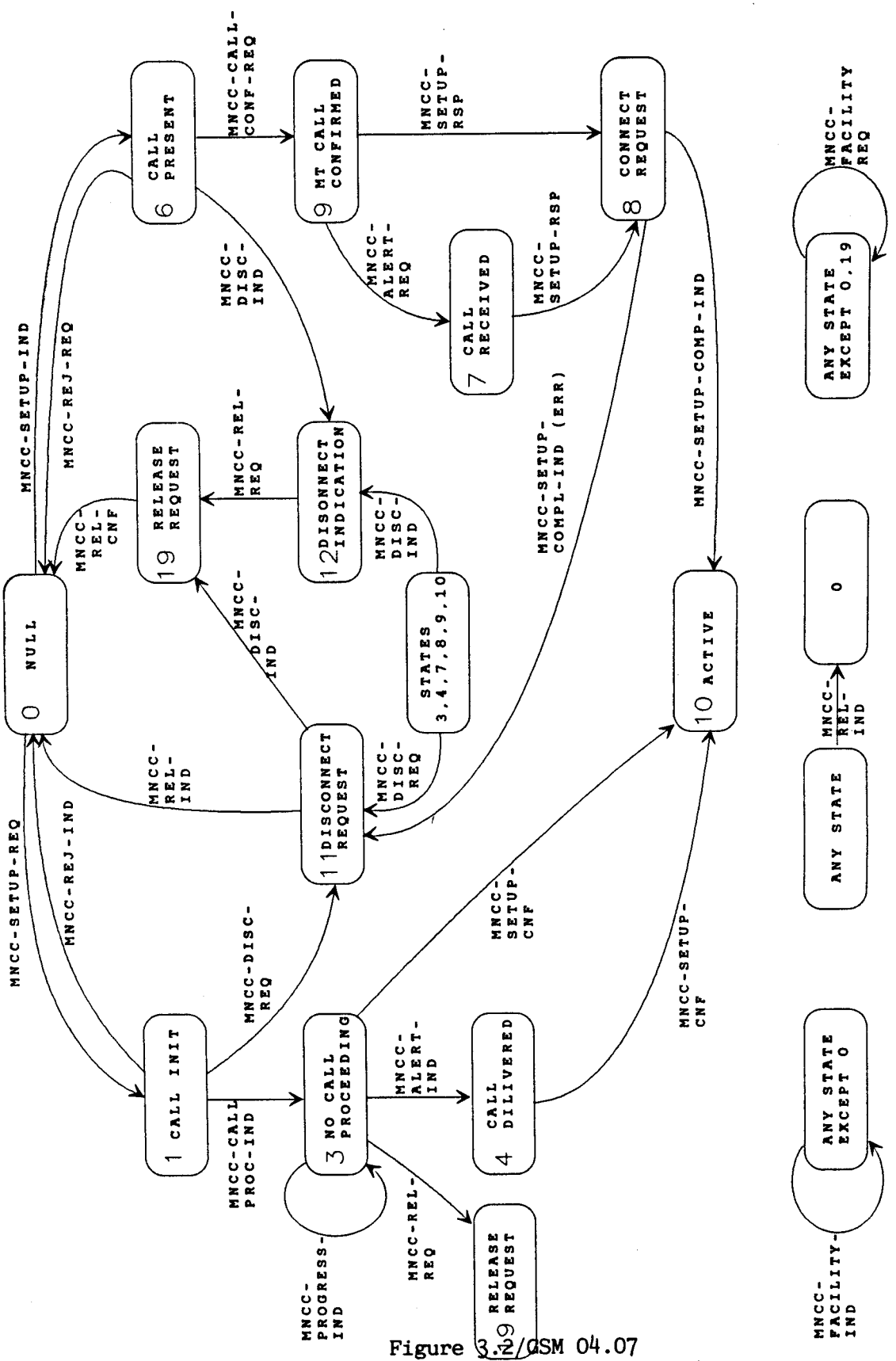



Figure 3.2/GSM 04.07
Service graph of Call Control entity/MS-side
(page 1 of 2)

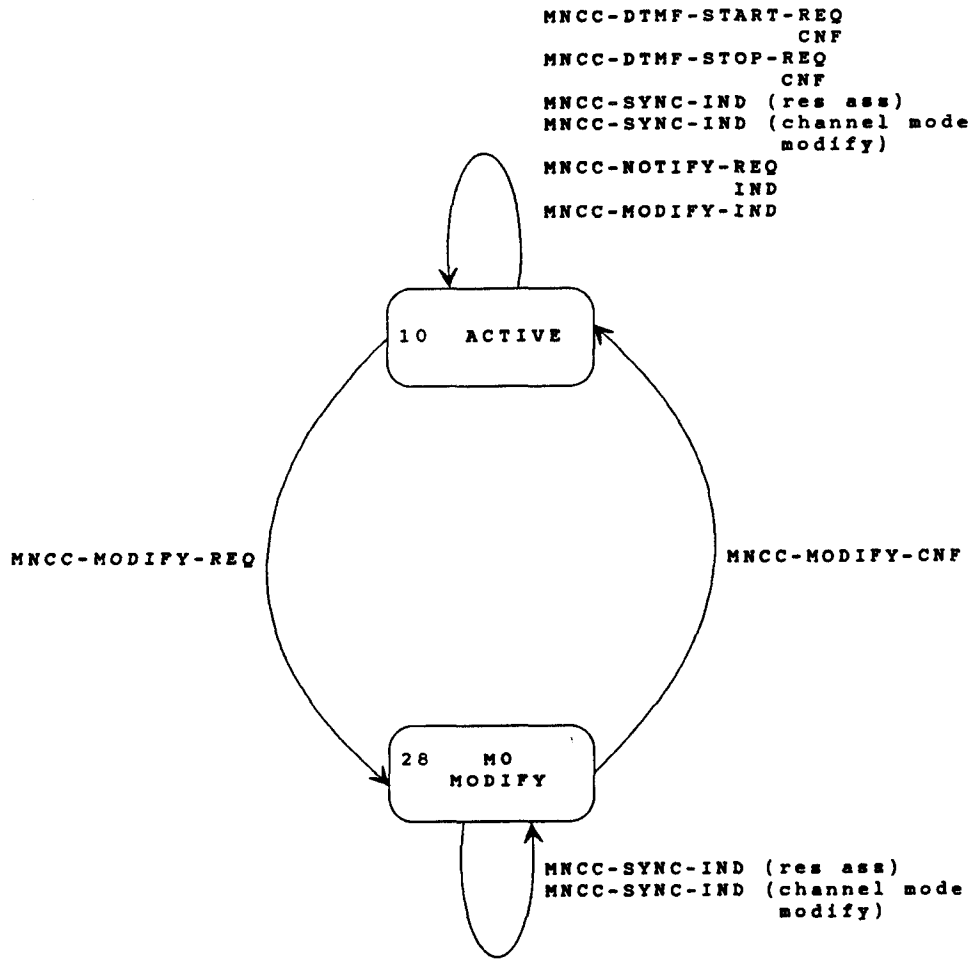



Figure 3.2/GSM 04.07
Service graph of Call Control entity/MS-side Active state
(page 2 of 2)

### 3.2.2 Service Primitives

MNCC_SETUP_REQ
Request to send a SETUP message to initiate mobile originating establishment of either a normal or an emergency call.

MNCC_SETUP_IND
Indication of the receipt of a SETUP message that the mobile terminated call establish-ment has been initiated.

MNCC_SETUP_RES
Response a CONNECT message to indicate call acceptance by the mobile terminated user.

MNCC_SETUP_CNF
Confirmation by receiving a CONNECT message that the mobile originated call has been accepted by the remote called user. The mobile originating user is informed that the appropriate TCH has been assigned and can be connected.

MNCC_SETUP_COMPL_IND
Indication of the receipt of a CONNECT ACKNOWLEDGE message that the mobile terminated call establishment has been completed; the user is informed that the appropriate TCH has been assigned and can be connected.

MNCC_REJ_REQ
Request to reject a mobile terminated call if the call cannot be accepted e.g. because of missing compatibility.

MNCC_CALL_CONF_REQ
Request to confirm a mobile terminated call by sending a CALL CONFIRM message. A bearer capability different form that given in NCC_SETUP_IND may be offered to the remote calling user.

MNCC_REJ_IND
Indication that the mobile originated call has been rejected, e.g. if the MM-connection cannot be provided.

MNCC_CALL-PROC-IND
Indication to the mobile originating user that call establishment has been initiated in the network and no more call establishment information will be accepted by the network.

MNCC_PROGRESS_IND
Indication to the mobile originating user that a call is in progress in the event of interworking or in relation with the provision of inband information/patterns.

MNCC_ALERT_REQ
Request to send an ALERTING message from the called mobile user to the remote calling user to indicate that user alerting has been initiated.

MNCC_ALERT_IND
Indication to the mobile originating user that remote called user alerting has been initiated.

MNCC_NOTIFY_REQ
Request to send information pertaining to a call, such as user suspended, to the network by either the mobile originating or the mobile terminated user.

MNCC_NOTIFY_IND
Indication to the mobile originating or mobile terminated user that information pertaining to a call, such as remote user suspended, has been received form the network.

MNCC_DISC_REQ
Request to send a DISCONNECT message to the network in order to clear the end-to-end connection.

MNCC_DISC_IND
Indication of reception of a DISCONNECT message, by which the network indicates that the end-to-end connection is cleared.

MNCC_REL_REQ
Request of the mobile originating or terminated user to send a RELEASE message to inform the network that he intends to release his call reference and the corresponding MM- connection so that the network can release its MM connection and the correspondent call reference.

MNCC_REL_IND
Indication to the mobile originating or terminated user that a RELEASE message has been received and the network intends to release its MM-connection. The mobile user is requested to release his call reference and the corresponding MM- connection.

MNCC_REL_CNF
Confirmation of the mobile user's request to release the MM- connection and call reference in the network. The mobile user itself may release its call reference and the corresponding MM-connection.

MNCC_FACILITY_REQ
Request to send a FACILITY message for call related supplementary service invocations.

MNCC_FACILITY_IND
Indication that a FACILITY message for call related supplementary service invocations has been received.

MNCC_START_DTMF_REQ
Request to send a START DTMF message in order to start a DTMF control operation.

MNCC_START_DTMF_CNF
Confirmation of the receipt of a START DTMF ACKNOWLEDGE or START DTMF REJECT message that the start of a DTMF control operation has been acknowledged or rejected.

MNCC_STOP_DTMF_REQ
Request to send a STOP DTMF message in order to stop a DTMF control operation.

MNCC_STOP_DTMF_CNF
Confirmation of the receipt of STOP DTMF ACKNOWLEDGE message, the DTMF control operation has been stopped.

MNCC_MODIFY_REQ
Request to start mobile originating in-call modification by sending a MODIFY message.

MNCC_MODIFY_CNF
Indication that mobile originating in-call modification has been completed after receipt of a MODIFY COMMAND message.

MNCC_MODIFY_IND
Indication that mobile terminating in-call modification has been completed.

MNCC_SYNC_IND
Indication that a dedicated channel assignment has been performed and/or the channel mode has been changed.

| PRIMITIVES | | PARAMETERS (Info elements of MESSAGE, other parameters) |
|---|---|---|
| GENERIC NAME | SPECIFIC NAME | |
| MNCC_SETUP | REQ | SETUP, forwarding priority 1) |
| | IND | SETUP |
| | RES | CONNECT |
| | CNF | CONNECT |
| MNCC_SETUP_COMPLETE | IND | -- |
| MNCC_REJ | REQ | RELEASE COMPLETE |
| | IND | cause |
| MNCC_CALL_CONF | REQ | CALL CONFIRM |
| MNCC_CALL PROC | IND | CALL PROCEEDING |
| MNCC_PROGRESS | IND | PROGRESS |
| MNCC_ALERT | REQ | ALERTING |
| | IND | ALERTING |
| MNCC_NOTIFY | REQ | NOTIFY |
| | IND | NOTIFY |
| MNCC_DISC | REQ | DISCONNECT |
| | IND | DISCONNECT |
| MNCC_REL | REQ | RELEASE |
| | IND | RELEASE |
| | CNF | RELEASE or RELEASE COMPLETE |

Table 3.2/GSM 04.07 (page 1 of 2)
Primitives and parameters at MNCC-SAP/MS-side

Note 1: Used to inform MM whether it is a normal or an emergency call

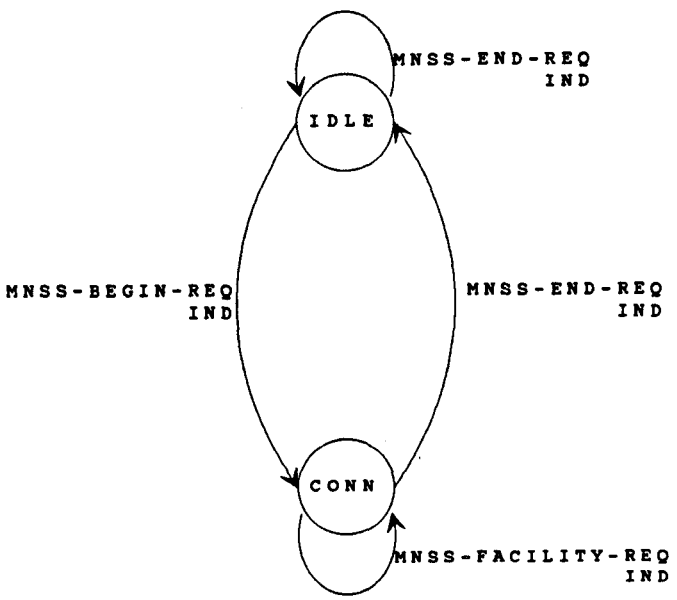
| PRIMITIVES | | PARAMETERS (Info elements of MESSAGE, other parameters) |
|---|---|---|
| GENERIC NAME | SPECIFIC NAME | |
| MNCC_FACILITY | REQ | FACILITY |
| | IND | FACILITY |
| MNCC_START_DTMF | REQ | START DTMF |
| | CNF | START DTMF ACK OR<br>START DTMF REJ |
| MNCC_STOP_DTMF | REQ | STOP DTMF |
| | CNF | STOP DTMF ACK |
| MNCC_MODIFY | REQ | MODIFY |
| | IND | F.S. |
| | CNF | MODIFY COMPLETE |
| MNCC_SYNC | IND | cause (res. ass. mode modify) |

Table 3.2/GSM 04.07 (page 2 of 2)
Primitives and parameters at MNCC-SAP/MS-side

3.3 Call independent supplementary services support

3.3.1 Service state diagram

The primitives provided by the call independent supplementary services support entity and the transitions between permitted states are shown in Fig. 3.3/GSM 04.07.




STATES:
IDLE - No SS-signalling transaction pending
CONN - SS-signalling transaction established

Figure 3.3/GSM 04.07
Service graph of the call independent supplementary services support entity/MS-side

### 3.3.2 Service Primitives

MNSS_BEGIN_REQ
Request to establish a signalling transaction for the provision of call independent supplementary services by sending a REGISTER message.

MNSS_BEGIN_IND
Indication of a signalling transaction for the provision of call independent supplementary services after receipt of a REGISTER message.

MNSS_FACILITY_REQ
Request of a supplementary service facility by sending a FACILITY message.

MNSS_FACILITY_IND
Indication that a supplementary service facility has been acknowledged after receipt of a FACILITY message.

MNSS_END_REQ
Request to release the signalling transaction by sending a RELEASE COMPLETE message.

MNSS_END_IND
Indication that the signalling transaction has been released after receipt of a RELEASE COMPLETE message.

| PRIMITIVES | | PARAMETERS Info elements of message |
|---|---|---|
| GENERIC NAME | SPECIFIC NAME | |
| MNSS_BEGIN | REQ | REGISTER |
| | IND | REGISTER |
| MNSS_FACILITY | REQ | FACILITY |
| | IND | FACILITY |
| MNSS_END | REQ | REL COMPLETE |
| | IND | REL COMPLETE |

Table 3.3/GSM 04.07
Primitives and Parameters at MNSS-SAP/MS-side

## 3.4 Short Message Services Support

### 3.4.1 Short Messages Services Support state diagram

The primitives provided by the Short Messages Service Support entity and the transition between the allowed states are shown in Fig. 3.4/GSM 04.07.

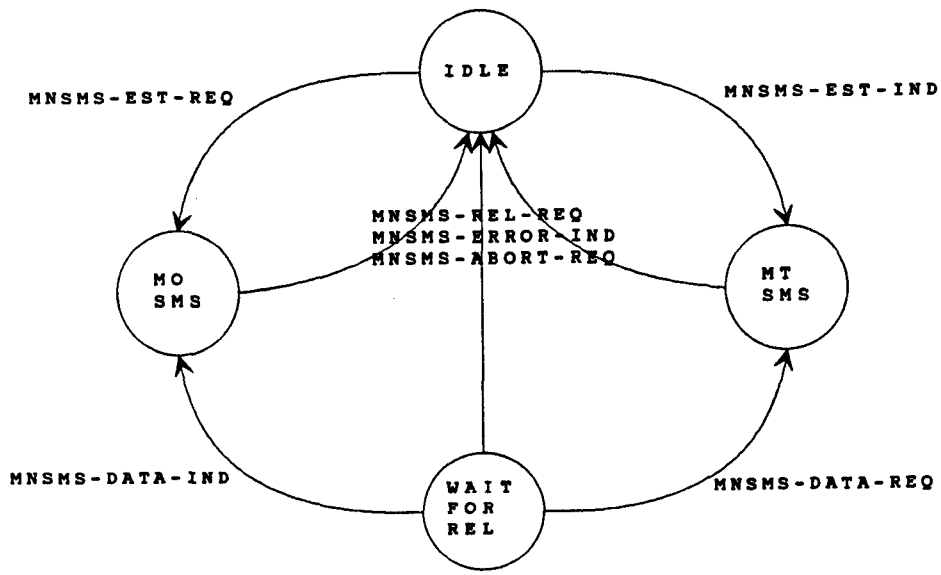



Figure 3.4/GSM 04.07
Service graph of the Short Messages Service Support entity/MS-side

### 3.4.2 Service Primitives

MNSMS_EST_IND
Indicates a received SMS-message and implicates establishment of a SMS-connection.

MNSMS_EST_REQ
A request to establish a SMS-connection containing the SMS- message.

MNSMS_DATA_REQ
A request to return the acknowledgement, or an error indication, upon an earlier reception of an SMS-message.

MNSMS_DATA_IND
An indication of a received SMS-message, acknowledgement or error indication.

MNSMS_REL_REQ
A request to release the SMS-connection.

MNSMS_ERROR_IND
Indication with error information; it implicates release of the SMS-connection.

MNSMS_ABORT_REQ
Request used to release the SMS-connection in abnormal cases.

| PRIMITIVES | | PARAMETERS |
|---|---|---|
| GENERIC NAME | SPECIFIC NAME | |
| MNSMS_EST | REQ | SMS message |
| | IND | SMS message |
| MNSMS_DATA | REQ | SMS message |
| | IND | SMS message |
| MNSMS_REL | REQ | cause |
| MNSMS_ERROR | IND | cause |
| MNSMS_ABORT | REQ | cause |

Table 3.4/GSM 04.07
Primitives and Parameters at MNSMS-SAP/MS-side

# 4 Services provided by signalling layer 3 on the network side

## 4.1 Call control services

The Call Control Services are provided by multiple CC entities at the service access point MNCC-SAP.

The Call Control service class consists of the following services:

- call establishment;
- call maintaining;
- call termination;
- call related Supplementary Services Support.

### 4.1.1 Service state diagram

The Call Control services provided at the service access point MNCC-SAP are illustrated in the Figure 4.1/GSM 04.07.

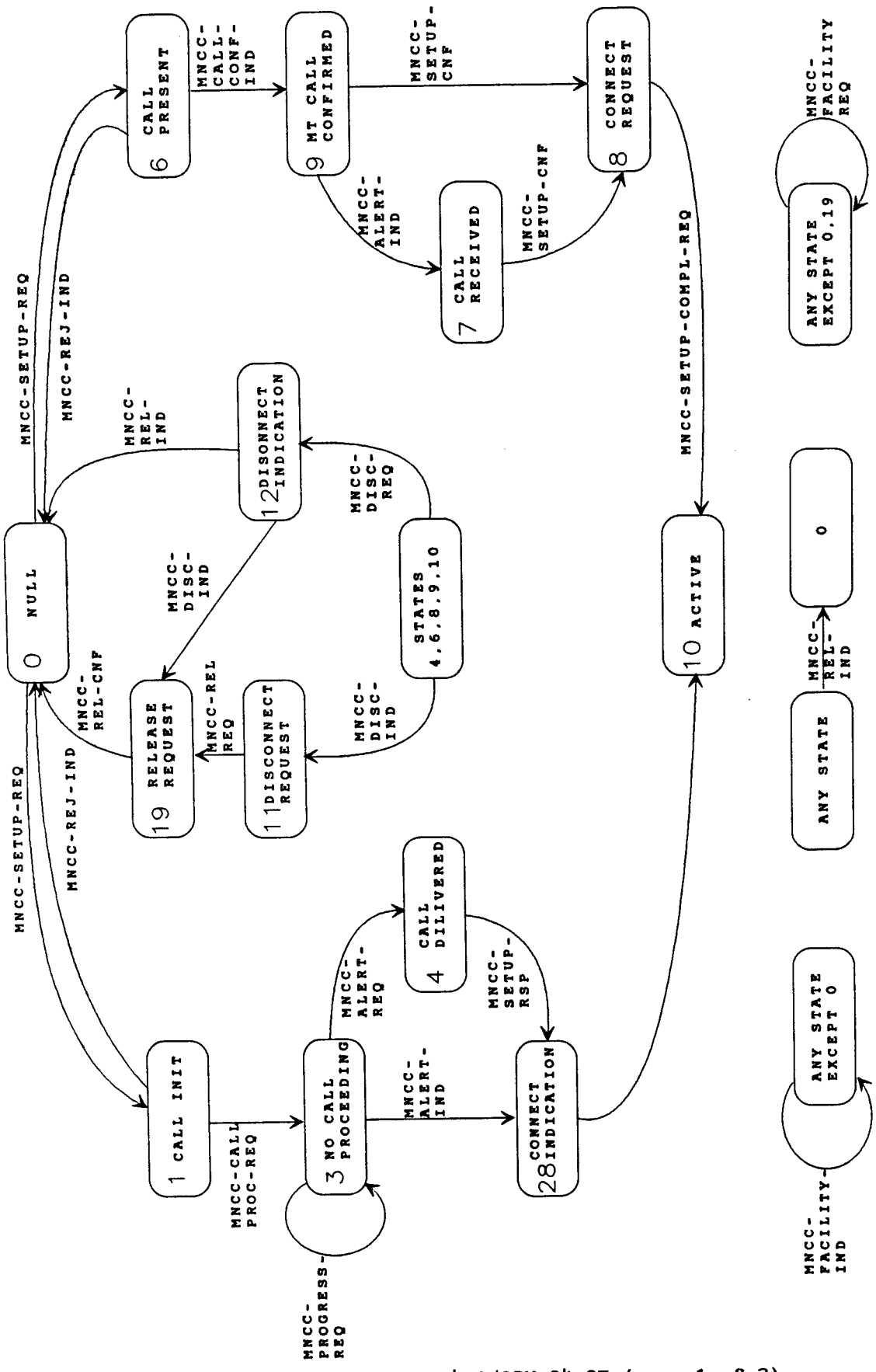



Figure 4.1/GSM 04.07 (page 1 of 2)
Service graph of Call Control entity/Network side

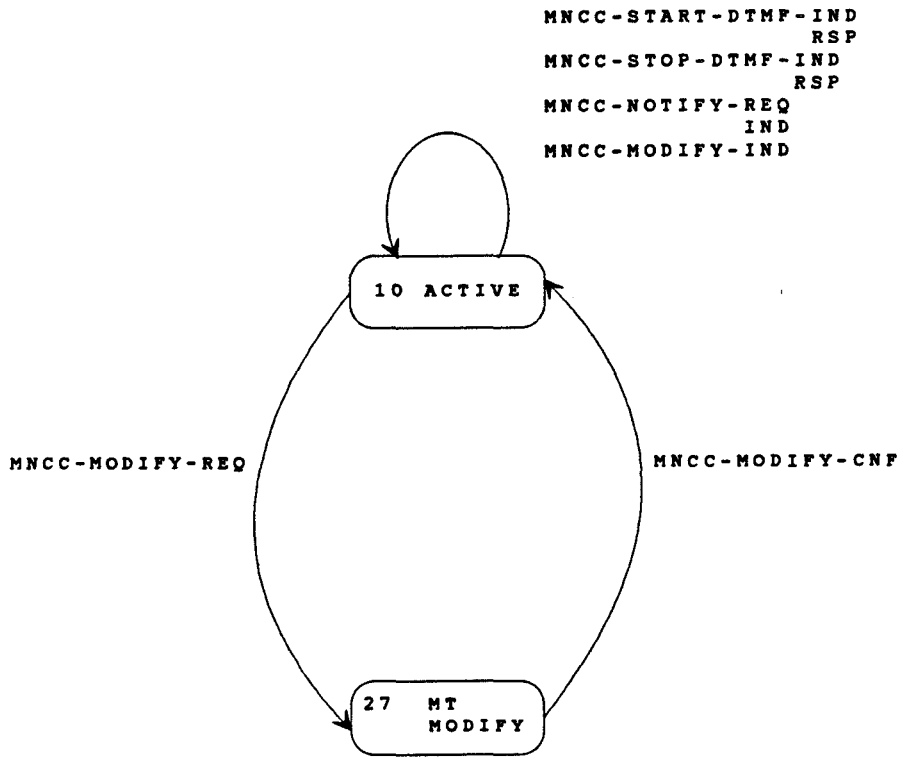



Figure 4.1/GSM 04.07 (page 2 of 2)
Service graph of call control entity/network side

### 4.1.2 Service Primitives

MNCC_SETUP_REQ
Request to send a SETUP message to initiate mobile terminated establishment.

MNCC_SETUP_IND
Receipt of a SETUP message, the mobile originating call establishment has been initiated.

MNCC_SETUP_RSP
Respond a CONNECT message to indicate call acceptance by the remote user.

MNCC_SETUP_CNF
Receipt of a CONNECT message, the mobile terminated call has been accepted.

MNCC_SETUP_COMPL_REQ
Request to send a CONNECT ACKNOWLEDGE message, the mobile terminated call establishment has been completed.

MNCC_SETUP_COMPL_IND
Indication of the receipt of a CONNECT ACKNOWLEDGE message, the mobile originating call establishment has been completed.

MNCC_REJ_REQ
Reject the mobile originated call establishment if the call cannot be accepted.

MNCC_REJ_IND
A mobile terminated call was rejected by MS e.g. because of missing compatibility.

MNCC_CALL_CONF_IND
Receipt of a CALL CONFIRM message, the mobile terminated call has been confirmed. A bearer capability different from that given in MNCC_SETUP_REQ may be offered to the remote calling user.

MNCC_CALL_PROC_REQ
Request to send a CALL PROCEEDING message to indicate to the mobile originating user that call establishment has been initiated in the network and no more call establishment information will be accepted.

MNCC_PROGRESS_REQ
Request to send a PROGRESS message to indicate to the mobile originating user that a call is in progress in the event of interworking or in relation with the provision of inband information/patterns.

MNCC_ALERT_REQ
Request to send an ALERTING message to indicate to the mobile originating user that remote called user alerting has been initiated.

MNCC_ALERT_IND
Receipt of an ALERTING message from the mobile terminated user to be sent to the remote calling user to indicate that user alerting has been initiated.

MNCC_NOTIFY_REQ
Request to send information pertaining to a call, such as user suspended, to the mobile originating or the mobile terminated user.

MNCC_NOTIFY_IND
Indication from the mobile originating or mobile terminated user of information pertaining to a call, such as remote user suspended.

MNCC_DISC_REQ
Request to send a DISCONNECT message to the mobile station in order to clear the end-to-end connection.

MNCC_DISC_IND
Receipt of a DISCONNECT message, the mobile station indicates that the end-to-end connection is cleared.

MNCC_REL_REQ
Request to send a RELEASE message to inform the mobile station that the net-work intends to release the MM- connection and the correspondent call reference.

MNCC_REL_IND
Receipt of a RELEASE message, the mobile station intends to release its MM-connection and call reference. The network is requested to release its call reference and MM-connection.

MNCC_REL_CNF
The RELEASE COMPLETE message has been received, the MM- connection in the Mobile Station has been released, the network itself shall release its MM-connection and the corresponding call reference.

MNCC_FACILITY_REQ
Request to send a FACILITY message for call related supplementary service invocations.

MNCC_FACILITY_IND
Indication that a FACILITY message for call related supplementary service invocations has been received.

MNCC_START_DTMF_IND
Indicate the receipt of a START DTMF message in order to start a DTMF control operation.

MNCC_START_DTMF_RSP
Request to send a START DTMF ACKNOWLEDGE or START DTMF REJECT message in order to acknowledge or reject the start of a DTMF control operation.

MNCC_STOP_DTMF_IND
Indicate the receipt of a STOP DTMF message in order to stop a DTMF control operation.

MNCC_STOP_DTMF_RSP
Request to send a STOP DTMF ACKNOWLEDGE message in order to acknowledge the completion of a DTMF control operation.

MNCC_MODIFY_REQ
Request to start the mobile terminating in-call modification.

MNCC_MODIFY_CNF
Confirmation that the mobile terminating in-call modification has been completed.

MNCC_MODIFY_IND
Indication that the mobile originating in-call modification has been completed.

| PRIMITIVES | | PARAMETERS (Info elements of MESSAGE, other parameters) |
|---|---|---|
| GENERIC NAME | SPECIFIC NAME | |
| MNCC_SETUP | REQ | SETUP incl. Mobile ID |
| | IND | SETUP |
| | RSP | CONNECT |
| | CNF | CONNECT |
| MNCC_SETUP_COMPLETE | REQ | CONNECT ACKNOWLEDGE |
| | IND | CONNECT ACKNOWLEDGE |
| MNCC_REJ | REQ | RELEASE COMPLETE |
| | IND | cause |
| MNCC_CALL_CONF | IND | CALL CONFIRM |
| MNCC_CALL PROC | REQ | CALL PROCEEDING |
| MNCC_PROGRESS | REQ | PROGRESS |
| MNCC_ALERT | REQ | ALERTING |
| | IND | ALERTING |
| MNCC_NOTIFY | REQ | NOTIFY |
| | IND | NOTIFY |
| MNCC_DISC | REQ | DISCONNECT |
| | IND | DISCONNECT |
| MNCC_REL | REQ | RELEASE or DISCONNECT |
| | IND | RELEASE |
| | CNF | RELEASE or RELEASE COMPLETE |

Table 4.1/GSM 04.07 (page 1 of 2)
Primitives and Parameters at MNCC-SAP/Network side

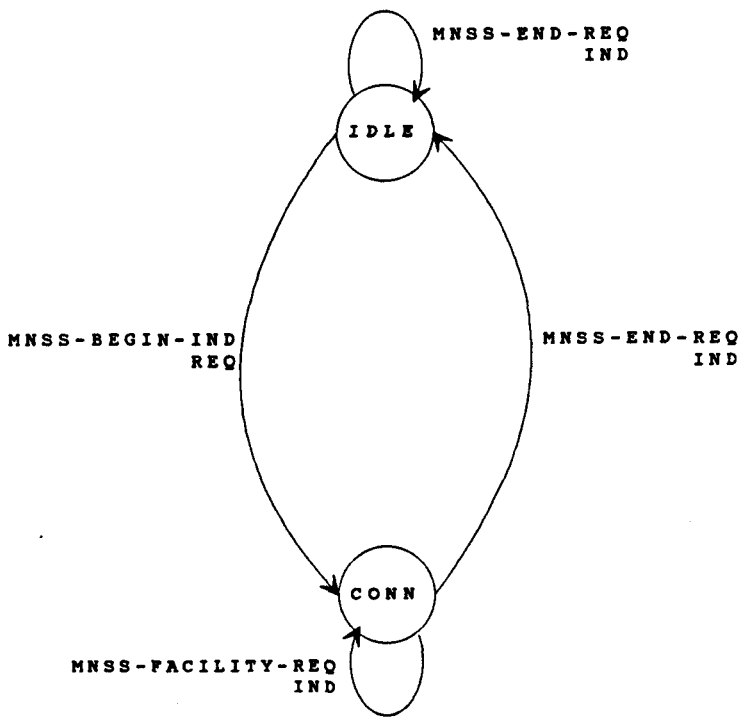
| PRIMITIVES | | PARAMETERS (Info elements of MESSAGE, other parameters) |
|---|---|---|
| GENERIC NAME | SPECIFIC NAME | |
| MNCC_FACILITY | REQ | FACILITY |
| | IND | FACILITY |
| MNCC_START_DTMF | IND | START DTMF |
| | RSP | START DTMF ACK or<br>START DTMF REJ |
| MNCC_STOP_DTMF | IND | STOP DTMF |
| | RSP | STOP DTMF ACK |
| MNCC_MODIFY | REQ | MODIFY or<br>BC-parameter |
| | IND | BC-parameter |
| | CNF | BC-parameter |

Table 4.1/GSM 04.07 (page 2 of 2)
Primitives and Parameters at MNCC-SAP/Network side

## 4.2 Call independent supplementary services support

### 4.2.1 Service state diagram

The primitives provided by the call independent supplementary services support entity and the transitions between permitted states are shown in the service graph of figure 4.2/GSM 04.07 below.




STATES:
IDLE - No SS-signalling transaction pending
CONN - SS-signalling transaction established

Figure 4.2/GSM 04.07
Service graph of the call independent supplementary services support entity/Network side

### 4.2.2 Service Primitives

MNSS_BEGIN_REQ
Request to establish a signalling transaction for the provision of call independent supplementary services by sending a REGISTER message.

MNSS_BEGIN_IND
Indication of a signalling transaction for the provision of call independent supplementary services after receipt of a REGISTER message.

MNSS_FACILITY_REQ
Request to send a FACILITY message for the provision of a call independent supplementary service facility.

MNSS_FACILITY_IND
Indication that a supplementary service facility has been requested after receipt of a FACILITY message.

MNSS_END_REQ
Request to release the signalling transaction by sending a RELEASE COMPLETE message.

MNSS_END_IND
Indication that the signalling transaction has been released after receipt of a RELEASE COMPLETE message.

| PRIMITIVES | | PARAMETERS Info elements of message |
|---|---|---|
| GENERIC NAME | SPECIFIC NAME | |
| MNSS_BEGIN | REQ | REGISTER |
| | IND | REGISTER |
| MNSS_FACILITY | REQ | FACILITY |
| | IND | FACILITY |
| MNSS_END | REQ | RELEASE COMPLETE |
| | IND | RELEASE COMPLETE |

Table 4.2/GSM 04.07
Primitives and Parameters at MNSS-SAP/Network side

## 4.3 Short Message Services Support

### 4.3.1 Service state diagram

The primitives provided by the Short Messages Service Support entity and the transition between the allowed states are shown in Fig. 4.3/GSM 04.07 below.

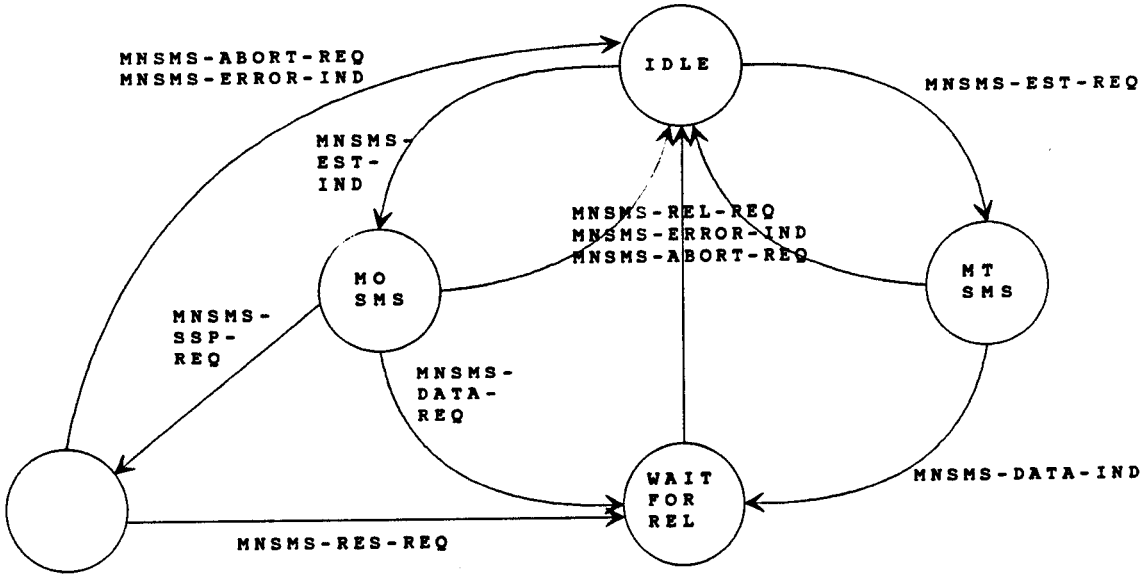



Figure 4.3/GSM 04.07
Service graph of the Short Messages Service Support entity
Network side

4.3.2 Service Primitives

MNSMS_EST_IND
Indicates a received SMS-message and implicates establishment of a SMS-connection.

MNSMS_EST_REQ
A request to establish a SMS-connection containing the SMS- message.

MNSMS_DATA_REQ
A request to return the acknowledgement, or an error indication, upon an earlier reception of an SMS-message.

MNSMS_DATA_IND
An indication of a received SMS-message, acknowledgement or error indication.

MNSMS_REL_REQ
A request to release the SMS-connection.

MNSMS_ERROR_IND
An indication with error information and implicates release of the SMS-connection.

MNSMS_ABORT_REQ
A request used to release the SMS-connection in abnormal cases.

MNSMS_SSP_REQ
Used by the short message relay entity to enable the release of the radio ressources during the time it takes to forward the message to the Service Centre, process it and return an acknowledge or an error indication to MSC.

MNSMS_RES_REQ
Used by the short message relay entity to resume operation on an earlier suspended CM-connection in order to forward the response from the Service Centre.

| PRIMITIVES | | PARAMETERS |
|---|---|---|
| GENERIC NAME | SPECIFIC NAME | |
| MNSMS_EST | REQ | SMS message |
| | IND | SMS message |
| MNSMS_DATA | REQ | SMS message |
| | IND | SMS message |
| MNSMS_REL | REQ | cause |
| MNSMS_ERROR | IND | cause |
| MNSMS_ABORT | REQ | cause |

Table 4.3/GSM 04.07
Primitives and Parameters at MNSMS-SAP/MS-side

# 5 Services assumed from signalling layers 1 and 2

The services provided by layer 2 are defined in detail in Recommendation GSM 04.05. A short summary is given below.

In addition, layer 1 communicates directly with layer 3 for information transfer related to channel management, and to measurement control. See section 5.5 below.

## 5.1 Priority

Messages from layer 3 can be sent with :

- no priority, i.e. the messages are sent in first-in-first- out order;
- priority, i.e. message with this indication is sent as early as possible by layer 2.

## 5.2 Unacknowledged information transfer

Transfer of unacknowledged information using the primitive

DL_UNIT_DATA_REQUEST/INDICATION.

## 5.3 Acknowledged information transfer

Transfer of information in multiframe acknowledged mode including :

- establishment of data link connection between L3 entities; - transfer of information in acknowledged mode;
- release of the data link connection.

The primitives associated with acknowledged information transfer are:

- DL_ESTABLISH_REQUEST/INDICATION/CONFIRM for establishment of acknowledged mode;
- DL_DATA_REQUEST/INDICATION for requesting the transmission of a message unit and for indicating the reception of a message unit;
- DL_SUSPEND_REQUEST/DL_RELEASE_CONFIRM for requesting and confirming the suspension of the acknowledged information transfer in the MS upon channel change;
- DL_RESUME_REQUEST/DL_ESTABLISH_CONFIRM for requesting and confirming the resumption of the acknowledged information transfer in the MS after suspension at channel change;
- DL_RELEASE_REQUEST/INDICATION/CONFIRM for the termination of acknowledged mode operation.
- DL_RECONNECT_REQUEST for rquesting the re-establishment of acknowledged information transfer in the MS on the old channel after channel change failure.

## 5.4 Random access

The transmission/reception of a random access burst is controlled by the primitives DL_RANDOM_ACCESS_REQUEST /INDICATION/CONFIRM.

## 5.5 Channel management and measurements

The management of channels, i.e. their activation, deactivation, configuration, deconfiguration, through- connection and disconnection is controlled by the RR- sublayer in layer 3. The measurements performed by the physical layer are also controlled by the RR-sublayer of layer 3 and they are reported to layer 3.
These functions use the primitives

MPH_INFORMATION_REQUEST/INDICATION/CONFIRMATION.

# 6 Interlayer service interfaces on the MS side

## 6.1 Services provided by the Radio Resource management entity

The Radio Resource (RR) management sublayer provides a service to the Mobility Management entity (MM).

The RR services are used for:

- establishing control channel connections;
- releasing control channel connections;
- control-data transfer.

The Radio Resource management services are represented by the RR-service primitives.

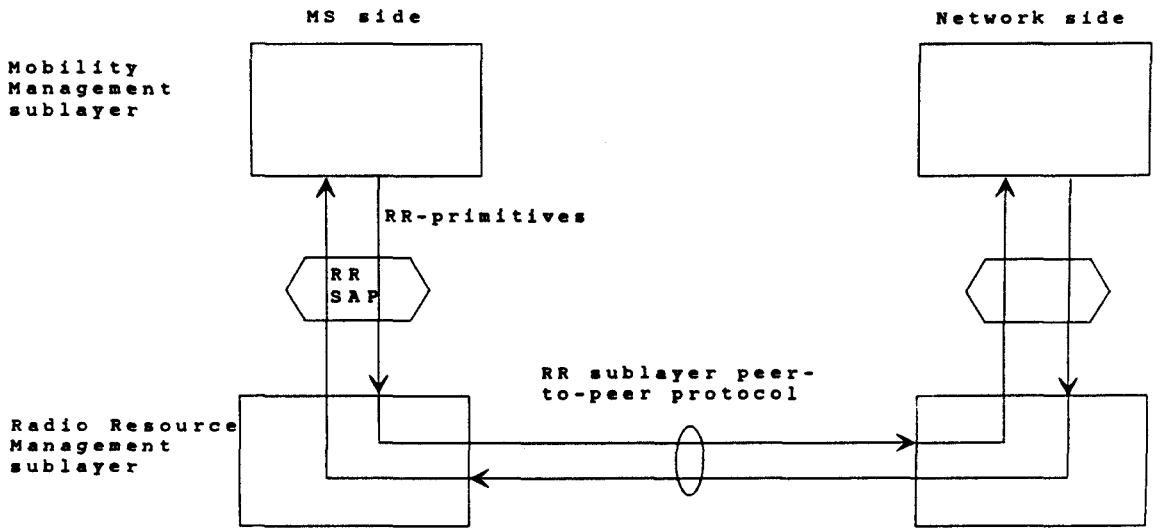



Figure 6.1/GSM 04.07
Services provided at RR-SAP/MS side

### 6.1.1 Service state diagram

The primitives provided by the Radio Resource management entity and the transition between permitted states are shown in Fig. 6.2/GSM 04.07.

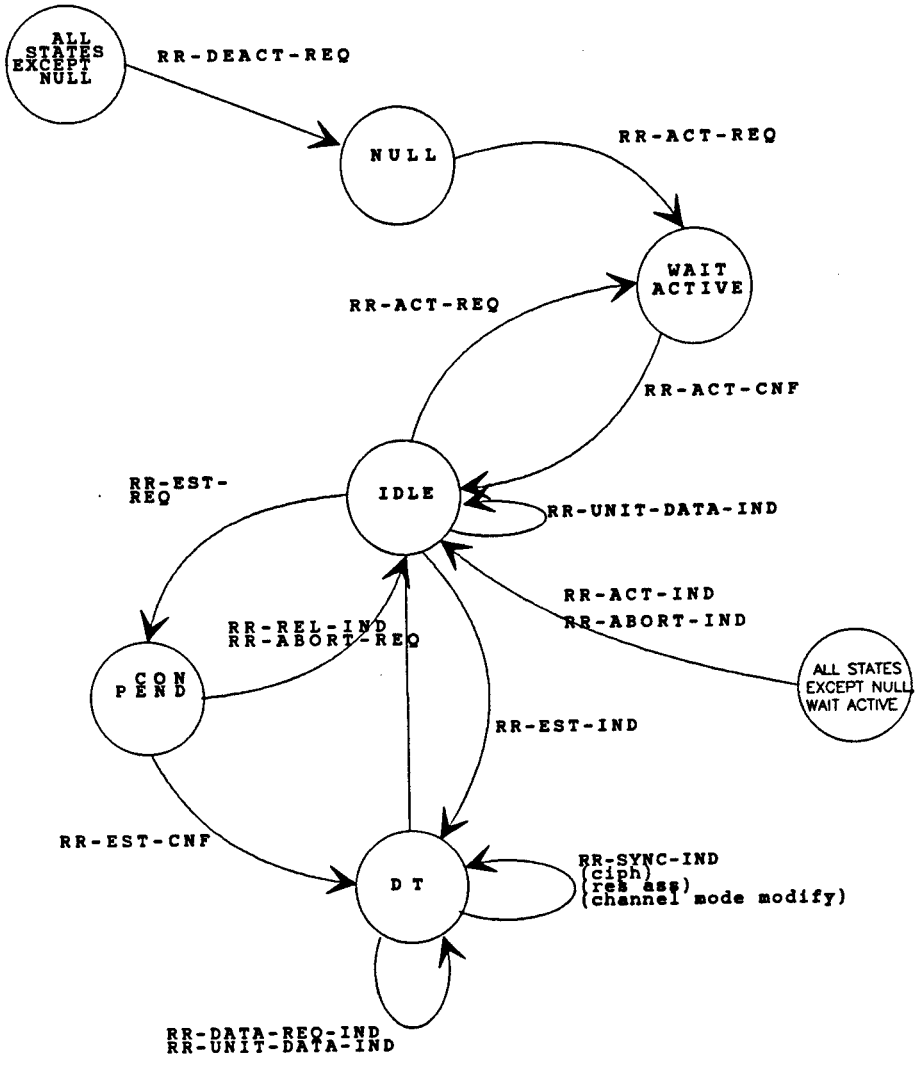



Figure 6.2/GSM 04.07
Service graph of the Radio Resource management MS side

### 6.1.2 Service primitives

RR_EST_REQ
Is used by the Mobility Management entity to request establishment of a Mobile originated RR-connection. This includes the immediate assign procedure to activate a new physical channel. The main DCCH as well as the establishment of a data link on that channel. The request shall be given only in the IDLE statewhen the MS listens to the CCCH and the previously selected BCCH.

RR_EST_CNF
Is used by RR to indicate the succesful completion of a Mobile originated RR-connection establishment. RR-connection exists and RR is in the dedicated mode.

RR_EST_IND
Indicates to the Mobility Management entity the establishment of a mobile terminated RR-connection. This includes all procedures such as paging, immediate assign procedures to activate a new physical channel (main DCCH) as well as the establishment of a data link on that channel. By this indication MM is informed that a transparent connection exisits and RR is in the dedicated mode.

RR_REL_IND
Is used by RR to indicate to the Mobility Management entity the release of a RR connection when RR has received a CHANNEL RELEASE from the network and has triggered a normal release of the data link layer. It is also used to indicate that a requested RR-connection cannot be established. In both cases RR returns to IDLE mode.

RR_SYNC_IND
Is used for synchronizing RR and the Mobility Management entityafter the establishment of a mobile originated as mobile terminated RR-connection. This indication is provided to MM in the following cases:
- ciphering has been started (ciph),
- a traffic channel has been assignedd (ress. ass.),
- the channel mode has been modified (ch. mode modify).

RR_DATA_REQ
Is used by the Mobility Management entity to send control data to its peer entity on the network side via an existing RR-connection.

RR_DATA_IND
Is used by RR to indicate control-data, which has been received from its peer entity on the network side via an existing RR-connection.

RR_UNIT_DATA_IND
Is used by RR to provide MM with system info. TThe system info is received on the current BCCH if RR is in the IDLE state. If a RR-connection has been established, the system info is received on the SACCH.

RR_ABORT_REQ
Request to abort an existing RR-connectioon or a RR-connection in progress. The data link, if already established, shall be released by a normal release procedure (DISC/UA) initiated by the Mobile Station. This is the only way the MS can trigger the release of a RR-connection in case of exceptional conditions. The RR returns to the IDLE state.

RR_ABORT_IND
Indication that the RR-connection has been aborted by a lower layer failure and RR has returned to the IDLE state.

RR_ACT_REQ
Request to select a BCCH with specific required by MM. The request is always given after power on, or it may be given during the selection process (WAIT ACTIVE state) or in the IDLE state if the characteristics required by MM have been changed.

RR_ACT_CNF
Confirmation given to MM, that a BCCH with the required characteristics has been selected. BCCH info is given to MM.

RR_ACT_IND
Indication that a new BCCH has been selected with the same characteristics as required for the previous BCCH. The new BCCH info is given to MM.

RR_DEACT_REQ
Request of the deactivation of the RR entity (and hence of the physical layer entities). Request to stop all RR procedures and to return to the NULL state. This request is passed to RR during the power off phase.

| PRIMITIVES | | PARAMETERS |
|---|---|---|
| GENERIC NAME | SPECIFIC NAME | |
| RR_EST | REQ | Layer 3 message Transferred in the SABM frame (not ciphered) |
| | CNF | — |
| | IND | — |
| RR_REL | IND | cause |
| RR_SYNC | IND | cause (ciphering res.ass ch. mode modify) |

Figure 6.1/GSM 04.07 (page 1 of 2)
Primitives and parameters at the RR-SAP/MS side

| PRIMITIVES | | PARAMETERS |
|---|---|---|
| GENERIC NAME | SPECIFIC NAME | |
| RR_DATA | REQ | Layer 3 message |
| | IND | Layer 3 message |
| RR_UNIT DATA | IND | Layer 3 message |
| RR_ABORT | REQ | cause |
| | IND | cause |
| RR_ACT | REQ | reselection mode |
| | CNF | BCCH information |
| | IND | BCCH information |
| RR_DEACT | REQ | -- |

Table 6.1/GSM 04.07 (page 2 of 2)
Primitives and Parameters at the RR-SAP/MS side

## 6.2 Services provided by the Mobility Management entity

The Mobility Management (MM) sublayer provides services to the Call Control (CC) entity, the Supplementary Services Support (SS) entity and the Short Message Service Support (SMS) entity.

The Mobility Management services primitives are discriminated by the MMCC, MMSS and MMSMS prefix.

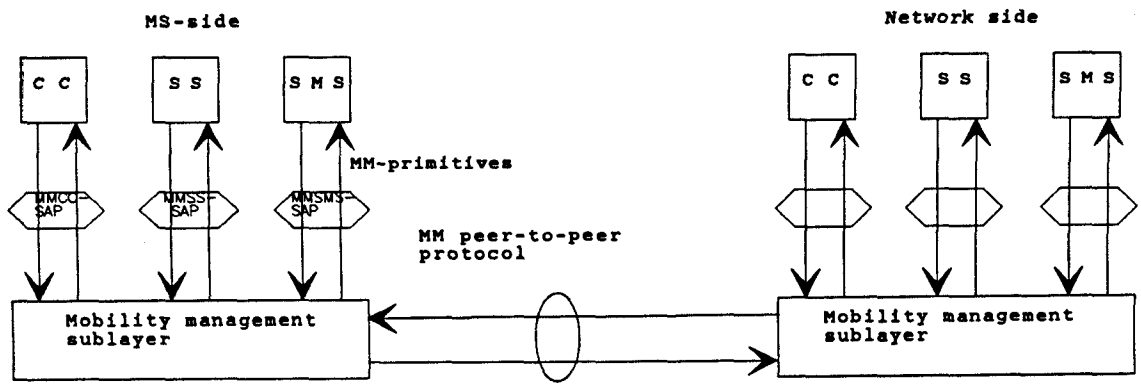



Figure 6.3/GSM 04.07
Services provided at the MMCC-SAP, MMSS-SAP, MMSMS-SAP
MS side

### 6.2.1 Service state diagram

The primitives provided by the Mobility Management entity towards Call Control, call independent Supplementary Service Support and towards Short Messages Service Support and the transition between permitted states are illustrated in Fig. 6.4/GSM 04.07 below.

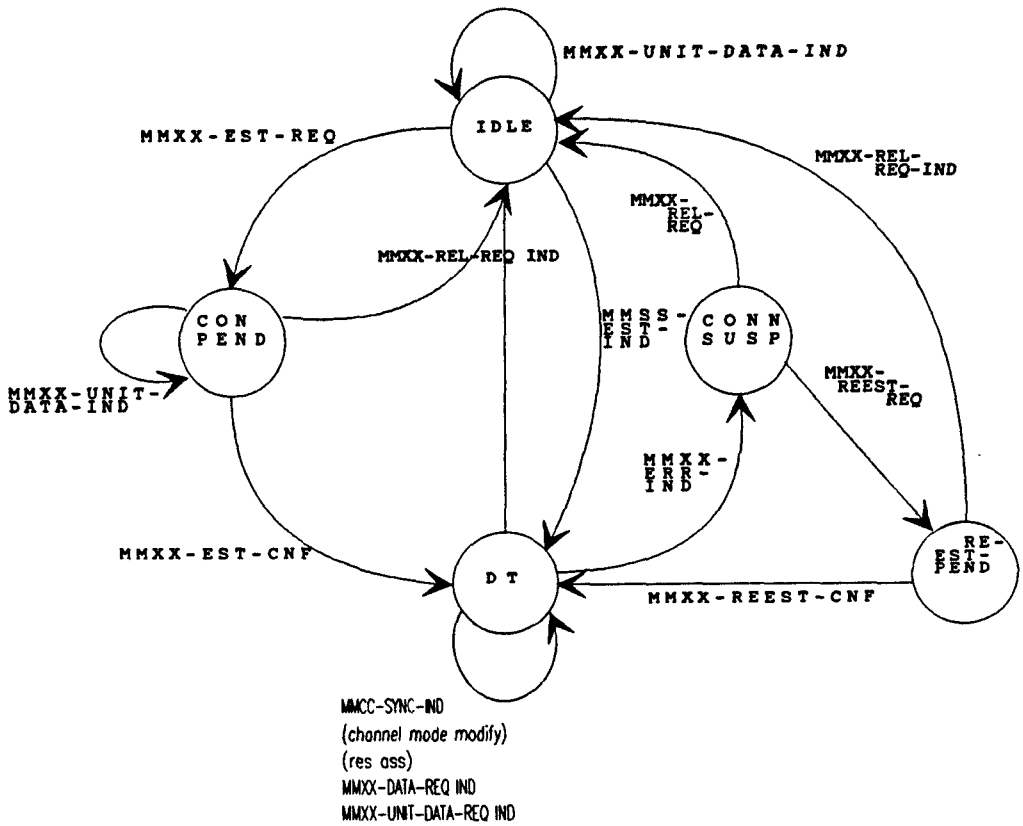



Figure 6.4/GSM 04.07
Service graph of the Mobility Management entity/MS side

Note: MMCC-primitives only at MMCC-SAP.

### 6.2.2 Service Primitives

Note: The prefix MMXX is used for substitution of MMCC, MMSS or MMSMS.

MMXX_EST_REQ
Request used by CC, SS and SMS respectively, to request establishment of a MM-connection. Several MM-connection may be provided in parallel to the requesting entities. The primitive may contain parameters which are relevant for the CM SERVICE REQUEST message, e.g. to distinguish a basic call from an emergency call.

MMXX_EST_CNF
Successful confirmation of the MM-connection establishment by the MM-sublayer to be given to the appropriate entity which has requested the service..

MMXX_EST_IND
Indication to CC, SS or SMS that aMobile terminated MM-connection has been establishedand the first message has been received from the respective peer entity. Several MM-connections may be provided in parallel. If a MM-connection already exxists, a new MM-connection using the same RR-connection is indicated by this primitive if MM detects a message with a new protoccol discriminator (PD) or with a new transaction identifier (TI) if the PD is already in use.

MMXX_REL_REQ
Used by CC, SS or SMS respectively, to request release of the MM-connection. The corresponding PD/TI will be released and may be used for a new MM-connection.

MMXX_REL_IND
Indication of the release of an existing MM-connection or a MM-connection in progress. This primitive is used in exceptional cases to indicate that the MM-connection cannot be established or kept any longer and PD/TI have been released.

MMXX_DATA_REQ
Request used by the CC, SS or SMS entities for acknowledged control-data transmission.

MMXX_DATA_IND
Indication used by MM to transfer the received acknowledged control-data to the CC, SS or SMS entities.

MMXX_UNIT_DATA_REQ
Request used by the CC, SS or SMS entities for unacknowledged control-data transmission.

MMXX_UNIT_DATA_IND
Indication used by MM to transfer the received unacknowledged control-data to the CC, SS or SMS entities.

MMCC_SYNC_IND
Indication that a dedicated channel assignment has been performed and/or the channel mode has been changed (only towards the CC-entity).

MMXX_REEST_REQ
Request to establish a MM-connection which has been interrupted by alower layer failure. The interruption must have been indicated by MMXX_ERR_IND.

MMXX_REEST_CNF
Confirmation of the successful reestablishment of tMM-connection. The MM-connection will continue with PD/TI as it had before.

MMXX_ERR_IND
Indication of a lower layer failure interrupting the MM- connection. The PD/TI are still kept by MM. In case of parallel transactionsthis indication is passed to all CM-entities for which a MM connection has been established. It is left to the decision of the appropriate CM-entity to either request the re-establishment of the MM-connection by MMXX_REEST_REQ or to release it by MMXX_REL_REQ.

| PRIMITIVES | | PARAMETERS |
|---|---|---|
| GENERIC NAME | SPECIFIC NAME | |
| MMXX_EST | REQ | Parameters for the appropriate CM SERVICE REQUEST (if any) |
| | CNF | -- |
| | IND | First CM message |
| MMXX_REL | REQ | cause |
| | IND | cause |
| MMXX_DATA | REQ | Layer 3 message |
| | IND | Layer 3 message |
| MMXX_UNIT_DATA | REQ | Layer 3 message |
| | IND | Layer 3 message |
| MMCC_SYNC | IND | cause: res.ass |
| MMXX_REEST | REQ | |
| | CNF | |
| MMXX_ERR | IND | cause |

Table 6.2/GSM 04.07
Primitives and Parameters at MMCC-SAP, MMSS-SAP or MMSMS-SAP
MS side

Note: MSXX is used as substitution for MMCC, MMSS or MMSMS

# 7 Interlayer service interfaces on the network side

## 7.1 Services provided by the Radio Resource Management entity

The Radio Resource (RR) management sublayer provides services to the Mobility Management entity (MM).

The RR services are used for:

- establishing control channel connections;
- establishing traffic channel connections;
- ciphering mode indication;
- releasing control channel connections;
- control-data transfer.

The Radio Resource management services are represented by the RR-service primitives.

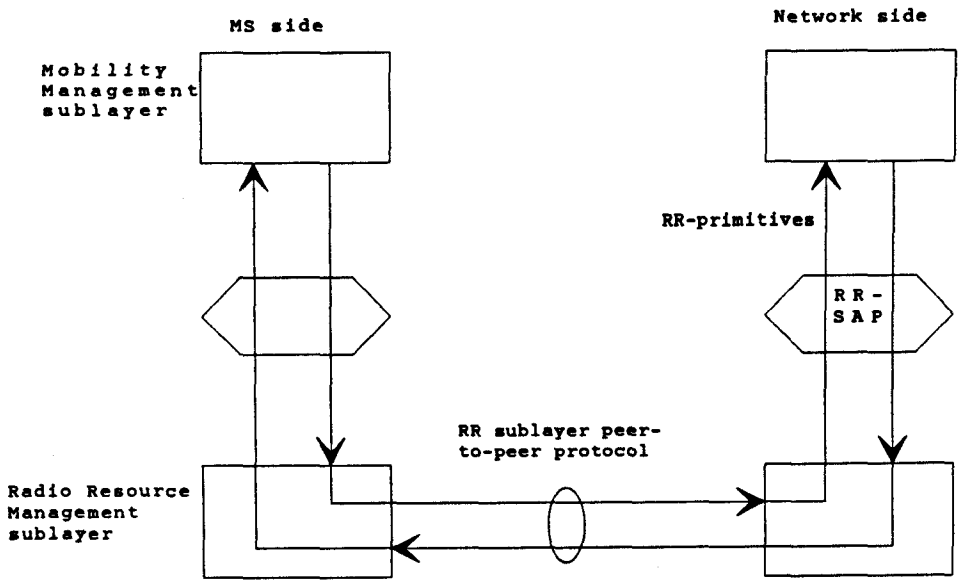
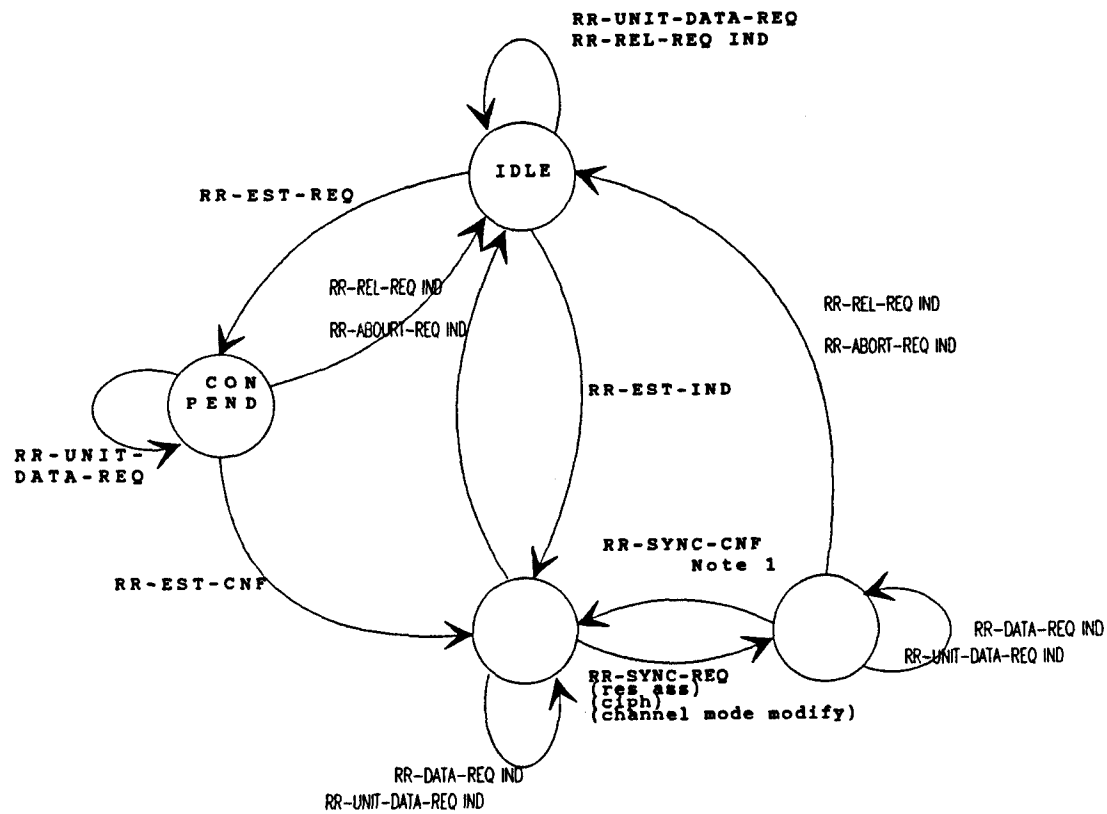



Figure 7.1/GSM 04.07
Services provided at RR-SAP/Network side

## 7.1.1 Service state diagram

The primitives provided by the Radio Resource management entity and the transition between permitted states are shown in Fig. 7.2/GSM 04.07 below.




STATES:
IDLE - No dedicated channel established.
CONPEND - Connection pending
DT1 - Data transfer 1, dedicated channel established.
DT2 - Data transfer 2, dedicated channel established, ciphering mode set

Figure 7.2/GSM 04.07
Service graph of the Radio Resource management entity/Network side

### 7.1.2 Service primitives

RR_EST_REQ
Request used by the Mobility Management entity to request establishment of control channel connections.

RR_EST_CNF
Confirmation used by RR to confirm the establishment of a requested control channel connection.

RR_EST_IND
Indication to the Mobility Management entity that the establishment of control channel connections has been done.

RR_REL_REQ
Request used by the Mobility Management to release a control channel connection.

RR_SYNC_REQ
Request used by the Mobility Management entity for synchronization with the RR protocol.

RR_SYNC_CNF
Confirmation used by RR that the requested synchronization is done.

RR_DATA_REQ
Request used by the Mobility Management entity for acknowledged control-data transmission.

RR_DATA_IND
Indication used by RR to transfer received control-data, which should be acknowledged, to the Mobility Management entity.

RR_UNIT_DATA_REQ
Request used by the Mobility Management entity for unacknowledged control-data transmission.

RR_UNIT_DATA_IND
Indication used by RR to transfer received control-data, which should not be acknowledged, to the Mobility Management entity.

RR_ABORT_REQ
Request of the abandon of the RR-connection.

RR_ABORT_IND
Indication that a radio link failure has occured.

| PRIMITIVES | | PARAMETERS |
|---|---|---|
| GENERIC NAME | SPECIFIC NAME | |
| RR_EST | REQ | Initial layer 3 message (not ciphered) |
| | CNF | — |
| | IND | Initial layer 3 message (not ciphered) |
| RR_REL | REQ | cause |
| | IND | cause |
| RR_SYNC | REQ | cause (resource assign, ciphering) |
| | CNF | cause (resource assign, cipher.) |
| RR_DATA | REC | Layer 3 message |
| | IND | Layer 3 message |
| RR_UNIT_DATA | REQ | Layer 3 message |
| | IND | Layer 3 message |
| RR_ABORT | REQ | cause |
| | IND | cause |

Table 7.1/GSM 04.07
Primitives and Parameters at the RR-SAP/Network side

## 7.2 Services provided by the Mobility Management entity

The Mobility Management (MM) sublayer provides services to the Call Control (CC) entity, the Supplementary Service Support (SS) entity and the Short Message Service Support (SMS) entity.

The Mobility Management services primitives are recognised by the MMCC, MMSS and MMSMS prefix.

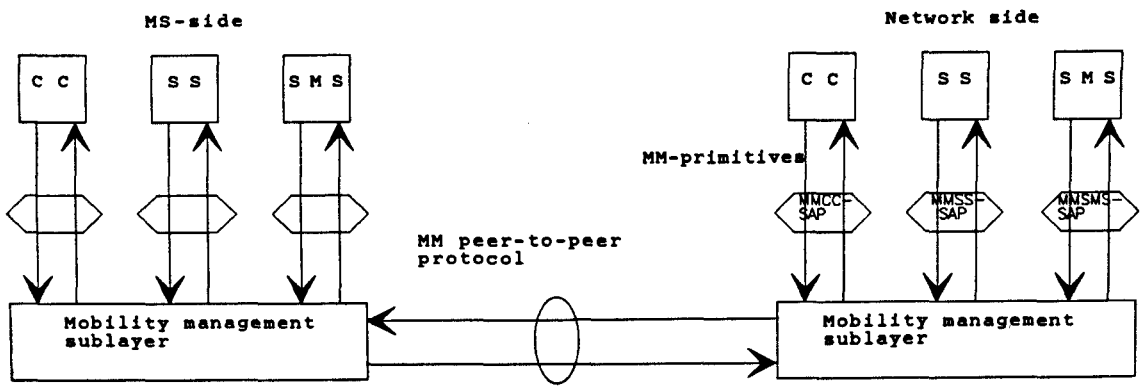



Figure 7.3/GSM 04.07
Services provided at MMCC-SAP, MMSS-SAP, MMSMS-SAP
Network side

## 7.2.1 Service state diagram

The primitives provided by the Mobility Management entity towards Call Control, Short Messages Service Support and call independent Supplementary Services Support as well as the transition between permitted states are illustrated in figure 7.4. The prefix MMXX is used for substitution of MMCC, MMSS or MMSMS.

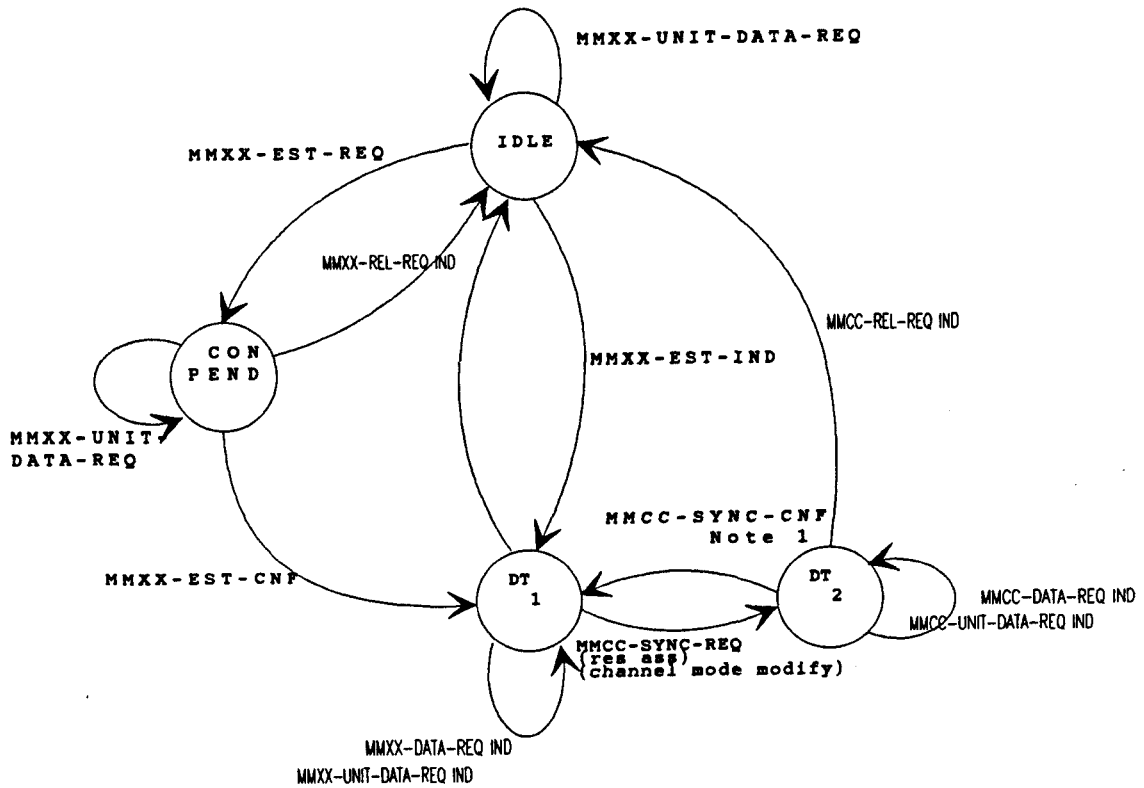



Figure 7.4/GSM 04.07
Service graph of the Mobility Management entity, towards Call Control/Network side

Note 1: the parameters in RR-SYNC-CNF must correspond to the parameter in RR-SYNC-REQ
Note 2: MMCC-primitives only at MMCC-SAP

### 7.2.2 Service Primitives

Note: The prefix MMXX is used for substitution of MMCC, MMSS or MMSMS.

MMXX_EST_REQ
Request by CC, SS and SMS respectively, for the establishment of a MM-connection.

MMXX_EST_CNF
Confirmation of the MM-connection establishment by the MM- sublayer.

MMXX_EST_IND
Indication by the MM sublayer that a MM-connection is established.

MMXX_REL_REQ
Request by CC, SS or SMS respectively, for the release of the MM-connection.

MMXX_REL_IND
Indication by the MM sublayer that a MM-connection has been released.

MMXX_DATA_REQ
Request by the CC, SS or SMS entities for acknowledged control-data transmission.

MMXX_DATA_IND
Indication used by MM to transfer the received acknowledged control-data to the CC, SS or SMS entities.

MMXX_UNIT_DATA_REQ
Request used by the CC, SS or SMS entities for unacknowledged control-data transmission.

MMXX_UNIT_DATA_IND
Indication used by MM to transfer the received unacknowledged control-data to the CC, SS or SMS entities.

The following primitives are used only at MMCC-SAP:

MMCC_SYNC_REQ
Request used by the CC entity to synchronize with the MM entity. (resource assign)

MMCC_SYNC_CNF
Confirmation used by the MM to inform the CC entity that synchronization is completed. (resource assign)

| PRIMITIVES | | PARAMETERS |
|---|---|---|
| GENERIC NAME 1) | SPECIFIC NAME | |
| MMXX_EST | REQ | Mobile ID |
| | CNF | — |
| | IND | First CM-message |
| MMXX_REL | REQ | cause |
| | IND | cause |
| MMXX_DATA | REQ | Layer 3 message |
| | IND | Layer 3 message |
| MMXX_UNIT_DATA | REQ | Layer 3 message |
| | IND | Layer 3 message |
| MMCC_SYNC | REQ | cause (resource assign) 2) |
| | CNF | cause (resource assign) 2) |

Table 7.2/GSM 04.07
Primitives and Parameters at MMCC-SAP, MMSS-SAP, MMSMS-SAP
Network side

Note 1: MMXX is used as substitution for MMCC, MMSS or MMSMS

Note 2: Only at MMCC-SAP

# 8 Functions provided by Layer 3 entities

## 8.1 Functions provided by the Radio Resource Management Entity (RR)

The Radio Resource Management (RR) entity contains elementary procedures for radio management e.g. establishing and maintaining physical channels. That includes Handover (cell change) upon request by the network.

The elementary procedures in the RR-sublayer are specified in Rec. GSM 04.08.

## 8.2 Functions provided by Mobility Management Entity (MM)

In this sublayer necessary functions to support the mobility of mobile users. The purpose of these functions are to inform the network when the mobile is activated and deactivated or it is changing a location area. It takes care also of the security aspects that are related to the open radio path.

The elementary procedures in the MM-sublayer are specified in Rec. GSM 04.08.

## 8.3 Functions provided by the Call Control Entity (CC)

The functions within this entity are necessary for establishment and clearing of mobile originated and terminated circuit-switched calls.

The elementary procedures in the CC-sublayer are specified in Rec. GSM 04.08.

## 8.4 Functions provided by the Supplementary Services Support Entity (SS)

The functions within this entity concern the administration of calls, such as e.g. call forwarding and charging.

The elementary procedures in the SS entity are specified in Rec. GSM 04.10.

## 8.5 Functions provided by the Short Message Service Support Entity (SMS)

The functions within this sublayer are for further studies, but are supposed to handle packet-oriented user information, transferred on the control channel.

This entity contains the functions to relay a short message between the MS and MSC (and vice versa) across the radio path. The functions and procedures are defined in detail in Recommendation GSM 04.11.

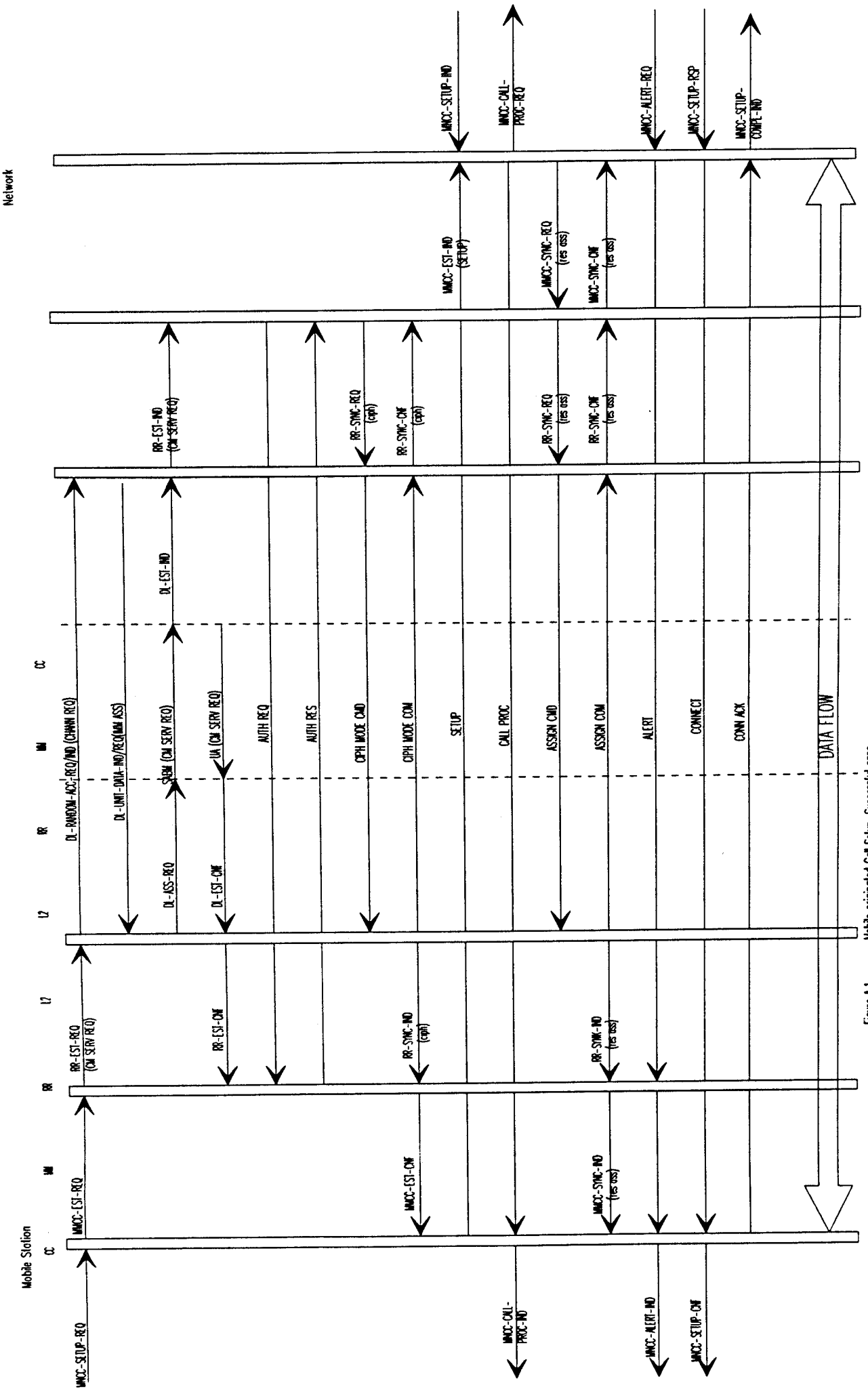



Figure A1 Mobile originated Call Setup. Successful case.

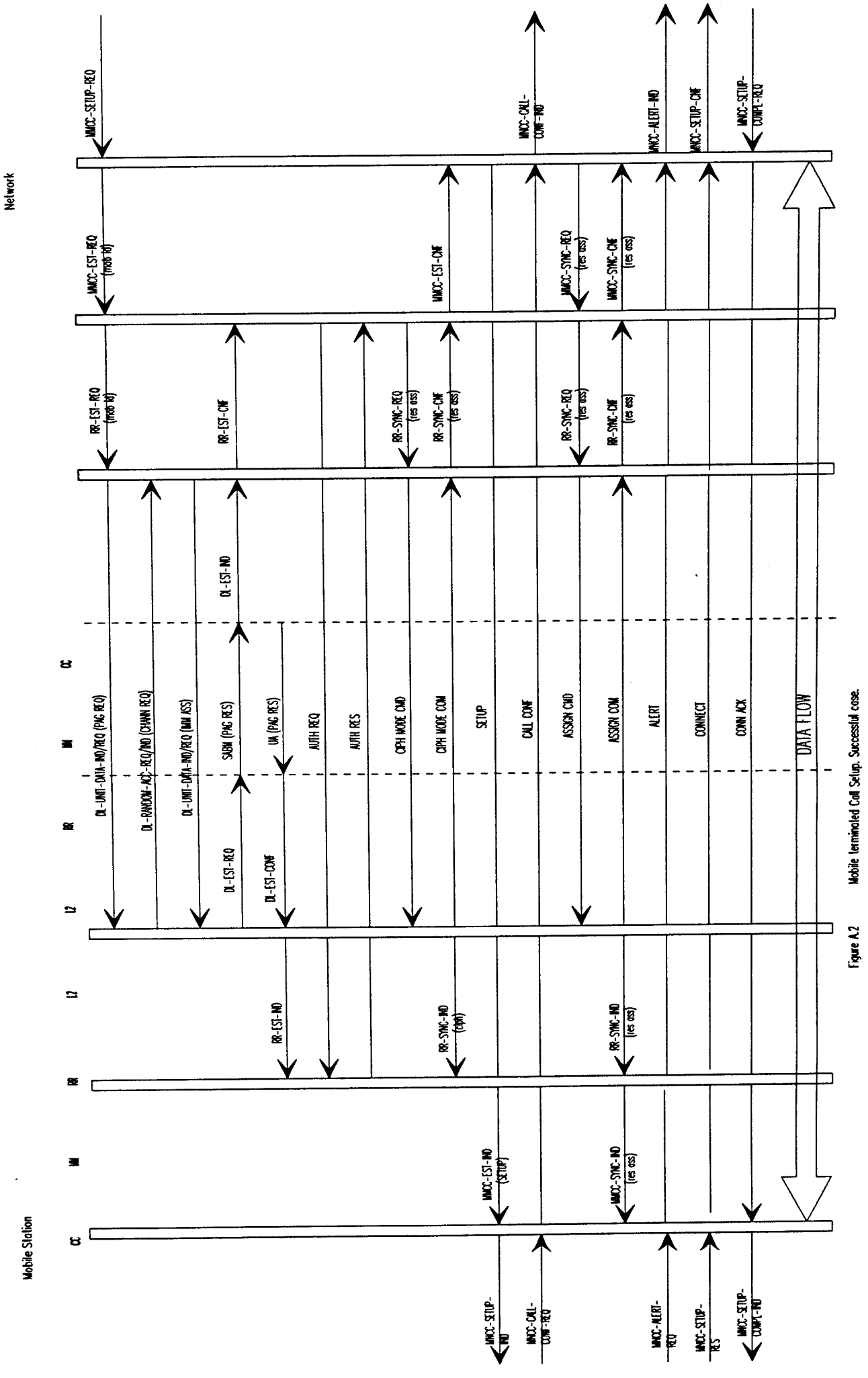



Figure A.2 Mobile terminated Call Setup. Successful case.

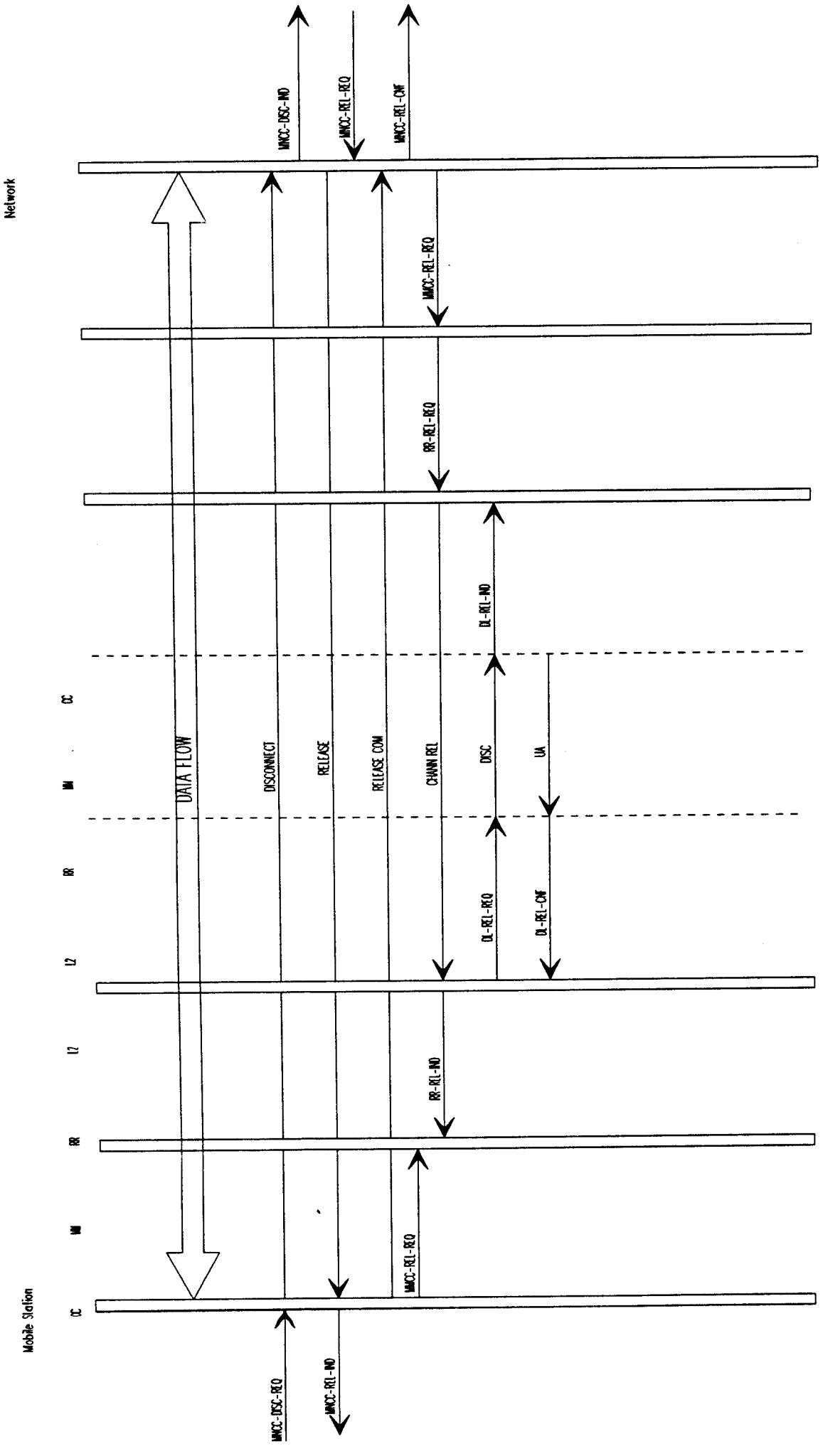



Figure A.3 Mobile Originating, Call Release & Channel Release Successful case

Mobile Station

Network

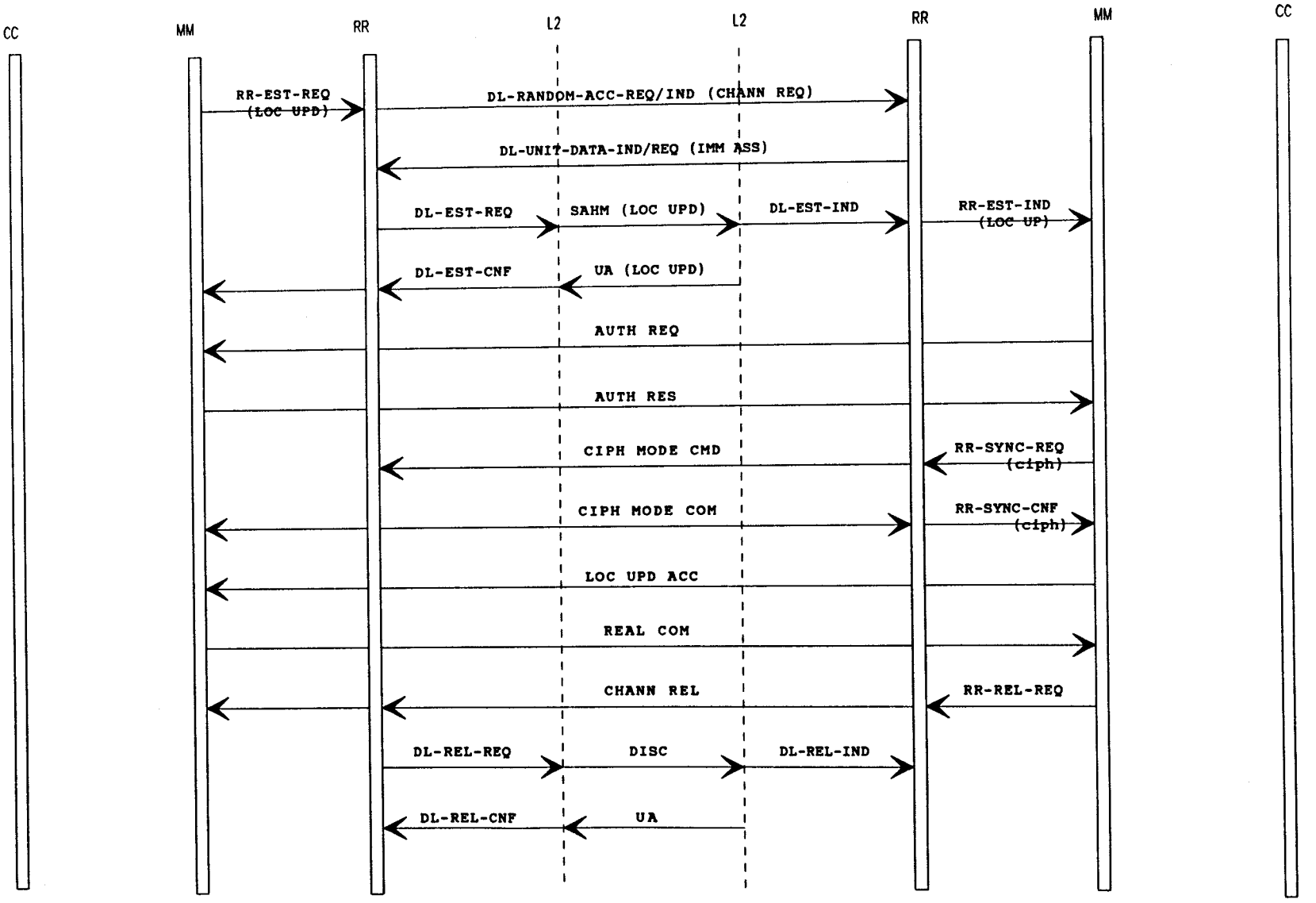



Figure A.4 Location updating. Successful case.

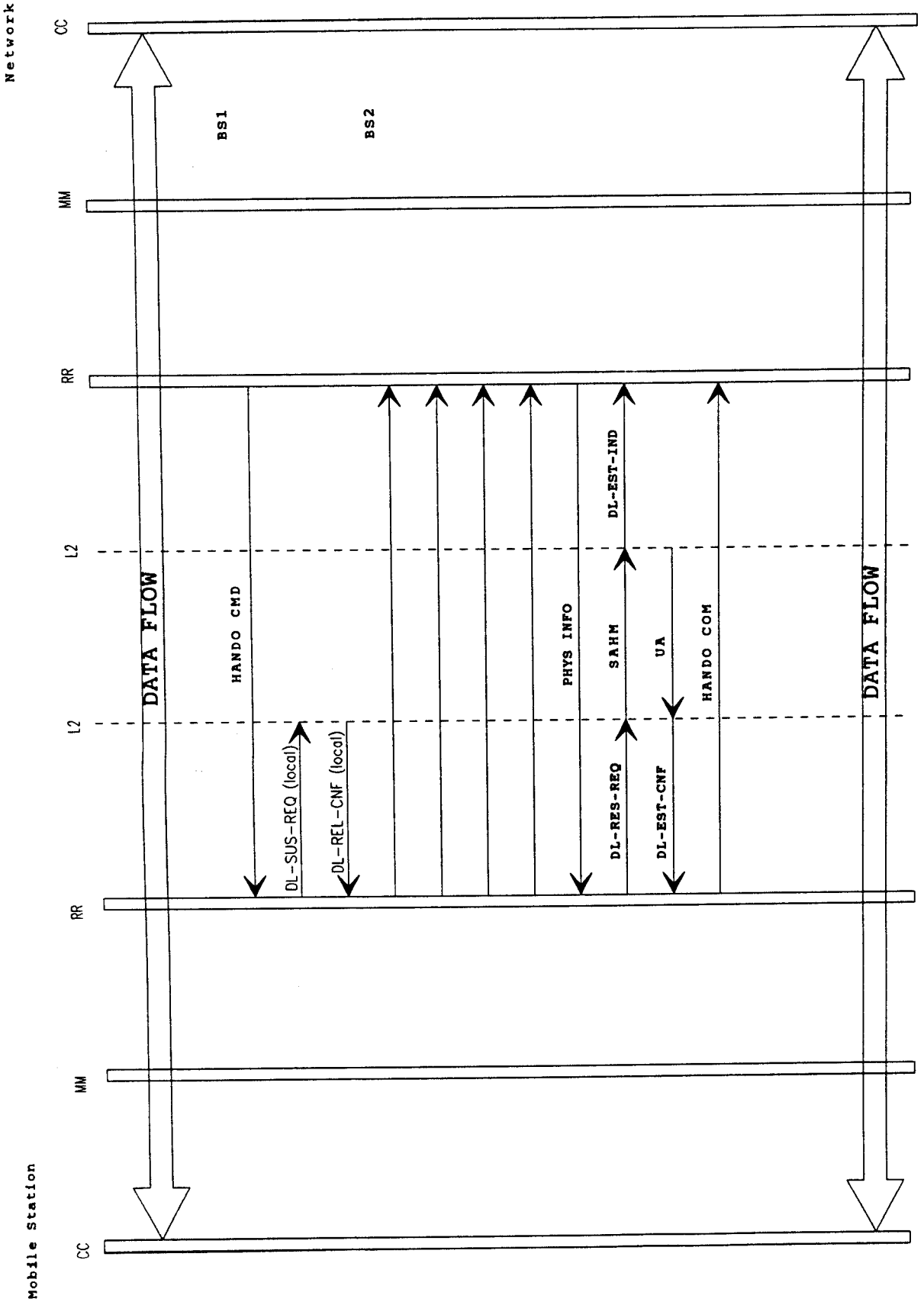



Figure A.5 Handover. Successful case.

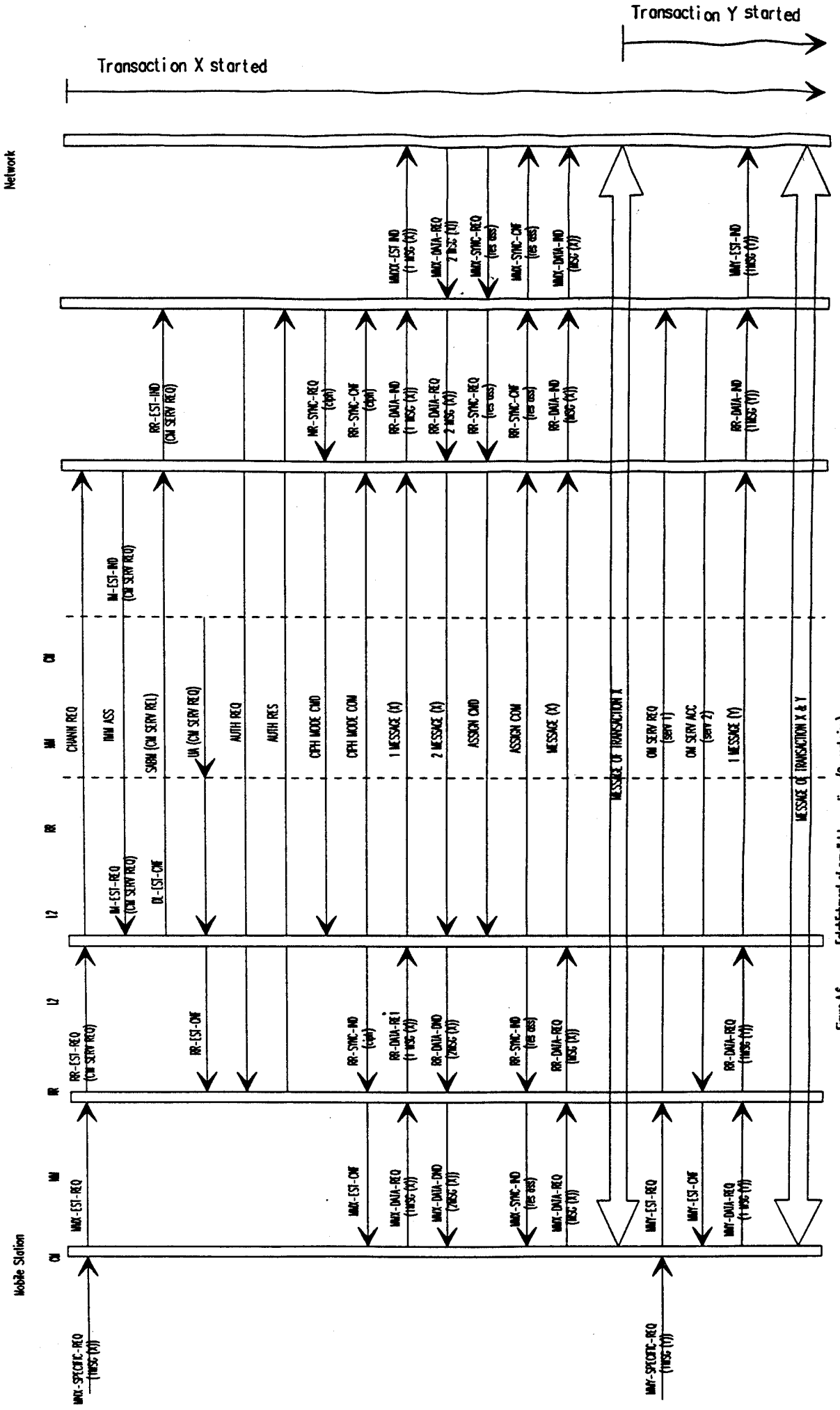



Figure A.6 Establishment of parallel transactions (General view)

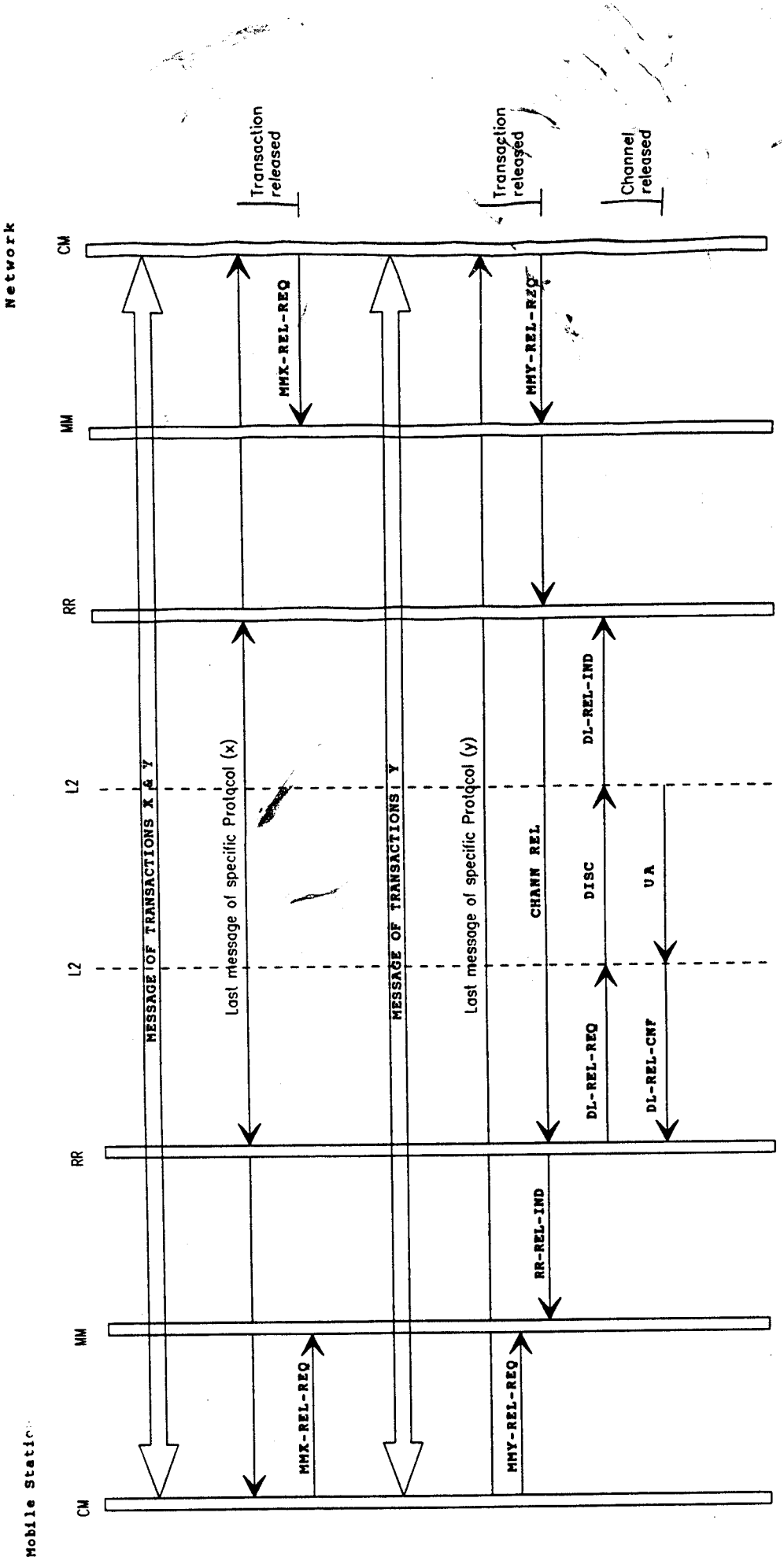



Figure A.7 Release of parallel transactions (General view)