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Technical Specification

**GEO-Mobile Radio Interface Specifications;
Part 4: Radio interface protocol specifications;
Sub-part 6: Mobile Radio Interface Signalling Layer 3;
General Aspects;
GMR-2 04.007**

ETSI

Reference
DTS/SES-002-04007

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IPRs:

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TS 101 377 V1.1.1	Digital Voice Systems Inc		US	US 5,715,365	US
TS 101 377 V1.1.1	Digital Voice Systems Inc		US	US 5,754,974	US
TS 101 377 V1.1.1	Digital Voice Systems Inc		US	US 5,226,084	US
TS 101 377 V1.1.1	Digital Voice Systems Inc		US	US 5,701,390	US
TS 101 377 V1.1.1	Digital Voice Systems Inc		US	US 5,826,222	US

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Project	Company	Title	Country of Origin	Patent n°	Countries Applicable
TS 101 377 V1.1.1	Ericsson Mobile Communication	Improvements in, or in relation to, equalisers	GB	GB 2 215 567	GB
TS 101 377 V1.1.1	Ericsson Mobile Communication	Power Booster	GB	GB 2 251 768	GB
TS 101 377 V1.1.1	Ericsson Mobile Communication	Receiver Gain	GB	GB 2 233 846	GB
TS 101 377 V1.1.1	Ericsson Mobile Communication	Transmitter Power Control for Radio Telephone System	GB	GB 2 233 517	GB

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Project	Company	Title	Country of Origin	Patent n°	Countries Applicable
TS 101 377 V1.1.1	Hughes Network Systems		US	Pending	US

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Project	Company	Title	Country of Origin	Patent n°	Countries Applicable
TS 101 377 V1.1.1	Lockheed Martin Global Telecommunic. Inc	2.4-to-3 KBPS Rate Adaptation Apparatus for Use in Narrowband Data and Facsimile Communication Systems	US	US 6,108,348	US
TS 101 377 V1.1.1	Lockheed Martin Global Telecommunic. Inc	Cellular Spacecraft TDMA Communications System with Call Interrupt Coding System for Maximizing Traffic ThroughputCellular Spacecraft TDMA Communications System with Call Interrupt Coding System for Maximizing Traffic Throughput	US	US 5,717,686	US
TS 101 377 V1.1.1	Lockheed Martin Global Telecommunic. Inc	Enhanced Access Burst for Random Access Channels in TDMA Mobile Satellite System	US	US 5,875,182	
TS 101 377 V1.1.1	Lockheed Martin Global Telecommunic. Inc	Spacecraft Cellular Communication System	US	US 5,974,314	US
TS 101 377 V1.1.1	Lockheed Martin Global Telecommunic. Inc	Spacecraft Cellular Communication System	US	US 5,974,315	US
TS 101 377 V1.1.1	Lockheed Martin Global Telecommunic. Inc	Spacecraft Cellular Communication System with Mutual Offset High-argin Forward Control Signals	US	US 6,072,985	US
TS 101 377 V1.1.1	Lockheed Martin Global Telecommunic. Inc	Spacecraft Cellular Communication System with Spot Beam Pairing for Reduced Updates	US	US 6,118,998	US

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Satellite Earth Stations and Systems (SES).

The contents of the present document are subject to continuing work within TC-SES and may change following formal TC-SES approval. Should TC-SES modify the contents of the present document it will then be republished by ETSI with an identifying change of release date and an increase in version number as follows:

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The present document is part 4, sub-part 6 of a multi-part deliverable covering the GEO-Mobile Radio Interface Specifications, as identified below:

Part 1:	"General specifications";

Part 2:	"Service specifications";

Part 3:	"Network specifications";

**Part 4:	"Radio interface protocol specifications";**

   Sub-part 1:	"GMR-2 Mobile Earth Station-Network Interface; General Aspects and Principles; GMR-2 04.001";

   Sub-part 2:	"GMR-2 Mobile Earth Station-Network Interface; Channel Structures and Access capabilities; GMR-2 04.003";

   Sub-part 3:	"Layer 1 General requirements; GMR-2 04.004";

   Sub-part 4:	"Data Link Layer General Aspects; GMR-2 04.005";

   Sub-part 5:	"GMR-2 Mobile Earth Station - Network Interface; Data Link (DL) layer Specifications; GMR-2 04.006";

   **Sub-part 6:	"Mobile Radio Interface Signalling Layer 3; General Aspects; GMR-2 04.007";**

   Sub-part 7:	"Mobile radio interface Layer 3 Specifications; GMR-2 04.008";

   Sub-part 8:	"Point-to-Point Short Message Services; GMR-2 04.011";

   Sub-part 9:	"Performance requirements on the mobile radio interface; GMR-2 04.013";

   Sub-part 10:	"Rate Adaptation on the Mobile Earth Station (MES) - Gateway System Interface; GMR-2 04.021";

   Sub-part 11:	"Call Waiting (CW) and Call Holding (HOLD) Supplementary Services; GMR-2 04.083";

   Sub-part 12:	"Multiparty Supplementary Services (MPTY); GMR-2 04.084";

   Sub-part 13:	"Technical Realisation of the Early Flag Technique; GMR-2 04.201";

   Sub-part 14:	"Call Barring Supplementary Services; GMR-2 02.088";

Part 5:	"Radio interface physical layer specifications";

Part 6:	"Speech coding specifications".

Introduction

GMR stands for GEO (Geostationary Earth Orbit) Mobile Radio interface, which is used for mobile satellite services (MSS) utilizing geostationary satellite(s). GMR is derived from the terrestrial digital cellular standard GSM and supports access to GSM core networks.

Due to the differences between terrestrial and satellite channels, some modifications to the GSM standard are necessary. Some GSM specifications are directly applicable, whereas others are applicable with modifications. Similarly, some GSM specifications do not apply, while some GMR specifications have no corresponding GSM specification.

Since GMR is derived from GSM, the organization of the GMR specifications closely follows that of GSM. The GMR numbers have been designed to correspond to the GSM numbering system. All GMR specifications are allocated a unique GMR number as follows:

GMR-n xx.zyy

where :

> xx.0yy (z=0) is used for GMR specifications that have a corresponding GSM specification. In this case, the numbers xx and yy correspond to the GSM numbering scheme.

> xx.2yy (z=2) is used for GMR specifications that do not correspond to a GSM specification. In this case, only the number xx corresponds to the GSM numbering scheme and the number yy is allocated by GMR.

> n denotes the first (n=1) or second (n=2) family of GMR specifications.

A GMR system is defined by the combination of a family of GMR specifications and GSM specifications as follows:

- If a GMR specification exists it takes precedence over the corresponding GSM specification (if any). This precedence rule applies to any references in the corresponding GSM specifications.

  NOTE: Any references to GSM specifications within the GMR specifications are not subject to this precedence rule. For example, a GMR specification may contain specific references to the corresponding GSM specification.

- If a GMR specification does not exist the corresponding GSM specification may or may not apply. The applicability of the GSM specifications are defined in GMR-n 01.201.

1   Scope

The present document defines the architecture of layer 3 and its sublayers on the GMR-2 Um interface, i.e., the interface between the Mobile Earth Station (MES) and the Network. It also defines the basic message format and error handling applied by the layer 3 protocols.

The corresponding protocols are defined elsewhere as follows:

1) The Radio Resource (RR) management protocol is defined in GMR-2 04.008 [5];

2) The Mobility Management (MM) protocol is defined in GMR-2 04.008 [5];

3) The Call Control (CC) protocol is defined in GMR-2 04.008 [5];

4) The Supplementary Services (SS) protocol is defined in GSM 04.10 [6], GSM 04.8x and GSM 04.9x;

5) The Short Message Service (SMS) protocol is defined in GSM 04.11 [7].

The communication between sublayers and adjacent layers and the services provided by the sublayers are distributed by use of abstract service primitives. But only externally observable behaviour resulting from the description is normatively prescribed by the present document.

2   References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, subsequent revisions do apply.

[1]   GMR-2 01.004 (ETSI TS 101 377-1-1): "GEO-Mobile Radio Interface Specifications; Part 1: General specifications; Sub-part 1: Abbreviations and Acronyms; GMR-2 01.004".

[2]   GMR-2 04.001 (ETSI TS 101 377-4-1): "GEO-Mobile Radio Interface Specifications; Part 4: Radio interface protocol specifications; Sub-part 1: GMR-2 Mobile Earth Station-Network Interface; General Aspects and Principles; GMR-2 04.001".

[3]   GMR-2 04.005 (ETSI TS 101 377-4-4): "GEO-Mobile Radio Interface Specifications; Part 4: Radio interface protocol specifications; Sub-part 4: Data Link Layer General Aspects; GMR-2 04.005".

[4]   GMR-2 04.006 (ETSI TS 101 377-4-5): "GEO-Mobile Radio Interface Specifications; Part 4: Radio interface protocol specifications; Sub-part 5: GMR-2 Mobile Earth Station - Network Interface; Data Link (DL) layer Specifications; GMR-2 04.006".

[5]   GMR-2 04.008 (ETSI TS 101 377-4-7): "GEO-Mobile Radio Interface Specifications; Part 4: Radio interface protocol specifications; Sub-part 7: Mobile radio interface Layer 3 Specifications; GMR-2 04.008".

[6]   GSM 04.10 (ETSI ETS 300 558 Edition 2): "Digital cellular telecommunications system (Phase 2); Mobile radio interface layer 3; Supplementary services specification; General aspects (GSM 04.10 version 4.10.1)".

[7]   GSM 04.11 (ETSI ETS 300 559 Edition 4): "Digital cellular telecommunications system (Phase 2); Point-to-Point (PP) Short Message Service (SMS) support on mobile radio interface (GSM 04.11 version 4.10.0)".

[8]   GSM 11.10 (ETSI ETS 300 607): "Digital cellular telecommunications system (Phase 2); Mobile Station (MS) conformance specification; Part 1: Conformance specification; (GSM 11.10-1 version 4.28.1)".

[9]   ITU-T Recommendation X.200: "Information technology - Open Systems Interconnection - Basic reference model: The basic model".

3   Abbreviations

For the purposes of the present document, the abbreviations listed in GMR-2 01.004 [1] apply.

4   Introduction

4.1   General

The signalling layer 3 provides the functions to establish, maintain and terminate circuit-switched connections across the GMR Network and with other networks to which the GMR Network is connected. It provides the necessary supporting functions related to supplementary services control and short message 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 GMR-2 04.008 [5], GSM 04.10 [6] and GSM 04.11 [7].

The layer 3 is composed of three sublayers comprising:

1)   The Radio Resource Management (RR) functions;

2)   The Mobility Management (MM) functions; and

3)   The Connection Management (CM) functions.

The Connection Management (CM) sublayer is composed of:

1)   Call Control (CC);

2)   Short Message Service Support (SMS); and

3)   Supplementary Services Support (SS).

4.2   Objectives

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

1)   The establishment, operation and release of a dedicated radio channel connection (RR);

2)   Establishment, maintenance and termination of circuit-switched calls (CC);

3)   Supplementary services support (SS);

4)   Short message service support (SMS).

4.3 General Characteristics

4.3.1 Technique of Description

The signalling layer 3 is described in terms of:

1) Services provided by the signalling layer 3;

2) Services assumed from the signalling layer 2;

3) 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 MES side and the Network side of the radio interface as viewed by the MES. The present document does not consider the distribution of signalling functions among the different items of network equipment. 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 data link layer 2 are described by means of primitives and parameters as recommended in ITU-T Recommendation X.200 [9].

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

4.3.2 Primitives

The services provided by the various sublayers are described in the present document. 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 GMR-2 04.001 [2].

4.3.3 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.

4.3.4 Contents of Signalling Layer 3 Related Technical Specifications

GMR-2 04.008 [5] specifies the protocols for Call Control, Mobility Management and Radio Resource Management.

GSM 04.10 [6] specifies the protocols for Supplementary Service Support.

GSM 04.11 [7] specifies the protocols for Short Message Service Support.

5 Structure of Signalling Layer 3 Functions

5.1 Basic Groups of Functions

Signalling Layer 3 comprises the following groups of signalling functions:

1) Call Control (CC);

2) Short Message Service Support (SMS);

3) Supplementary Services Support (SS);

4) Mobility Management (MM);

5) Radio Resource Management (RR).

These functional groups are realized by separate protocol control entities.

In addition, other functions are contained in layer 2 which are related to the transport of messages, e.g., multiplexing and splitting. Those functions are defined in the Radio Resource Management and Mobility Management. They have the task to route the messages according 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 (SAP) 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 split by the RR routing function according to the protocol discriminator. Messages with a PD equal to RR are passed to the RR entity of the 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 according to the protocol discriminator and the transaction identifier towards the MM entity or towards the CM entities via the various MM-SAPs. 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.

5.2 Protocol Architecture

As shown in figure 5.1, a hierarchy of three sublayers is defined as follows:

1) The RR sublayer provides services to the MM sublayer and utilizes the services of signalling layer 2;

2) The MM sublayer provides common services to the entities of the Connection Management (CM) sublayer;

3) The CM sublayer includes the CC, SS and SMS entities, which are independent entities.
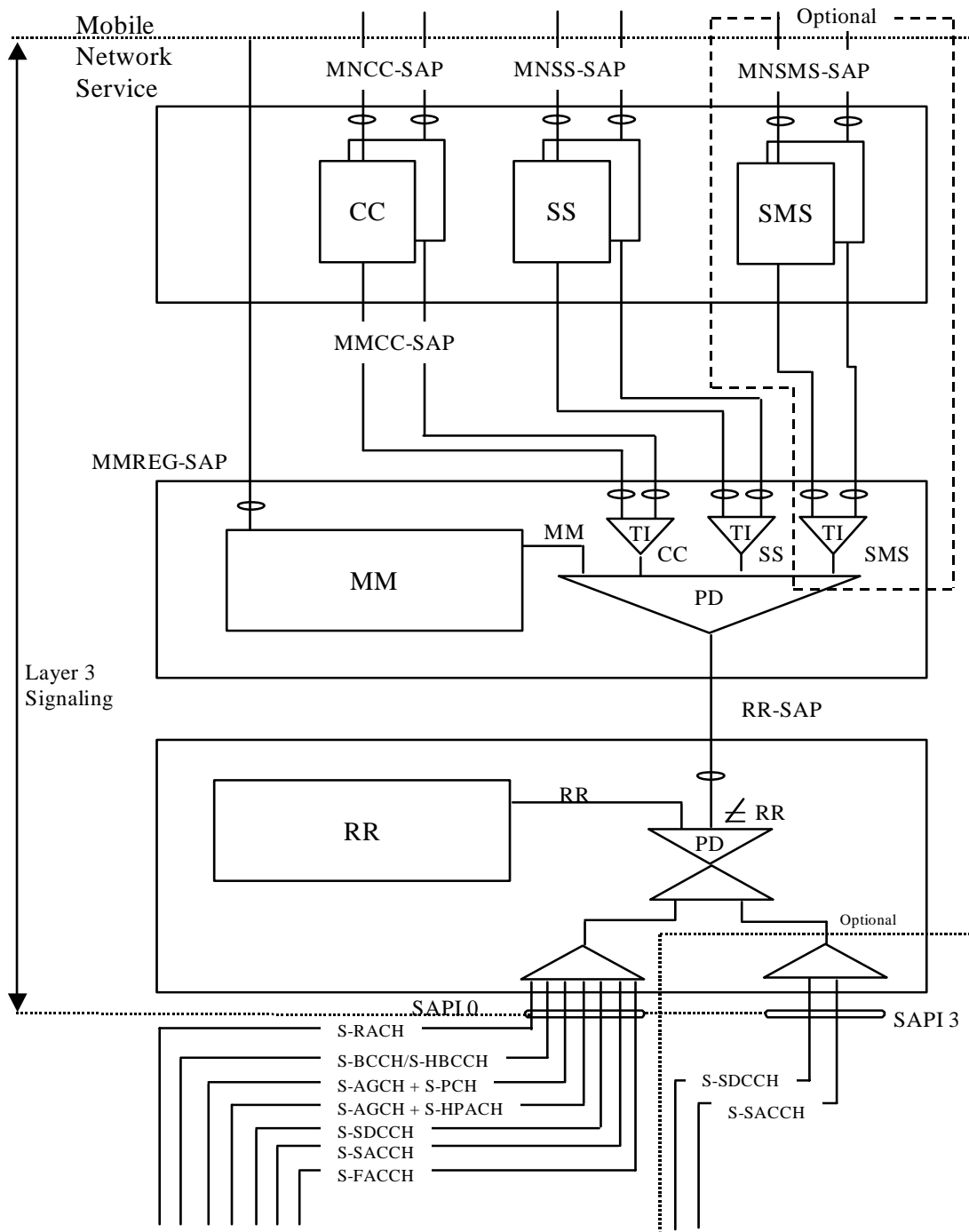
Figure 5.1: Hierarchy of Sublayers in Signalling Layer 3

6 Services Provided by Signalling Layer 3 at the MES Side

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

1) Registration services at the MMREG-SAP;

2) Call Control services for normal and emergency calls including call-related Supplementary Services Support services at the MNCC-SAP;

3) Short Message Service Support services at the MNSMS-SAP;

4) Call-independent Supplementary Services Support services at the MNSS-SAP.

6.1 Registration Services

The registration services (location updating, International Mobile Subscriber Identifier (lMSl) attach/detach) are provided at the service access point MMREG-SAP. As opposed to all other MN services, these services are provided by, and can be directly accessed at, the Mobility Management sublayer.

6.1.1 Service State Diagram

The registration services provided at the service access point MMREG-SAP are illustrated in the state diagrams of figure 6.1.
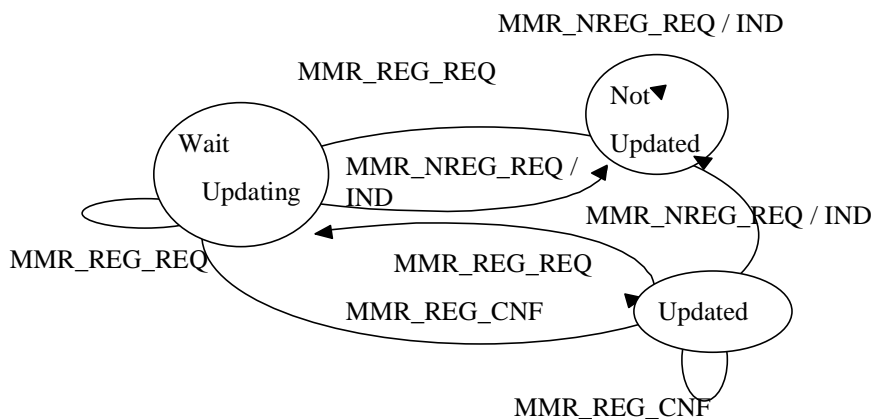
Figure 6.1: Registration Services Provided at MMREG-SAP - MES Side

6.1.2   Service Primitives

Table 6.1: Primitives and Parameters at the MMREG-SAP – MES Side

PRIMITIVE	PARAMETER	REFERENCE
MMR_REQ_REQ	IMSI	Clause 6.1.2.1
MMR_REG_CNF	-	Clause 6.1.2.2
MMR_NREG_REQ	-	Clause 6.1.2.4
MMR_NREG_IND	cause	Clause 6.1.2.5

6.1.2.1   MMR_REG_REQ

Registration request, triggered by activation of the IMSI, e.g., by activation of the MES with inserted Subscriber Identity Module (SIM), insertion of the SIM into the activated MES, pressing of a reset button.

6.1.2.2   MMR_REG_CNF

Registration confirmation. Indicates to the user that the MES is ready to start a transaction.

6.1.2.3   [Reserved]

6.1.2.4   MMR_NREG_REQ

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

6.1.2.5   MMR_NREG_IND

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

6.2   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:

1) Mobile-originated and Mobile-terminated call establishment for normal calls;

2) Mobile-originated call establishment for emergency calls;

3) Call maintaining;

4) Call termination;

5) Call-related Supplementary Services Support.

6.2.1   Service State Diagram

The Call Control services provided at the service access point MNCC-SAP are illustrated in the state diagram of figures 6.2.1 and 6.2.2.

Figure 6.2.1: Service Graph of Call Control - MES Side

MNCC_START_DTMF_REQ / CNF
MNCC_STOP_DTMF_REQ / CNF
MNCC_SYNC_IND (res. assgn.)
MNCC_SYNC_IND (channel mode modify)
MNCC_NOTIFY_REQ / IND
MNCC_MODIFY_IND

Figure 6.2.2: Service Graph of Call Control Entity - MES Side Active State

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6.2.2   Service Primitives

Table 6.2.1: Primitives and Parameters at MNCC-SAP – MES Side

PRIMITIVE	PARAMETER (message, info elements of message, other parameters)	REFERENCE
MNCC_SETUP_REQ	SETUP or EMERGENCY SETUP	Clause 6.2.2.1
MNCC_SETUP_IND	SETUP	Clause 6.2.2.2
MNCC_SETUP_RSP	CONNECT	Clause 6.2.2.3
MNCC_SETUP_CNF	CONNECT	Clause 6.2.2.4
MNCC_SETUP_COMPL_IND		Clause 6.2.2.6
MNCC_REJ_REQ	RELEASE COMPLETE	Clause 6.2.2.7
MNCC_REJ_IND	cause	Clause 6.2.2.8
MNCC_CALL_CONF_REQ	CALL CONFIRMED	Clause 6.2.2.9
MNCC_CALL_PROC_IND	CALL PROCEEDING	Clause 6.2.2.10
MNCC_PROGRESS_IND	PROGRESS	Clause 6.2.2.11
MNCC_ALERT_REQ	ALERTING	Clause 6.2.2.12
MNCC_ALERT_IND	ALERTING	Clause 6.2.2.13
MNCC_NOTIFY_REQ	NOTIFY	Clause 6.2.2.14
MNCC_NOTIFY_IND	NOTIFY	Clause 6.2.2.15
MNCC_DISC_REQ	DISCONNECT	Clause 6.2.2.16
MNCC_DISC_IND	DISCONNECT	Clause 6.2.2.17
MNCC_REL_REQ	RELEASE	Clause 6.2.2.18
MNCC_REL_IND	RELEASE	Clause 6.2.2.19
MNCC_REL_CNF	RELEASE or RELEASE COMPLETE	Clause 6.2.2.20
MNCC_FACILITY_REQ	Facility	Clause 6.2.2.21
MNCC_FACILITY_IND	Facility	Clause 6.2.2.22
MNCC_START_DTMF_REQ	START DTMF	Clause 6.2.2.23
MNCC_START_DTMF_CNF	START DTMF ACK or START DTMF REJ	Clause 6.2.2.24
MNCC_STOP_DTMF_REQ	STOP DTMF	Clause 6.2.2.25
MNCC_STOP_DTMF_CNF	STOP DTMF ACK	Clause 6.2.2.26
MNCC_MODIFY_REQ	MODIFY	Clause 6.2.2.27
MNCC_MODIFY_IND	MODIFY	Clause 6.2.2.28
MNCC_MODIFY_RSP	MODIFY COMPLETE	Clause 6.2.2.29
MNCC_MODIFY_CNF	MODIFY COMPLETE	Clause 6.2.2.30
MNCC_SYNC_IND	cause (res. assgn., channel mode modify)	Clause 6.2.2.31

6.2.2.1   MNCC_SETUP_REQ

Request to send a SETUP or EMERGENCY SETUP message to initiate Mobile-originating establishment of either a normal or an emergency call.

6.2.2.2   MNCC_SETUP_IND

Receipt of a SETUP message, the Mobile-terminated call establishment has been initiated.

6.2.2.3   MNCC_SETUP_RSP

Response to send a CONNECT message to indicate call acceptance by the Mobile-terminated user; call control is requested to attach the user connection (if it is not yet attached).

6.2.2.4   MNCC_SETUP_CNF

Receipt of a CONNECT message, the Mobile-originated call has been accepted by the remote called user.

6.2.2.5 [Reserved]

6.2.2.6 MNCC_SETUP_COMPL_IND

Receipt of a CONNECT ACKNOWLEDGE message, the Mobile-terminated call establishment has been completed; for a data call, the user is informed that the user connection is attached.

6.2.2.7 MNCC_REJ_REQ

Request to reject a Mobile-terminated call if the call is refused or if the call cannot be accepted, e.g., because of missing compatibility.

6.2.2.8 MNCC_REJ_IND

Indication that the Mobile-originated call has been rejected, e.g., if the MM connection cannot be provided or if the call establishment initiation has been rejected by the Network.

6.2.2.9 MNCC_CALL_CONF_REQ

Request to confirm a Mobile-terminated call by sending a CALL CONFIRMED message. A bearer capability different from that given in MNCC_SETUP_IND may be offered to the remote calling user.

6.2.2.10 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.

6.2.2.11 MNCC_PROGRESS_IND

Indication to the Mobile user that a PROGRESS message or a message containing a progress IE (Information Element) has been received, e.g., because the call is progressing in the Public Land Mobile Network/Integrated Services Digital Network (PLMN/ISDN) environment, or because the call has left the PLMN/ISDN environment, or because in-band tones/announcement are available.

6.2.2.12 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.

6.2.2.13 MNCC_ALERT_IND

Indication of the receipt of an ALERTING message, alerting call initiator that the call to the remote called user has been initiated.

6.2.2.14 MNCC_NOTIFY_REQ

Request to send information pertaining to a call, such as user suspended, to the Network by the Mobile user.

6.2.2.15 MNCC_NOTIFY_IND

Indication to the Mobile user that information pertaining to a call, such as remote user suspended, has been received from the Network.

6.2.2.16 MNCC_DISC_REQ

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

6.2.2.17 MNCC_DISC_IND

Indication of the receipt of a DISCONNECT message, by which the Network indicates that the end-to-end connection is cleared.

6.2.2.18 MNCC_REL_REQ

Request by the Mobile user to send a RELEASE message to inform the Network that the user intends to release the call reference and the corresponding MM connection so that the Network can release its MM connection and the correspondent call reference.

6.2.2.19 MNCC_REL_IND

Indication to the Mobile user (originating or terminating) that a RELEASE message has been received and the Network intends to release its MM connection. The Mobile user is requested to release the call reference and the corresponding MM connection.

6.2.2.20 MNCC_REL_CNF

Confirmation of the Mobile user's request to release the MM connection and call reference in the Network. The Mobile user may release the call reference and the corresponding MM connection.

6.2.2.21 MNCC_FACILITY_REQ

Request to transport a facility IE for a call-related supplementary service invocation.

6.2.2.22 MNCC_FACILITY_IND

Indication that a facility IE for a call-related supplementary service invocation has been received.

6.2.2.23 MNCC_START_DTMF_REQ

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

6.2.2.24 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.

6.2.2.25 MNCC_STOP_DTMF_REQ

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

6.2.2.26 MNCC_STOP_DTMF_CNF

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

6.2.2.27 MNCC_MODIFY_REQ

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

6.2.2.28 MNCC_MODIFY_IND

Receipt of a MODIFY message, a Mobile-terminating in-call modification has been initiated.

6.2.2.29   MNCC_MODIFY_RSP

Response to send a MODIFY COMPLETE message to indicate Mobile-terminating in-call modification completion by the Mobile user.

6.2.2.30   MNCC_MODIFY_CNF

Receipt of a MODIFY COMPLETE message, the Mobile-originating in-call modification has been completed.

6.2.2.31   MNCC_SYNC_IND

Indication that a dedicated channel assignment has been performed (res. assgn. = "resource assigned") and/or the channel mode has been changed.

6.3   Call-Independent Supplementary Services Support

6.3.1   Service State Diagram

The primitives provided by the call-independent Supplementary Services Support entity and the transitions between permitted states are shown in figure 6.3.1.
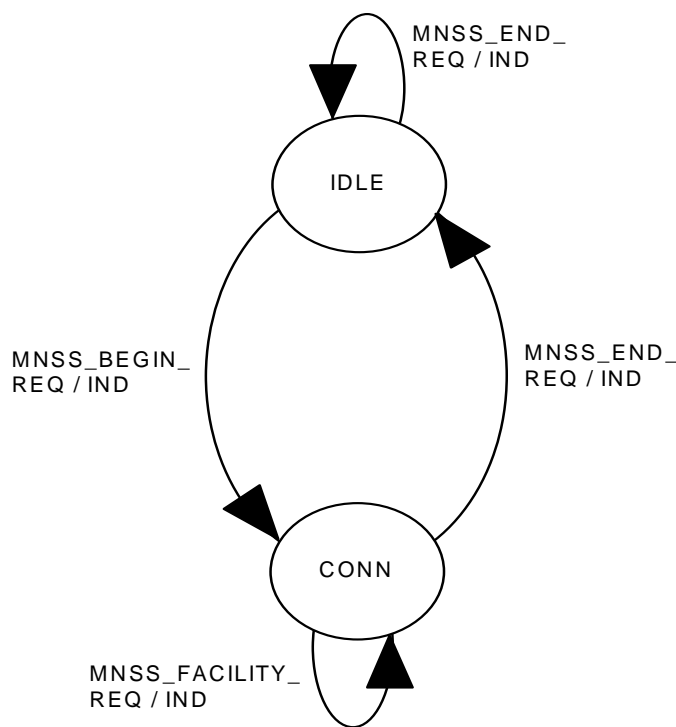
STATES:
IDLE - No SS signaling transaction pending
CONN - SS signaling transaction established

Figure 6.3.1: Service Graph of the Call-Independent Supplementary Services Support Entity - MES Side

6.3.2 Service Primitives

Table 6.3.1: Primitives and Parameters at MNSS-SAP – MES Side

PRIMITIVES	PARAMETERS (Info elements of message)	REFERENCE
MNSS_BEGIN_REQ	REGISTER	Clause 6.3.2.1
MNSS_BEGIN_IND	REGISTER	Clause 6.3.2.2
MNSS_FACILITY_REQ	FACILITY	Clause 6.3.2.3
MNSS_FACILITY_IND	FACILITY	Clause 6.3.2.4
MNSS_END_REQ	REL COMPLETE	Clause 6.3.2.5
MNSS_END_IND	REL COMPLETE	Clause 6.3.2.6

6.3.2.1 MNSS_BEGIN_REQ

Request to send a REGISTER message in order to establish a signalling transaction for the provision of call-independent supplementary services. The request for a call independent supplementary service invocation may be included.

6.3.2.2 MNSS_BEGIN_IND

Receipt of a REGISTER message, a signalling transaction is established for the provision of call-independent supplementary services after receipt of a REGISTER message. The indication of a supplementary service invocation may be included.

6.3.2.3 MNSS_FACILITY_REQ

Request to send a FACILITY message for the provision of a call-independent supplementary service invocation.

6.3.2.4 MNSS_FACILITY_IND

Receipt of a FACILITY message for a call-independent supplementary service invocation.

6.3.2.5 MNSS_END_REQ

Request to send a RELEASE COMPLETE message in order to release the signalling transaction. The request for transfer of a supplementary service facility may be included.

6.3.2.6 MNSS_END_IND

Receipt of a RELEASE COMPLETE message, the singling transaction has been released. The indication of a supplementary service facility may be included.

6.4 Short Message Services Support

The service provided by the CM sublayer to support the short message service are defined in GSM 04.11 [7].

7 Services Provided by Signalling Layer 3 on the Network Side

7.1 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:

1) Call establishment;

2) Call maintaining;

3) Call termination;

4) Call-related Supplementary Services Support.

7.1.1 Service State Diagram

The Call Control services provided at the service access point MNCC-SAP are illustrated in figures 7.1.1 and 7.1.2.
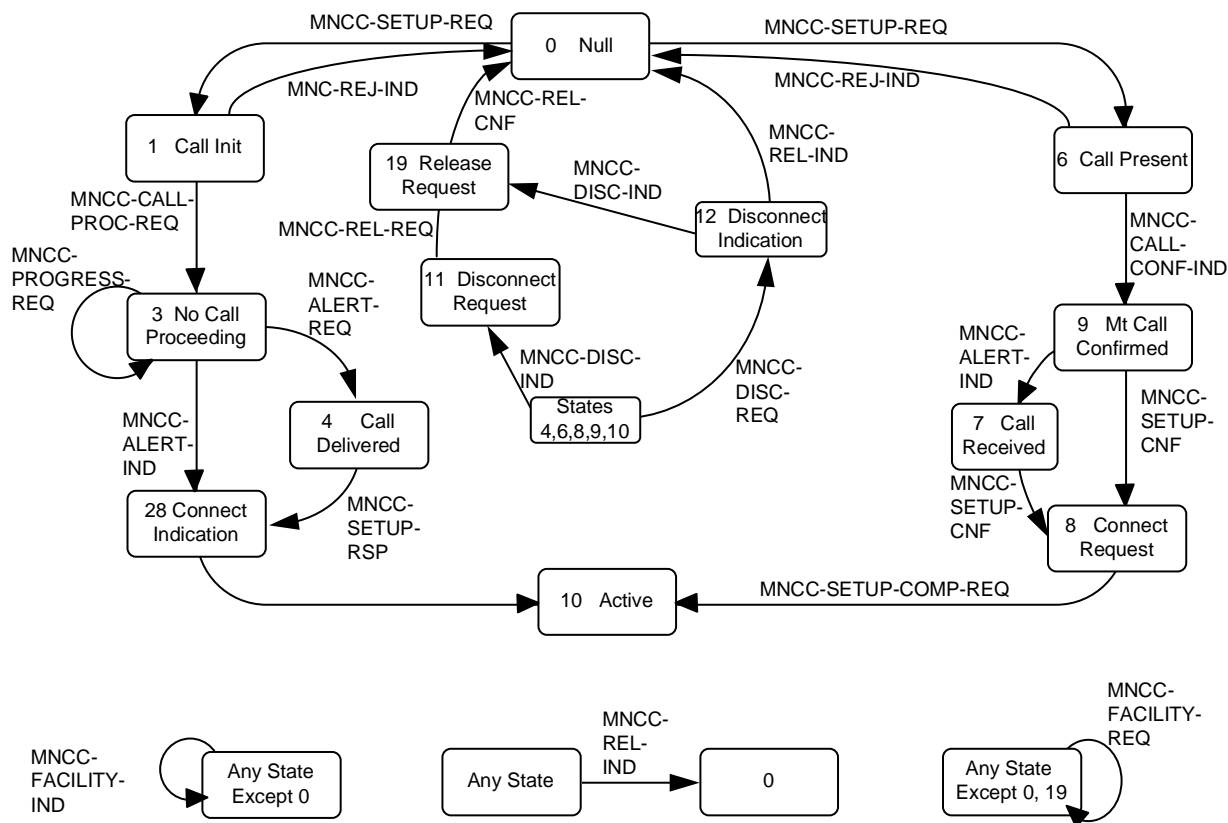
Figure 7.1.1: Service Graph of Call Control Entity - Network Side

MNCC_START_DTMF_IND / RSP
MNCC_STOP_DTMF_IND / RSP
MNCC_NOTIFY_REQ / IND
MNCC_MODIFY_IND

10 ACTIVE

MNCC_
MODIFY_REQ

MNCC_
MODIFY_CNF

27 MT MODIFY

MNCC_MODIFY_RSP
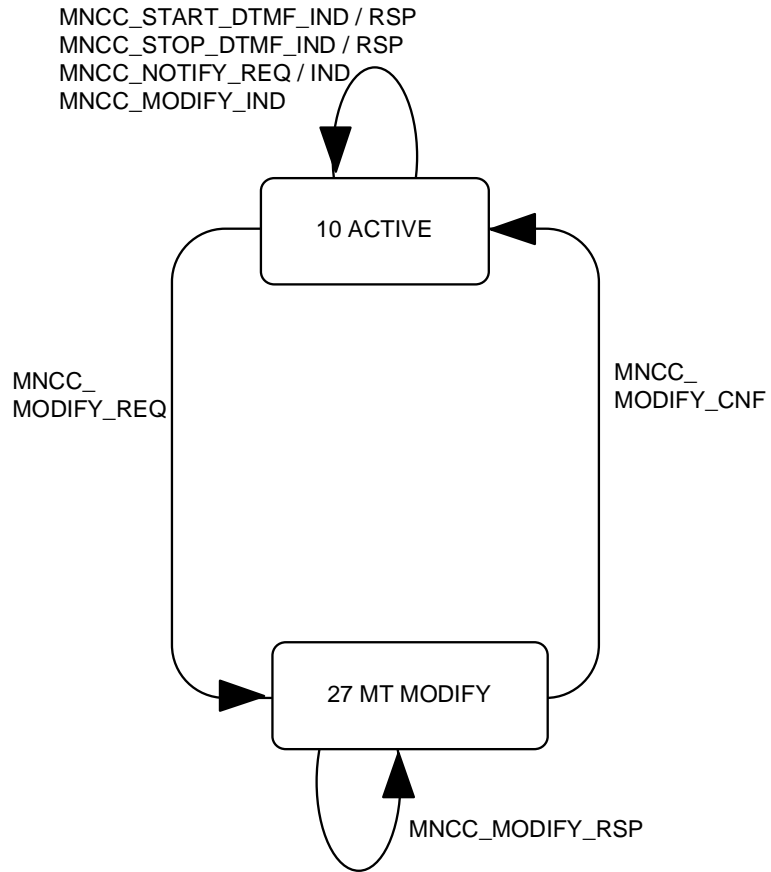
Figure 7.1.2: Service Graph of Call Control Entity - Network Side Active State

7.1.2   Service Primitives

Table 7.1.1: Primitives and Parameters at MNCC-SAP - Network Side

PRIMITIVE	PARAMETER (message, info elements of message, other parameters)	REFERENCE
MNCC_SETUP_REQ	SETUP incl. Mobile ID or EMERGENCY SETUP	Clause 7.1.2.1
MNCC_SETUP_IND	SETUP	Clause 7.1.2.2
MNCC_SETUP_RSP	CONNECT	Clause 7.1.2.3
MNCC_SETUP_CNF	CONNECT	Clause 7.1.2.4
MNCC_SETUP_COMPL_REQ	CONNECT ACKNOWLEDGE	Clause 7.1.2.5
MNCC_SETUP_COMPL_IND	CONNECT ACKNOWLEDGE	Clause 7.1.2.6
MNCC_REJ_REQ	RELEASE COMPLETE	Clause 7.1.2.7
MNCC_REJ_IND	cause	Clause 7.1.2.8
MNCC_CALL_CONF_IND	CALL CONFIRMED	Clause 7.1.2.9
MNCC_CALL_PROC_REQ	CALL PROCEEDING	Clause 7.1.2.10
MNCC_PROGRESS_REQ	PROGRESS	Clause 7.1.2.11
MNCC_ALERT_REQ	ALERTING	Clause 7.1.2.12
MNCC_ALERT_IND	ALERTING	Clause 7.1.2,13
MNCC_NOTIFY_REQ	NOTIFY	Clause 7.1.2.14
MNCC_NOTIFY_IND	NOTIFY	Clause 7.1.2.15
MNCC_DISC_REQ	DISCONNECT	Clause 7.1.2.16
MNCC_DISC_IND	DISCONNECT	Clause 7.1.2.17
MNCC_REL_REQ	RELEASE or DISCONNECT	Clause 7.1.2.18
MNCC_REL_IND	RELEASE	Clause 7.1.2.19
MNCC_REL_CNF	RELEASE or RELEASE COMPLETE	Clause 7.1.2.20
MNCC_FACILITY_REQ	facility	Clause 7.1.2.21
MNCC_FACILITY_IND	facility	Clause 7.1.2.22
MNCC_START_DTMF_IND	START DTMF	Clause 7.1.2.23
MNCC_START_DTMF_RSP	START DTMF ACK or START DTMF REJ	Clause 7.1.2.24
MNCC_STOP_DTMF_IND	STOP DTMF	Clause 7.1.2.25
MNCC_STOP_DTMF_RSP	STOP DTMF ACK	Clause 7.1.2.26
MNCC_MODIFY_REQ	MODIFY or BC-parameter	Clause 7.1.2.27
MNCC_MODIFY_IND	BC-parameter	Clause 7.1.2.28
MNCC_MODIFY_RSP	MODIFY COMPLETE	Clause 7.1.2.29
MNCC_MODIFY_CNF	BC-parameter	Clause 7.1.2.30

7.1.2.1   MNCC_SETUP_REQ

Request to send a SETUP message to initiate Mobile-terminated establishment.

7.1.2.2   MNCC_SETUP_IND

Receipt of a SETUP or EMERGENCY SETUP message, the Mobile-originating call establishment has been initiated.

7.1.2.3   MNCC_SETUP_RSP

Response to send a CONNECT message to indicate call acceptance by the remote user.

7.1.2.4   MNCC_SETUP_CNF

Receipt of a CONNECT message, the Mobile-terminated call has been accepted.

7.1.2.5 MNCC_SETUP_COMPL_REQ

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

7.1.2.6 MNCC_SETUP_COMPL_IND

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

7.1.2.7 MNCC_REJ_REQ

Reject the Mobile-originated call establishment if the call cannot be accepted.

7.1.2.8 MNCC_REJ_IND

A Mobile-terminated call was rejected by the MES, e.g., because of missing compatibility.

7.1.2.9 MNCC_CALL_CONF_IND

Receipt of a CALL CONFIRMED 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.

7.1.2.10 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.

7.1.2.11 MNCC_PROGRESS_REQ

Request to send a PROGRESS message or to piggy-back a progress IE in a suitable CC message in order to give the Mobile user information about the call, e.g., that the call is progressing in the PLMN/ISDN environment, or that the call has left the PLMN/ISDN environment or that in-band tones/announcement are available.

7.1.2.12 MNCC_ALERT_REQ

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

7.1.2.13 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.

7.1.2.14 MNCC_NOTIFY_REQ

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

7.1.2.15 MNCC_NOTIFY_IND

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

7.1.2.16 MNCC_DISC_REQ

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

7.1.2.17 MNCC_DISC_IND

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

7.1.2.18 MNCC_REL_REQ

Request to send a RELEASE message to inform the MES that the Network intends to release the MM connection and the correspondent call reference.

7.1.2.19 MNCC_REL_IND

Receipt of a RELEASE message, the User Terminal intends to release its MM connection and call reference. The Network is requested to release its call reference and MM connection.

7.1.2.20 MNCC_REL_CNF

The RELEASE COMPLETE message has been received, the MM connection in the MES has been released, the Network itself shall release its MM connection and the corresponding call reference.

7.1.2.21 MNCC_FACILITY_REQ

Request to transport a facility IE for call-related supplementary service invocations.

7.1.2.22 MNCC_FACILITY_IND

Indication that a facility IE for call-related supplementary service invocations has been received.

7.1.2.23 MNCC_START_DTMF_IND

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

7.1.2.24 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.

7.1.2.25 MNCC_STOP_DTMF_IND

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

7.1.2.26 MNCC_STOP_DTMF_RSP

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

7.1.2.27 MNCC_MODIFY_REQ

Request to start the Mobile-terminating in-call modification.

7.1.2.28 MNCC_MODIFY_IND

Receipt of a MODIFY message, the Mobile-originating in-call modification has been initiated.

7.1.2.29 MNCC_MODIFY_RSP

Response to send a MODIFY COMPLETE to indicate to the Mobile user that the Mobile-originating in-call modification procedure has been completed.

7.1.2.30 MNCC_MODIFY_CNF

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

7.2 Call-Independent Supplementary Services Support

7.2.1 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 7.2.1.
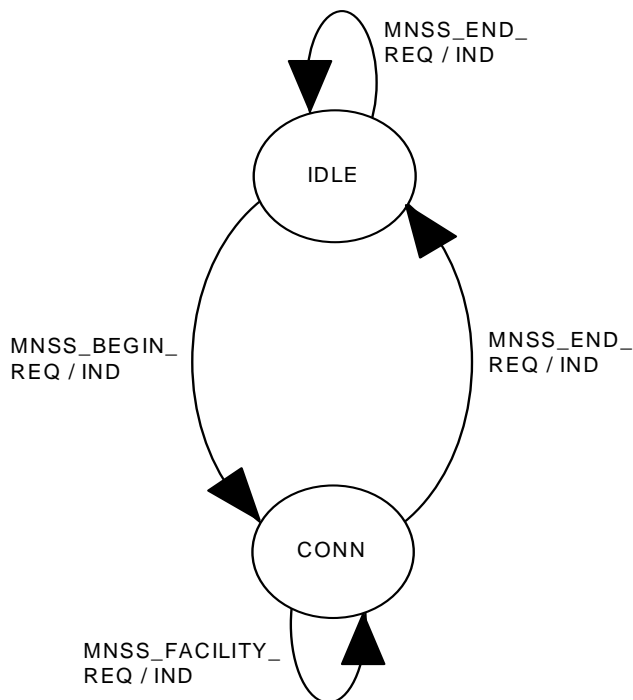
STATES:
IDLE - No SS signaling transaction pending
CONN - SS signaling transaction established

Figure 7.2.1: Service Graph of the Call-Independent Supplementary Services Support Entity - Network Side

7.2.2 Service Primitives

Table 7.2.1: Primitives and Parameters at MNSS-SAP - Network Side

PRIMITIVES	PARAMETERS	REFERENCE
MNSS_BEGIN_REQ	REGISTER	Clause 7.2.2.1
MNSS_BEGIN_IND	REGISTER	Clause 7.2.2.2
MNSS_FACILITY_REQ	FACILITY	Clause 7.2.2.3
MNSS_FACILITY_IND	FACILITY	Clause 7.2.2.4
MNSS_END_REQ	RELEASE COMPLETE	Clause 7.2.2.5
MNSS_END_IND	RELEASE COMPLETE	Clause 7.2.2.6

7.2.2.1 MNSS_BEGIN_REQ

Request to send a REGISTER message in order to establish a signalling transaction for the provision of call-independent supplementary services. The request for a supplementary service invocation may be included.

7.2.2.2 MNSS_BEGIN_IND

Receipt of a REGISTER message, a signalling transaction is established for the provision of call-independent supplementary services. The indication of a supplementary service invocation may be included.

7.2.2.3 MNSS_FACILITY_REQ

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

7.2.2.4 MNSS_FACILITY_IND

Receipt of a FACILITY message, a supplementary service facility has been requested.

7.2.2.5 MNSS_END_REQ

Request to send a RELEASE COMPLETE message in order to release the signaling transaction by sending a RELEASE COMPLETE message. The request for transfer of a supplementary service facility may be included.

7.2.2.6 MNSS_END_IND

Indication that the signaling transaction has been released after receipt of a RELEASE COMPLETE message. The indication of a supplementary service facility may be included.

7.3 Short Message Services Support

The service provided by the CM sublayer to support the short message service are defined in GSM 04.11 [7].

8 Services Assumed from Signalling Layers 1 and 2

The services provided by layer 2 are defined in detail in GMR-2 04.005 [3]. 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 clause 8.5 below.

8.1 Priority

Messages from layer 3 can be sent with:

    1) No priority, i.e., the messages are sent in first-in-first-out order; and

    2) Priority, i.e., a priority message is sent as early as possible by layer 2.

8.2 Unacknowledged Information Transfer

Transfer of unacknowledged information using the primitives DL_UNIT_DATA_REQUEST/INDICATION.

8.3   Acknowledged Information Transfer

Transfer of information in multiframe acknowledged mode including the following:

1) Establishment of data link connection between L3 entities;

2) Transfer of information in acknowledged mode;

3) Release of the data link connection.

The primitives associated with acknowledged information transfer are as follows:

1) DL_ESTABLISH_REQUEST/INDICATION/CONFIRM for establishment of acknowledged mode;

2) DL_DATA_REQUEST/INDICATION for requesting the transmission of a message unit and for indicating the reception of a message unit;

3) DL_SUSPEND_REQUEST/DL_RELEASE_CONFIRM for requesting and confirming the suspension of the acknowledged information transfer in the MES upon channel change;

4) DL_RESUME_REQUEST/DL_ESTABLISH_CONFIRM for requesting and confirming the resumption of the acknowledged information transfer in the MES after suspension at channel change;

5) DL_RELEASE_REQUEST/INDICATION/CONFIRM for the termination of acknowledged mode operation; and

6) DL_RECONNECT_REQUEST for requesting the re-establishment of acknowledged information transfer in the MES on the old channel after channel change failure.

8.4   Random Access

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

8.5   Channel Management and Measurements

The management of channels, i.e., their activation, deactivation, configuration, reconfiguration, 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 primitives MPH_INFORMATION_REQUEST/INDICATION/ CONFIRMATION.

9   Interlayer Service Interfaces on the MES Side

9.1   Service provided by the Radio Resource Management Entity

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

The RR services are used for:

1) Establishing control channel connections;

2) Releasing control channel connections; and

3) Control data transfer.

The Radio Resource Management services are represented by the RR-service primitives.
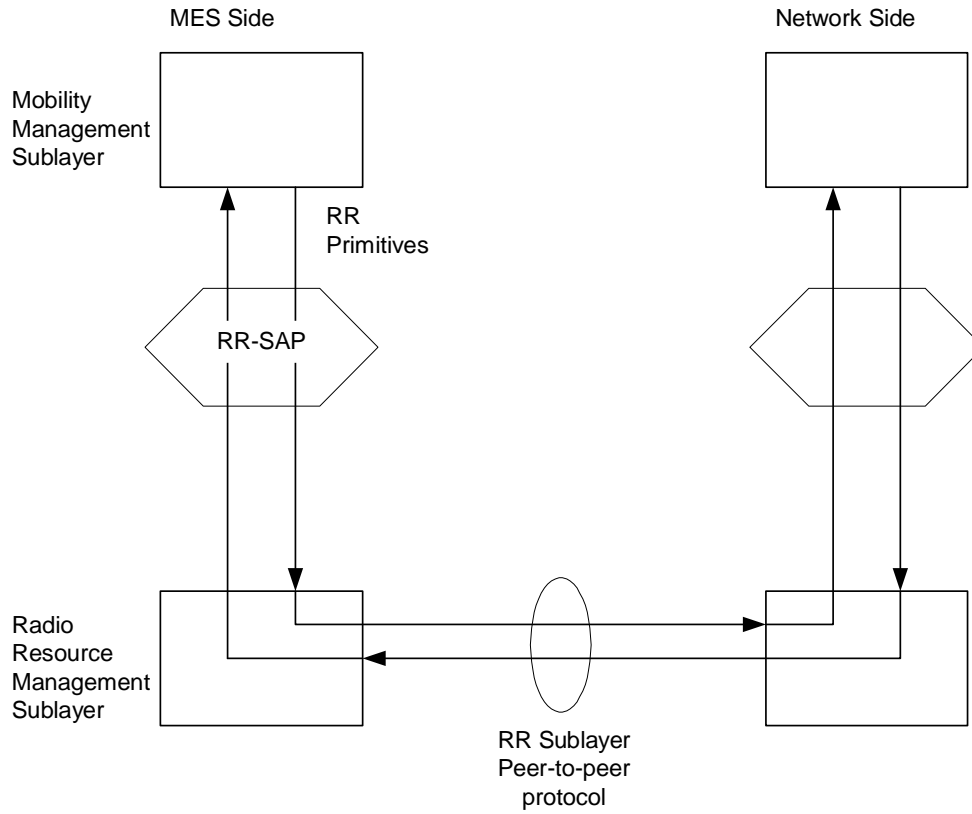
Figure 9.1.1: Services Provided at RR-SAP – MES Side

9.1.1   Service State Diagram

The primitives provided by the Radio Resource Management entity and the transition between permitted states are shown in figure 9.1.2.
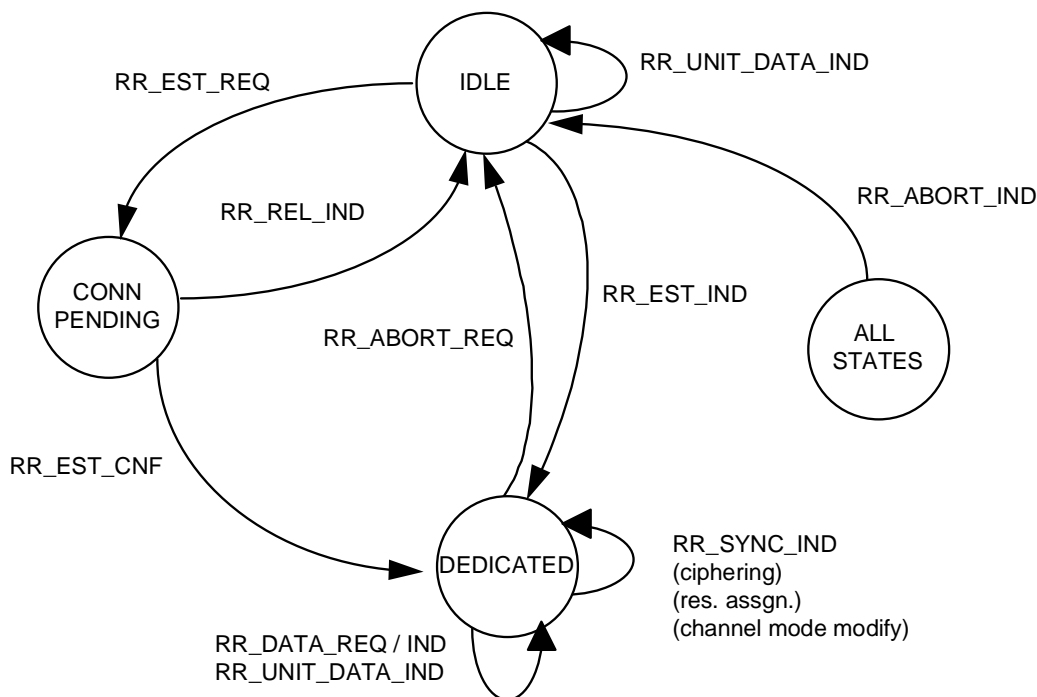
Figure 9.1.2: Service Graph of the Radio Resource Management – MES Side

9.1.2 Service Primitives

Table 9.1.1: Primitives and Parameters at the RR-SAP - MES Side

PRIMITIVES	PARAMETERS	REFERENCE
RR_EST_REQ	Layer 3 message Transferred in the SABM frame	Clause 9.1.2.1
RR_EST_IND	-	Clause 9.1.2.2
RR_EST_CNF	-	Clause 9.1.2.3
RR_REL_IND	cause	Clause 9.1.2.4
RR_SYNC_IND	cause (ciphering, res. assgn., channel mode modify)	Clause 9.1.2.5
RR_DATA_REQ	Layer 3 message	Clause 9.1.2.6
RR_DATA_IND	Layer 3 message	Clause 9.1.2.7
RR_UNIT_DATA_IND	Layer 3 message	Clause 9.1.2.8
RR_ABORT_REQ	cause	Clause 9.1.2.9
RR_ABORT_IND	cause	Clause 9.1.2.10

9.1.2.1 RR_EST_REQ

Is used by the Mobility Management entity to request establishment of a Mobile originated RR connection. The request shall be given only in the IDLE state when the MES listens to the S-HPACH and the previously selected S-BCCH.

9.1.2.2 RR_EST_IND

Indicates to the Mobility Management entity the establishment of a Mobile-terminated RR connection. By this indication, MM is informed that a transparent connection exists and RR is in the dedicated mode.

9.1.2.3 RR_EST_CNF

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

9.1.2.4 RR_REL_IND

Is used by RR to indicate to the Mobility Management entity the release of an 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.

9.1.2.5 RR_SYNC_IND

Is used for synchronizing RR and the Mobility Management entity after the establishment of a Mobile-originated or Mobile-terminated RR connection. This indication is provided to MM in the following cases:

1) Ciphering has been started (ciphering);

2) A traffic channel has been assigned (res. assgn. = "resource assigned");

3) The channel mode has been modified (channel mode modify).

9.1.2.6 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.

9.1.2.7 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.

9.1.2.8 RR_UNIT_DATA_IND

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

9.1.2.9 RR_ABORT_REQ

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

9.1.2.10 RR_ABORT_IND

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

9.2 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 as illustrated in figure 9.2.1.

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

MES Side

Network Side
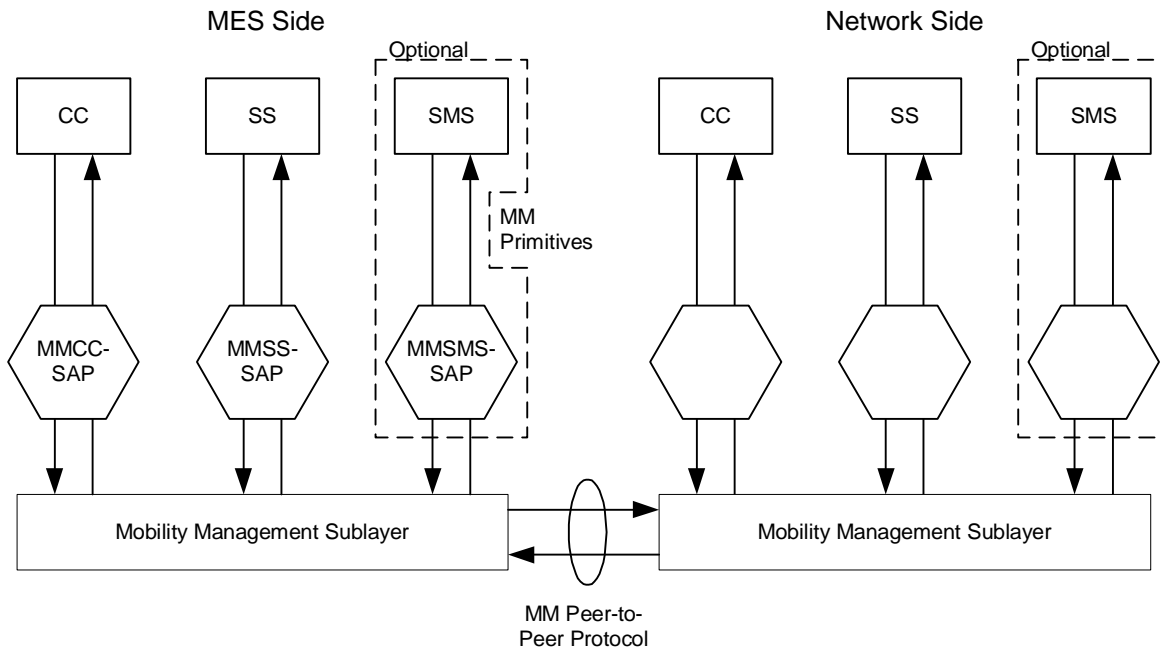
Figure 9.2.1: Services Provided at the MMCC-SAP, MMSS-SAP and MMSMS-SAP - MES

9.2.1 Service State Diagram

The primitives provided by the Mobility Management entity towards Call Control, call- independent Supplementary Services Support and towards Short Message Service Support and the transition between permitted states are Illustrated in figure 9.2.2.
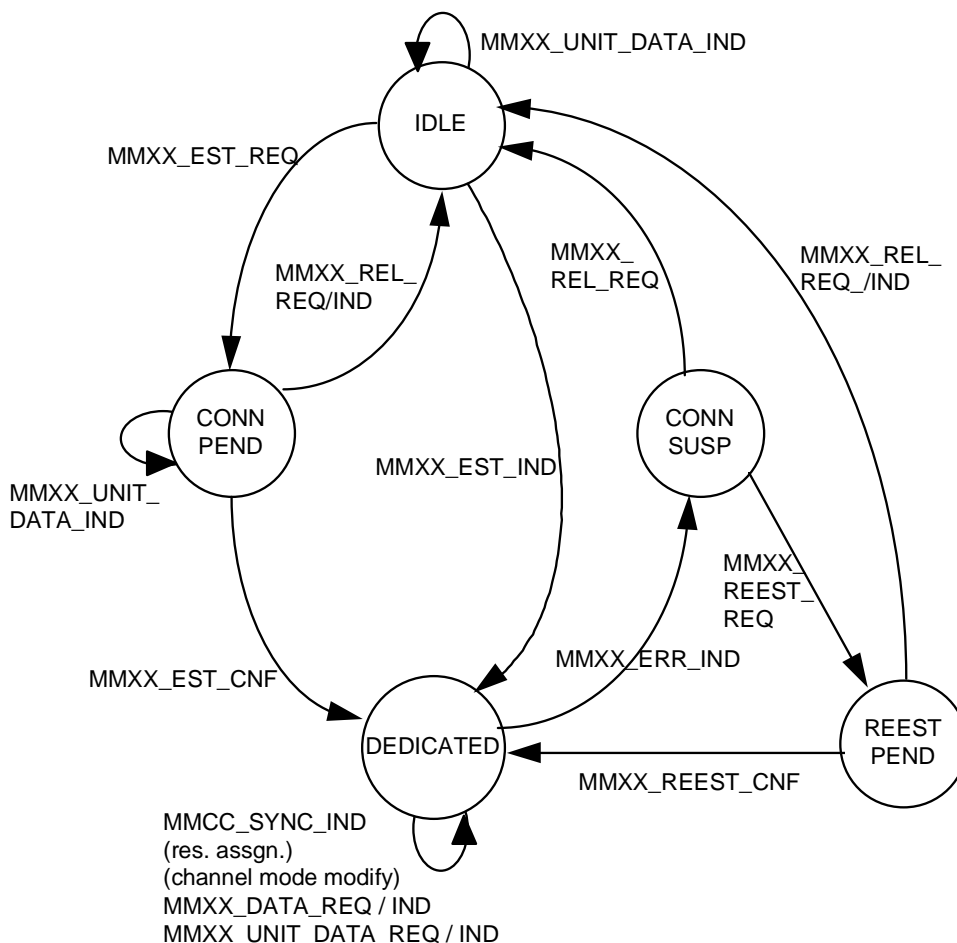
NOTE 1:   MMCC-primitives only at MMCC-SAP.
NOTE 2:   The prefix MMXX is used for substitution of MMCC, MMSS or MMSMS.

Figure 9.2.2: Service Graph of the Mobility Management Entity - MES Side

9.2.2   Service Primitives

Table 9.2.1: Primitives and Parameters at MMCC-SAP, MMSS-SAP or MMSMS-SAP - MES Side

PRIMITIVES	PARAMETERS	REFERENCE
MMXX_EST_REQ[1]	Parameters for the appropriate CM SERVICE REQUEST (if any)	Clause 9.2.2.1
MMXX_EST_IND[1]	First CM message	Clause 9.2.2.2
MMXX_EST_CNF[1]	-	Clause 9.2.2.3
MMXX_REL_REQ[1]	cause	Clause 9.2.2.4
MMXX_REL_IND[1]	cause	Clause 9.2.2.5
MMXX_DATA_REQ[1]	Layer 3 message	Clause 9.2.2.6
MMXX_DATA_IND[1]	Layer 3 message	Clause 9.2.2.7
MMXX_UNIT_DATA_REQ[1]	Layer 3 message	Clause 9.2.2.8
MMXX_UNIT_DATA_IND[1]	Layer 3 message	Clause 9.2.2.9
MMCC_SYNC_IND[2]	cause: res. Assgn.	Clause 9.2.2.10
MMXX_REEST_REQ[1]	-	Clause 9.2.2.11
MMXX_REEST_CNF[1]	-	Clause 9.2.2.12
MMXX_ERR_IND[1]	cause	Clause 9.2.2.13
NOTE 1: MMXX is used as substitution for MMCC, MMSS or MMSMS NOTE 2: Only at MMCC-SAP		

9.2.2.1   MMXX_EST_REQ

Request used by CC, SS and SMS respectively, to request establishment of an MM connection. Several MM connections 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.

9.2.2.2   MMXX_EST_IND

Indication to CC, SS or SMS that a Mobile-terminated MM connection has been established and the first message has been received from the respective peer entity. Several MM connections may be provided in parallel. If an MM connection already exists, a new MM connection using the same RR connection is indicated by this primitive if MM detects a message with a new combination of Protocol Discriminator (PD) and Transaction Identifier (TI).

9.2.2.3   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.

9.2.2.4   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.

9.2.2.5   MMXX_REL_IND

Indication of the release of an existing MM connection or an 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.

9.2.2.6   MMXX_DATA_REQ

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

9.2.2.7   MMXX_DATA_IND

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

9.2.2.8   MMXX_UNIT_DATA_REQ

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

9.2.2.9   MMXX_UNIT_DATA_IND

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

9.2.2.10   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).

9.2.2.11   MMXX_REEST_REQ

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

9.2.2.12   MMXX_REEST_CNF

Confirmation of the successful re-establishment of the MM connection. The MM connection will continue with PD/TI as it had before.

9.2.2.13   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 transactions, this indication is passed to all CM entities for which an 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.

10   Interlayer Service Interfaces on the Network Side

10.1   Services Provided by the Radio Resource Management Entity

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

The RR Services are used for:

1) Establishing control channel connections;

2) Establishing traffic channel connections;

3) Ciphering mode indication;

4) Releasing control channel connections;

5) Control data transfer.

The Radio Resource Management services are represented by the RR service primitives.
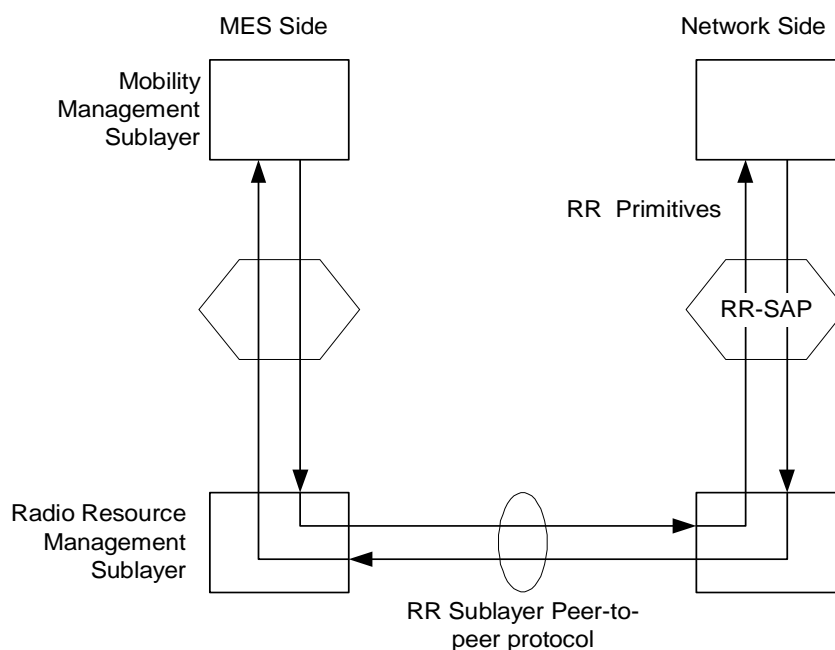
Figure 10.1.1: Services Provided at RR-SAP - Network Side

10.1.1 Service State Diagram

The primitives provided by the Radio Resource Management entity and the transition between permitted states are shown in figure 10.1.2.

STATES:
IDLE -- No dedicated channel established
CONN PEND - Connecting pending
DT1 - Data Transfer 1, dedicated Channel established
DT2 - Data Transfer 2, dedicated channel established, ciphering mode set
Note: The parameters in RR_SYNC_CNF must correspond to the parameter in RR_SYNC_REQ.

Figure 10.1.2: Service Graph of the Radio Resource Management Entity - Network Side

10.1.2   Service Primitives

Table 10.1.1: Primitives and Parameters at the RR-SAP - Network Side

PRIMITIVES	PARAMETERS	REFERENCE
RR_EST_REQ	Parameters for the initial layer 3 message	Clause 10.1.2.1
RR_EST_IND	Initial layer 3 message	Clause 10.1.2.2
RR_EST_CNF	-	Clause 10.1.2.3
RR_REL_REQ	cause	Clause 10.1.2.4
RR_REL_IND	cause	Clause 10.1.2.5
RR_SYNC_REQ	cause (resource assign, ciphering)	Clause 10.1.2.6
RR_SYNC_CNF	cause (resource assign, ciphering)	Clause 10.1.2.7
RR_DATA_REQ	Layer 3 message	Clause 10.1.2.8
RR_DATA_IND	Layer 3 message	Clause 10.1.2.9
RR_UNIT_DATA_REQ	Layer 3 message	Clause 10.1.2.10
RR_UNIT_DATA_IND	Layer 3 message	Clause 10.1.2.11
RR_ABORT_REQ	cause	Clause 10.1.2.12
RR_ABORT_IND	cause	Clause 10.1.2.13

10.1.2.1   RR_EST_REQ

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

10.1.2.2   RR_EST_IND

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

10.1.2.3   RR_EST_CNF

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

10.1.2.4   RR_REL_REQ

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

10.1.2.5   RR_REL_IND

Indication from RR to MM that the main signalling link has been released.

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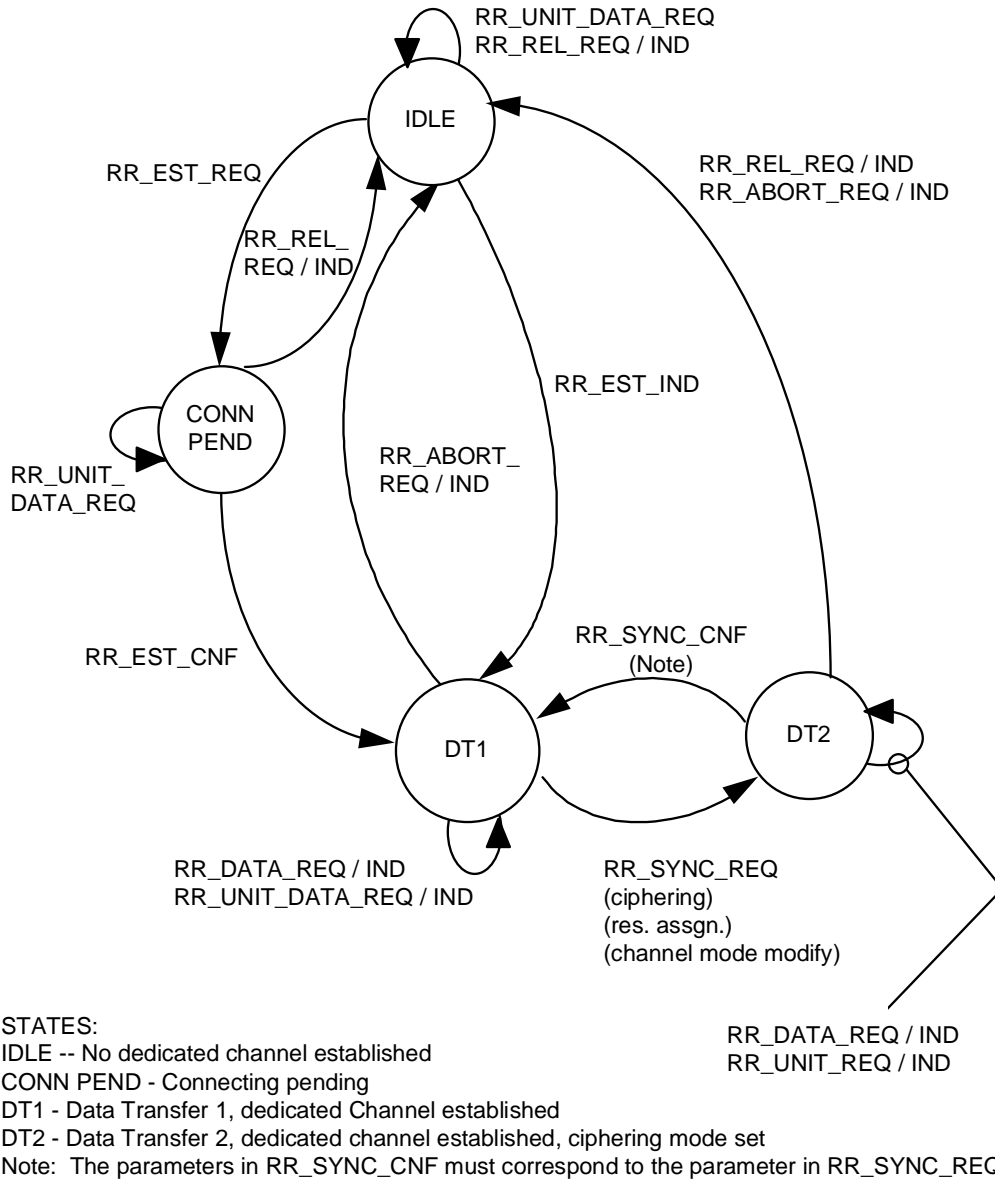
Request used by the Mobility Management entity for synchronization with the RR protocol.

10.1.2.7   RR_SYNC_CNF

Confirmation used by RR that the requested synchronization is completed.

10.1.2.8   RR_DATA_REQ

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

10.1.2.9   RR_DATA_IND

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

10.1.2.10   RR_UNIT_DATA_REQ

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

10.1.2.11   RR_UNIT_DATA_IND

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

10.1.2.12   RR_ABORT_REQ

Request to abandon the RR connection.

10.1.2.13   RR_ABORT_IND

Indication that a radio link failure has occurred.

10.2   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 as illustrated in figure 10.2.1.

The Mobility Management services primitives are recognized by the MMCC, MMSS and MMSMS prefix.
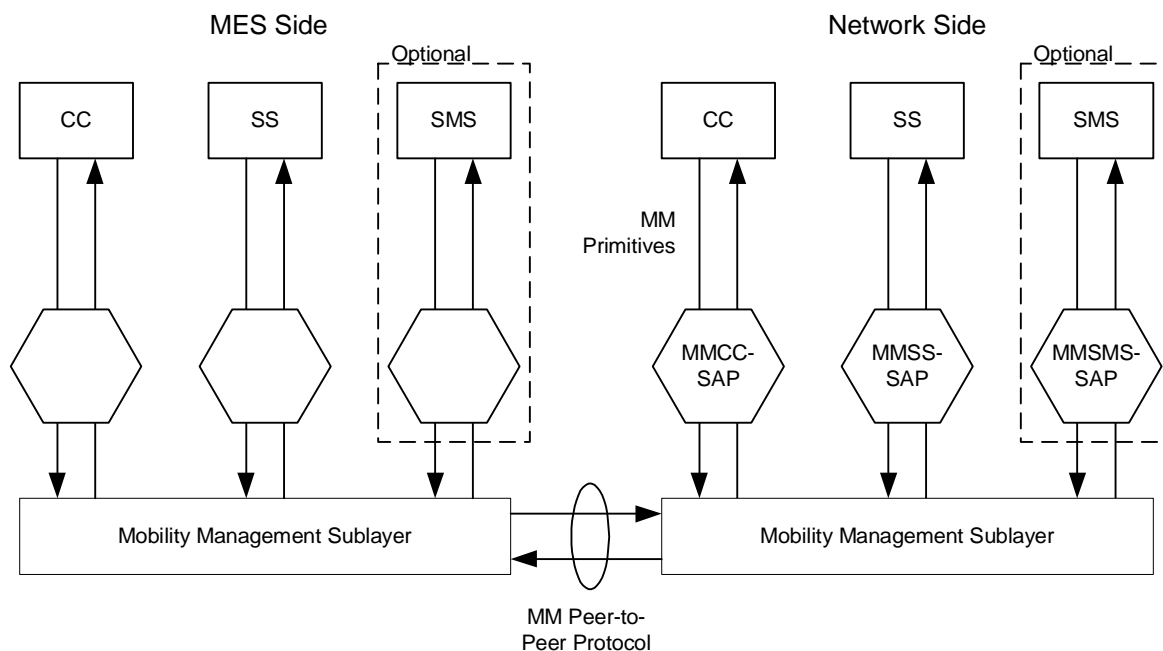
Figure 10.2.1: Services provided at MMCC-SAP, MMSS-SAP, MMSMS-SAP - Network Side

10.2.1   Service State Diagram

The primitives provided by the Mobility Management entity towards Call Control, Short Message Service Support and call-independent Supplementary Services Support as well as the transition between permitted states are illustrated in figure 10.2.2.

MMXX_UNIT_DATA_REQ

IDLE

MMXX_REL_REQ / IND

MMXX_EST_REQ

MMX_
REL_
REQ/
IND

MMXX_UNIT_
DATA_REQ

CONN
PEND

MMXX_EST_IND

MMXX_ABORT_
REQ / IND

MMXX_EST_CNF

MMCC_SYNC_CNF
Note 1

DT1

DT2

MMCC_DATA_REQ / IND
MMX_UNIT_DATA_REQ / IND

MMCC_SYNC_REQ
(res. assgn.)
(channel mode modify)

MMXX_DATA_REQ / IND
MMXX_UNIT_DATA_REQ / IND
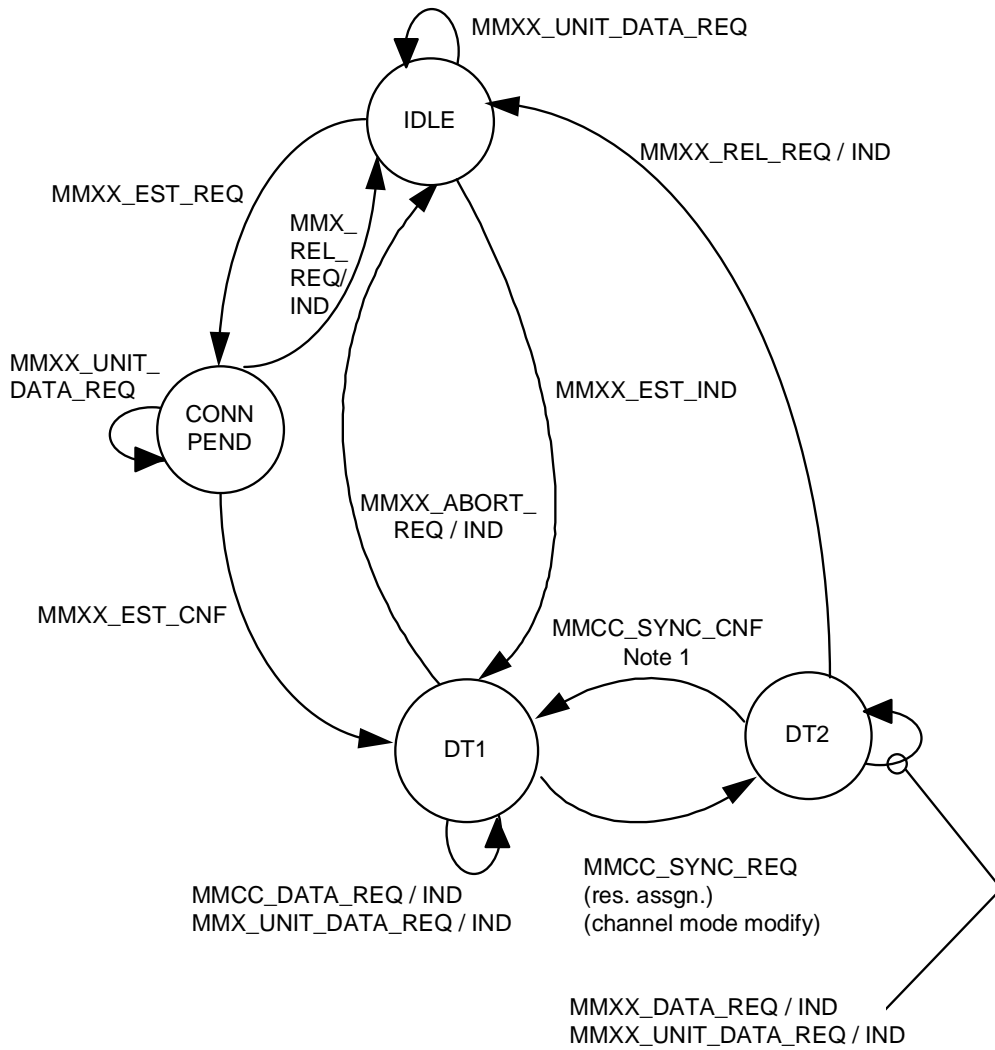
NOTE 1:   The parameters in MMCC_SYNC_CNF must correspond to the parameter in MMCC_SYNC_REQ.
NOTE 2:   MMCC primitives only at MMCC-SAP.
NOTE 3:   The prefix MMXX is used for substitution of MMCC, MMSS or MMSMS.

**Figure 10.2.2: Service Graph of the Mobility Management Entity Towards Call Control, Short Message
Service Support and Call-Independent Supplementary Services Support - Network Side**

10.2.2   Service Primitives

Table 10.2.1: Primitives and Parameters at MMCC-SAP, MMSS-SAP, MMSMS-SAP - Network Side

PRIMITIVES	PARAMETERS	REFERENCE
MMXX_EST_REQ[1]	Mobile ID	Clause 10.2.2.1
MMXX_EST_IND[1]	First CM message	Clause 10.2.2.2
MMXX_EST_CNF[1]	-	Clause 10.2.2.3
MMXX_REL_REQ[1]	cause	Clause 10.2.2.4
MMXX_REQ_IND[1]	cause	Clause 10.2.2.5
MMXX_DATA_REQ[1]	Layer 3 message	Clause 10.2.2.6
MMXX_DATA_IND[1]	Layer 3 message	Clause 10.2.2.7
MMXX_UNIT_DATA_REQ[1]	Layer 3 message	Clause 10.2.2.8
MMXX_UNIT_DATA_IND[1]	Layer 3 message	Clause 10.2.2.9
MMCC_SYNC_REQ[2]	cause (resource assign)	Clause 10.2.2.10
MMCC_SYNC_CNF[2]	cause (resource assign)	Clause 10.2.2.11
Note 1: MMXX is used as substitution for MMCC, MMSS or MMSMS.		
Note 2: Only at MMCC-SAP.		

10.2.2.1   MMXX_EST_REQ

Request by CC, SS and SMS, respectively, for the establishment of an MM connection.

10.2.2.2   MMXX_EST_IND

Indication by the MM sublayer that an MM connection is established.

10.2.2.3   MMXX_EST_CNF

Confirmation of the MM connection establishment by the MM sublayer.

10.2.2.4   MMXX_REL_REQ

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

10.2.2.5   MMXX_REL_IND

Indication by the MM sublayer that an MM connection has been released.

10.2.2.6   MMXX_DATA_REQ

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

10.2.2.7   MMXX_DATA_IND

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

10.2.2.8   MMXX_UNIT_DATA_REQ

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

10.2.2.9   MMXX_UNIT_DATA_IND

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

10.2.2.10   MMCC_SYNC_REQ

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

10.2.2.11   MMCC_SYNC_CNF

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

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11   Standard L3 Messages

In this section, the structure of standard L3 messages and their basic handling are defined. Standard L3 messages are used in layer 3 protocols of the Um interface when the relevant protocol specifications, e.g., GMR-2 04.008 [5], define so.

11.1   Components of a Standard L3 Message

A standard L3 message consists of an imperative part followed by a non-imperative part. Both imperative and non-imperative parts are composed of information elements (IEs).

> NOTE: A layer 3 message consists of an integer number of octets, at least one octet, as defined in GMR-2 04.006 [4].

11.1.1   Format of Information Elements

An information element (IE) occurring in a standard layer 3 message is known as a standard IE. It consists of a half octet or one or more octets. A standard IE may have the following components:

1) An information element identifier (IEI);

2) A length indicator (LI);

3) A value part.

A standard IE has one of the formats shown in table 11.1.1.

Table 11.1.1: Formats of Information Elements

Format	Meaning	IEI Present?	LI Present?	Value Part Present?
T	Type only	yes	no	no
V	Value only	no	no	yes
TV	Type and Value	yes	no	yes
LV	Length and Value	no	yes	yes
TLV	Type, Length and Value	yes	yes	yes

11.1.1.1   Information Element Type and Value Part

Every standard IE has an information element type which determines the values possible for the value part of the IE.

The value part of a standard IE either consists of a half octet or one or more octets. The value part of a standard IE with format LV or TLV may be empty, i.e., consist of zero octets. If it consists of a half octet and has format TV, its IEI consists of a half octet.

The value part of a standard IE may be further structured into fields.

11.1.1.2   Length Indicator

The LI of a standard IE consists of one octet. It contains the binary encoding of the number of octets of the IE occurring after the octet containing the LI, with bit 1 as the least significant bit. The length indicator of a standard IE with empty value part indicates 0 octets.

11.1.1.3   Information Element Identifier

The IEI of a standard IE consists of a half octet or one octet. A standard IE with IEI consisting of a half octet has format TV, and its value part consists of a half octet.

11.1.1.4   Categories of IEs; Order of Occurrence of IEI, LI and Value Part

A total of five categories of standard information statements are defined as follows:

1) Information elements of format V or TV with value part consisting of 1/2 octet (type 1);

2) Information elements of format T with value part consisting of 0 octets (type 2);

3) Information elements of format V or TV with value part that has fixed length of at least one octet (type 3);

4) Information elements of format TLV or LV with value part consisting of zero, one or more octets (type 4);

5) Information elements of format V with value part consisting of zero, one or more octets (type 5).

Type 1 standard information elements of format V provide the value in bit positions 8, 7, 6, 5 of an octet (see figure 11.1.1) or bits 4, 3, 2, 1 of an octet (see figure 11.1.2).
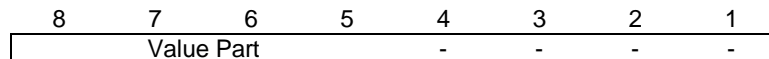
8	7	6	5	4	3	2	1
	Value Part			-	-	-	-

Figure 11.1.1: Type 1 Information Element of Format V

8	7	6	5	4	3	2	1
-	-	-	-		Value Part		
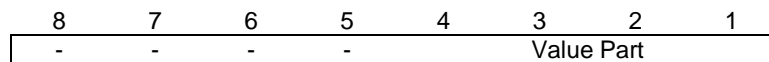
Figure 11.1.2: Type 1 Information Element of Format V

Type 1 standard information elements of format TV have an IEI of a half octet length. They provide the IEI in bit positions 8, 7, 6, 5 of an octet and the value part in bit positions 4, 3, 2, 1 of the same octet, see figure 11.1.3.

8	7	6	5	4	3	2	1
	IEI				Value Part		
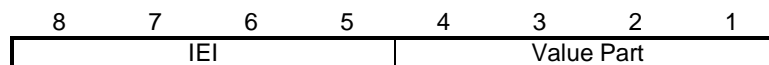
Figure 11.1.3: Type 1 Information Element of Format TV

A type 2 standard IE has format T. Its IEI consists of one octet, and its value part is empty, see figure 11.1.4.

8	7	6	5	4	3	2	1
				IEI			

Figure 11.1.4: Type 2 Information Element

A type 3 standard information element has format V or TV. If it has format TV, its IEI consists of one octet and precedes the value part in the IE. The value part consists of at least one octet. See figures 11.1.5 and 11.1.6.
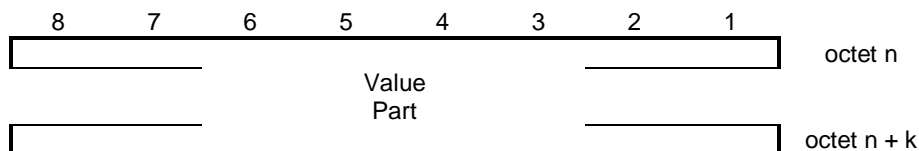
8	7	6	5	4	3	2	1	
								octet n
			Value Part					
								octet n + k

Figure 11.1.5: Type 3 Information Element of Format V (k = 0, 1, 2, ...)

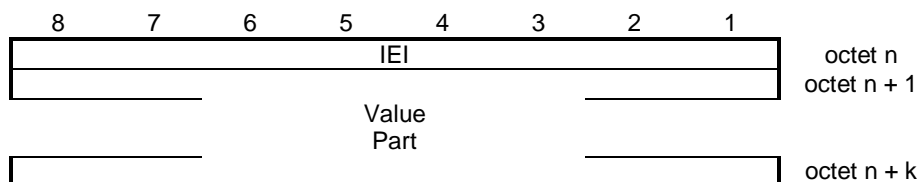| 8	7	6	5	4	3	2	1	
			IEI					octet n
								octet n + 1
			Value Part					
								octet n + k

Figure 11.1.6: Type 3 Information Element of Format TV (k = 1, 2, ...)

A type 4 standard information element has format LV or TLV. Its LI precedes the value part, which consists of zero, one, or more octets. If present, its IEI has a length of one octet and precedes the LI. See figures 11.1.7 and 11.1.8.
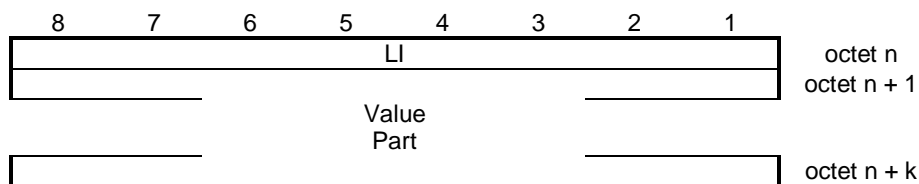
8	7	6	5	4	3	2	1	
			LI					octet n
								octet n + 1
			Value Part					
								octet n + k

Figure 11.1.7: Type 4 Information Element of Format LV (k = 0, 1, 2, ...)

8	7	6	5	4	3	2	1	
			IEI					octet n
			LI					octet n + 1
								octet n + 2
			Value Part					
								octet n + k
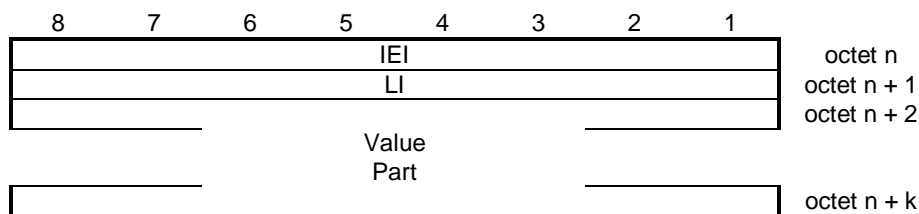
Figure 11.1.8: Type 4 Information Element of Format TLV (k = 1, 2, ...)

A type 5 standard information element has format V. Its value part consists of zero, one or more octets. An information element of this type can only appear as the last information element in a L3 message for which the layer 3 length is either:

- Indicated by layer 2;

- Pre-determined (e.g., by the channel used).

11.2   Imperative Part of a Standard L3 Message

The imperative part of a standard L3 message is composed of two or more IEs having the format V or LV.

11.2.1   Protocol Discriminator

Bits 1 to 4 of the first octet of a standard L3 message contain the protocol discriminator (PD) information element. It is a type 1 IE and has always format V. The PD identifies the L3 protocol to which the standard layer 3 message belongs. The correspondence between L3 protocols and PDs is one-to-one.

The PD can take the values shown in table 11.2.1.

Table 11.2.1: Protocol Discriminator Values

Bits	4	3	2	1	
	0	0	1	1	Call Control; Call-related SS messages
	0	1	0	1	Mobility Management messages
	0	1	1	0	Radio Resources Management messages
	1	0	0	1	SMS messages
	1	0	1	1	Non-call-related SS messages
	1	1	1	1	Reserved for test procedures described in GSM 11.10 [8]

If the network receives a standard L3 message with a protocol discriminator different from those specified in table 11.2.1, the network may ignore the message or initiate the channel release procedure defined in GMR-2 04.008 [5].

If the MES receives a standard L3 message with a protocol discriminator different from those specified in table 11.2.1, the MES shall ignore the message.

11.2.2   Skip Indicator

Bits 5 to 8 of octet 1 of a standard L3 message may contain the skip indicator IE. The skip indicator IE is a type 1 IE. It always has format V in a standard L3 message. The relevant protocol specification may define that a standard L3 message received with certain values of the skip indicator shall be ignored.

11.2.3   Transaction Identifier

Bits 5 to 8 of octet 1 of a standard L3 message may contain the transaction identifier (TI) IE. The TI IE is a type 1 IE and always has format V in a standard L3 message.

The TI IE is coded as shown in figure 11.2.1 and table 11.2.2. It is composed of the TI value and the TI flag.

The TI value and the TI flag occupy bits 5 - 7 and bit 8 of the first octet, respectively.

TI values are assigned by the side of the interface initiating a transaction. At the beginning of a transaction, a free TI value (i.e., a value not yet used for the given PD and with the given originator) is chosen and assigned to this transaction. It then remains fixed for the lifetime of the transaction. After a transaction ends, the associated TI value is free and may be reassigned to a later transaction.

Two identical transaction identifier values may be used when each value pertains to a transaction originated at opposite ends of the interface. In this case, the TI flag shall avoid ambiguity. The transaction identifier flag can take the values "0" or "1." The TI flag is used to identify which end of the radio interface originated a TI. The origination side always sets the TI flag to "0." The destination side always sets the TI flag to "1."

Hence, the TI flag identifies who allocated the TI value for this transaction, and the only purpose of the TI flag is to resolve simultaneous attempts to allocate the same TI value.

The TI may, in future evaluations of the L3 protocols, be extended by using a combination of bits in the TI value field that is specified as "reserved for future extension" in table 11.2.2.
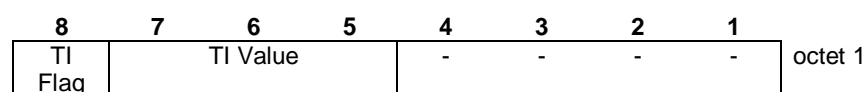
8	7	6	5	4	3	2	1	
TI Flag		TI Value		-	-	-	-	octet 1

Figure 11.2.1: Transaction Identifier

Table 11.2.2: Transaction Identifier

TI Flag (octet 1)			
Bit 8			
0		The message is sent <u>from</u> the side that originates the TI	
1		The message is sent <u>to</u> the side that originates the TI	
TI Value (octet 1)			
Bit 7 6 5			
0 0 0		TI Value	0
0 0 1			1
0 1 0			2
0 1 1			3
1 0 0			4
1 0 1			5
1 1 0			6
1 1 1		Reserved for future extension	

11.2.4 Message Type

In every standard L3 message, the third IE of the imperative part is the message type IE which is contained in octet 2 of the message.

When a standard L3 message is received that is too short to contain a complete message type information element, that message shall be ignored.

The message type IE is coded as shown in figure 11.2.2.

Bit 8 is encoded as "0," and value "1" is reserved for possible future use as an extension bit. A protocol entity receiving a standard L3 message containing a message type IE with bit 8 encoded as "1" shall treat the message type as "not defined" for the PD.

The MM messages and the CM messages using SAPI=0 sent from the User Terminal to the network specify the send sequence number N(SD) in bit 7. At the time when such a message is designated for transmission, the value of N(SD) for the message to be transferred is set equal to the value of the send state variable.

In all other standard layer 3 messages, bit 7 is set to "0" by the sending side. The receiving side shall ignore such messages if bit 7 is set to "1."
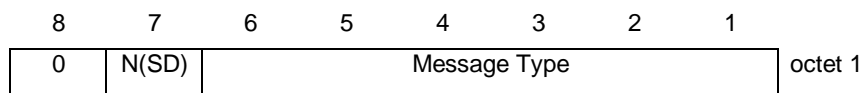
8	7	6	5	4	3	2	1	
0	N(SD)	Message Type						octet 1

Figure 11.2.2: Message Type Information Element

The message type determines the function of a message within a protocol in a given direction. The meaning of the message type is therefore dependent on the protocol (the same value may have different meanings in different protocols) and direction (the same value may have different meanings, in the same protocol, when sent from the User Terminal to the Network and when sent from the Network to the User Terminal).

The reaction of a protocol entity receiving a message with message type not defined for the PD in that direction is defined in the relevant protocol specification.

11.2.5   Further Information Elements of the Imperative Part

The message type IE of a standard L3 message may be followed by further IEs having the format V or LV as defined in the relevant protocol specification.

If a standard L3 message is received that is too short to contain the complete imperative part as specified in the relevant protocol specification, an imperative message part error is diagnosed. (The same error may be diagnosed at detection of certain contents of the imperative part of a message. This is defined in the relevant protocol specification.) The treatment of an imperative message part error is defined in the relevant protocol specification.

11.3   Non-Imperative Part of a Standard L3 Message

The imperative part of a standard L3 message is followed by the (possibly empty) non-imperative part. The relevant protocol specification defines where the imperative part of a standard L3 message ends. The non-imperative part of a standard L3 message is composed of (zero, one or several) IEs having the format T, TV or TLV. The receiver of a standard L3 message shall be prepared for the non-imperative part of the message to contain IEs that are not specified in the relevant protocol specification. The receiver will assume that the first octet of such IEs contains the IEI.

An IEI may be known in a message or unknown in a message. Whether it is known or unknown in the message is defined in the relevant protocol specification.

An IEI that is known in a message designates the IE type of the IE the first part of which the IEI is. Which IE type it designates is specified in the relevant protocol specification. Within a message, different lEls may designate the same IE type if that is defined in the relevant protocol specification.

Whether the second part of an IE with IEI known in a message is the length or not (in other words, whether the IEI is the first part of an IE formatted as TLV or not) is specified in the relevant protocol specification.

The relevant protocol specification defines which category and format of an IE the receiving side shall assume if the IE occurs in the non-imperative part of a received standard L3 message with IEI unknown in the message.

A message may contain two or more IEs with equal IEI.

11.4   Presence Requirements of Information Elements

The relevant protocol specification may define three different presence requirements (M, C or O) for an IE within a given message as shown below.

M ("Mandatory") means that the IE shall be included by the sending side and that the receiver diagnoses a missing mandatory IEI error when detecting that the IE is not present. An IE belonging to the imperative part of a message has presence requirement M. An IE belonging to the non-imperative part of a message may have presence requirement "M."

C ("Conditional") means that:

1) Inclusion of the IE by the sender depends on conditions specified in the relevant protocol specification;

2) There are conditions for the receiver to expect that the IE is present and/or conditions for the receiver to expect that the IE is not present. These conditions depend only on the message itself, and not on the state in which the message was received; they are known as static conditions;

3) The receiver detecting that the IE is not present, when sufficient static conditions are fulfilled for its presence, shall diagnose a "missing conditional IE" error;

4) The receiver detecting that the IE is present, when sufficient static conditions are fulfilled for its non-presence, shall diagnose an "unexpected conditional IE" error.

Only IEs belonging to the non-imperative part of a message may have presence requirement "C."

O ("Optional") means that the receiver shall never diagnose a "missing mandatory IE" error, a "missing conditional IE" error, or an "unexpected conditional IE" error because it detects that the IE is present or that the IE is not present. (There may, however, be conditions depending on the states, resources, etc. of the receiver to diagnose other errors.) Only IEs belonging to the non-imperative part of a message may have presence requirement "O."

11.5 Handling of Superfluous Information

All equipment should be able to ignore any extra information present in a standard L3 message, which is not required for the proper operation of that equipment. For example, a User Terminal may ignore the calling party BCD number if that number is of no interest to the User Terminal when a SETUP message is received.

11.5.1 Information Elements that are Unnecessary in a Message

The relevant protocol specification may define certain IEs to be unnecessary in a standard L3 message. A protocol entity detecting an unnecessary IE in a received standard L3 message shall ignore the contents of that IE for treating the message. It is not obliged to check whether the contents of the IE are syntactically correct.

History

Document history		
V1.1.1	March 2001	Publication