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GSM PROTOCOL STACK

MESSAGE SEQUENCE CHARTS

SUPPLEMENTARY SERVICES

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1.2 Abbreviations

AGCH	Access Grant Channel
BCCH	Broadcast Control Channel
BS	Base Station
BSIC	Base Station Identification Code
CBCH	Cell Broadcast Channel
CBQ	Cell Bar Qualify
CC	Call Control
CCCH	Common Control Channel
CCD	Condat Coder Decoder
CKSN	Ciphering Key Sequence Number
C/R	Command / Response
C1	Path Loss Criterion
C2	Reselection Criterion
DCCH	Dedicated Control Channel
DISC	Disconnect Frame
DL	Data Link Layer
DM	Disconnected Mode Frame
EA	Extension Bit Address Field
EL	Extension Bit Length Field
EMMI	Electrical Man Machine Interface
F	Final Bit
FACCH	Fast Associated Control Channel
FHO	Forced Handover
GP	Guard Period
GSM	Global System for Mobile Communication
HPLMN	Home Public Land Mobile Network
I	Information Frame
IMEI	International Mobile Equipment Identity
IMSI	International Mobile Subscriber Identity
Kc	Authentication Key
L	Length Indicator
LAI	Location Area Information
LPD	Link Protocol Discriminator
M	More Data Bit
MCC	Mobile Country Code

MM	Mobility Management
MMI	Man Machine Interface
MNC	Mobile Network Code
MS	Mobile Station
NCC	National Colour Code
NECI	New Establishment Causes included
N(R)	Receive Number
N(S)	Send Number
OTD	Observed Time Difference
P	Poll Bit
PCH	Paging Channel
PDU	Protocol Description Unit
P/F	Poll / Final Bit
PL	Physical Layer
PLMN	Public Land Mobile Network
RACH	Random Access Channel
REJ	Reject Frame
RNR	Receive Not Ready Frame
RR	Radio Resource Management
RR	Receive Ready Frame
RTD	Real Time Difference
SABM	Set Asynchronous Balanced Mode
SACCH	Slow Associated Control Channel
SAP	Service Access Point
SAPI	Service Access Point Identifier
SDCCH	Slow Dedicated Control Channel
SIM	Subscriber Identity Module
SMS	Short Message Service
SMSCB	Short Message Service Cell Broadcast
SS	Supplementary Services
TCH	Traffic Channel
TCH/F	Traffic Channel Full Rate
TCH/H	Traffic Channel Half Rate
TDMA	Time Division Multiple Access
TMSI	Temporary Mobile Subscriber Identity
UA	Unnumbered Acknowledgement Frame
UI	Unnumbered Information Frame
VPLMN	Visiting Public Land Mobile Network
V(A)	Acknowledgement State Variable
V(R)	Receive State Variable
V(S)	Send State Variable

1.3 Terms

Entity:	Program which executes the functions of a layer
Message:	A message is a data unit which is transferred between the entities of the same layer (peer-to-peer) of the mobile and infrastructure side. Message is used as a synonym to protocol data unit (PDU). A message may contain several information elements.
Primitive:	A primitive is a data unit which is transferred between layers on one component (mobile station or infrastructure). The primitive has an operation code which identifies the primitive and its parameters.
Service Access Point:	A Service Access Point is a data interface between two layers on one component (mobile station or infrastructure).

2 Overview

The Protocol Stacks are used to define the functionality of the GSM protocols for interfaces. The GSM specifications are normative when used to describe the functionality of interfaces, but the stacks and the subdivision of protocol layers does not imply or restrict any implementation.

The base of the Protocol Stack rests on the physical layer.

The Data Link Layer (DL) is used to handle an acknowledged connection between mobile and base station. The LAPDm protocol is used.

Radio Resource (RR) manages the resources of the air-interface. That means configuration of physical layer, cell selection and cell reselection, data transfer, RR-Connection handling.

Mobility Management (MM) handles registration aspects for the mobile station. It detects changes of location areas and updates a mobile station in the new location area.

Call Control (CC) provides the call functionality. This includes call establishment, call maintenance procedures like Hold, Retrieve or Modify, and call disconnection.

Supplementary Services (SS) handles all call independent supplementary services like call forwarding or call barring.

Short Message Services (SMS) is used for sending and receiving point-to-point short messages. Additionally the reception of cell broadcast short messages is included.

The man machine interface (MMI) is the interface to the user. Normally it is connected with a keypad as input device and a display as output device.

Between the several entities data interfaces are defined. These data interfaces are called Service Access Points (SAPs), indicating that an upper layer uses the services of a lower layer.

The SIM card used by MM, MMI and SMS in several ways. This document describes the services needed for the SIM application.

3 Overview

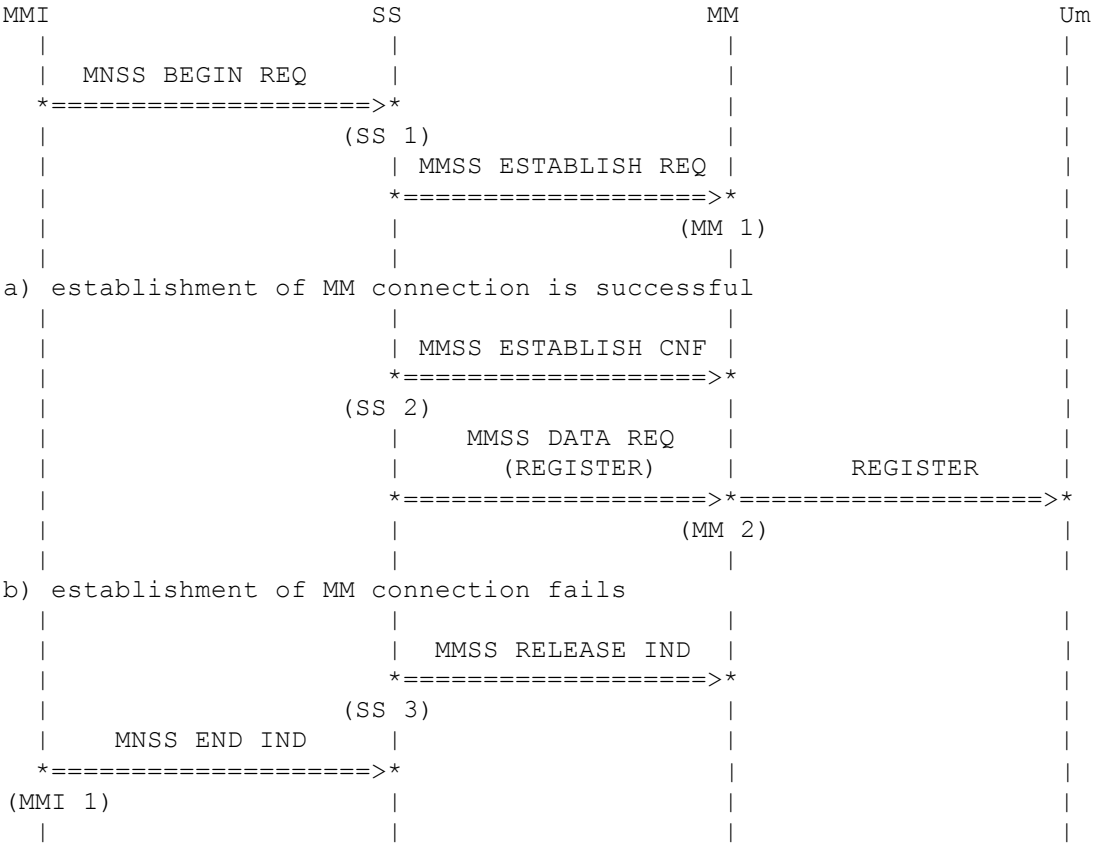
The protocol entity Supplementary Services (SS) is used to transport facility elements from and to the infrastructure for all call independent supplementary services.
It has the following states:

- IDLE — there is no existing connection
- MM CONNECTION PENDING — SS has requested a MM connection, but it is not confirmed
- CONNECTED — SS has a MM connection.

4 Procedures

4.1 Connection Establishment

4.1.1 Mobile Originated Connection Establishment



(SS 1)

MMI starts establishment of a connection. A facility information element and the SS version info are forwarded to SS. SS checks the transaction identifier. It is not expected that this leads to a problem, because the MS shall make no internal errors. If this check fails, the request is ignored.

(MM 1)

SS stores the facility and the SS version information element and requests a MM connection by MM. The new state of SS is MM CONNECTION PENDING. In this state SS awaits the confirmation for the MM connection.

(SS 2)

MM has established a MM connection successfully and confirms this to SS.

(MM 2)

Using the stored information elements for facility and SS version, SS codes a SS REGISTER message and sends this message to the infrastructure. Any SS transaction starts with the SS REGISTER message. SS enters the state CONNECTED.

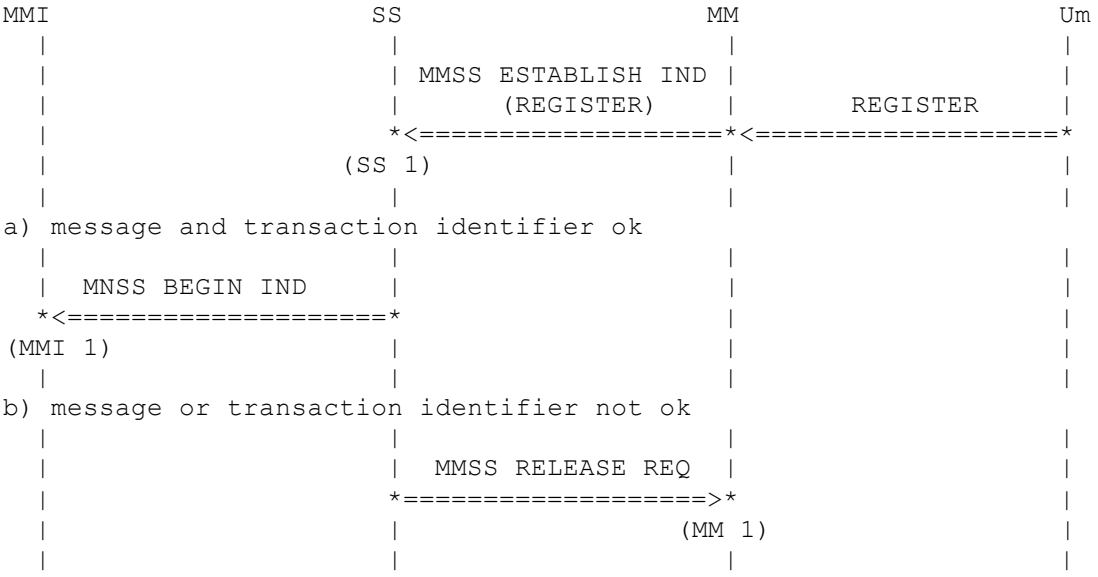
(SS 3)

MM was not able to establish a MM connection. This is signalled to SS.

(MMI 1)

MMI is informed about the release.

4.1.2 Mobile Terminated Connection Establishment



(SS 1)

SS receives a message. It must be a SS REGISTER message, because it is the first message of this transaction.

(MMI 1)

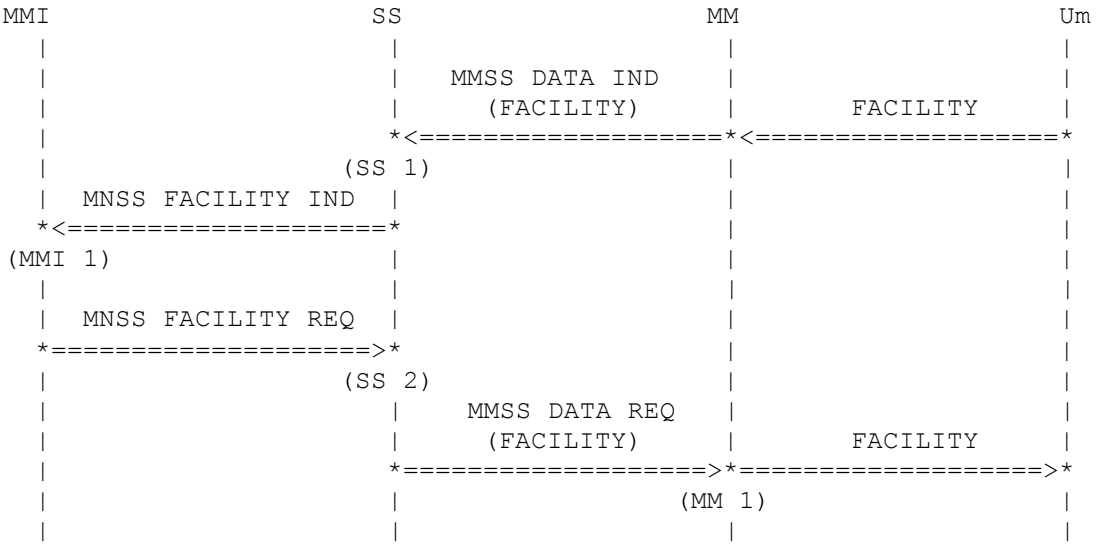
SS checks the message type and the transaction identifier. If it is a SS REGISTER message and the transaction identifier is not reserved and in the range for mobile terminated transactions, SS forwards the content (facility information) to MMI.

(MM 1)

If this check fails, SS ignores the message and releases the connection. MM is informed about this.

4.2 Connected

4.2.1 Exchange of Facility Messages



During a transaction (SS has the state CONNECTED) the mobile station and the infrastructure may exchange facility information elements with SS FACIILITY messages.

(SS 1)

The infrastructure sends a SS FACILITY message to the mobile station.

(MMI 1)

SS decodes the message and forwards the facility information element to MMI.

(SS 2)

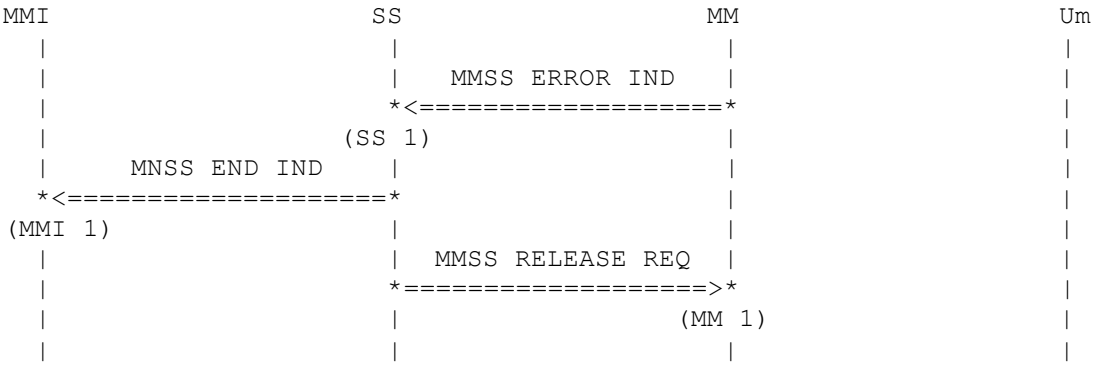
MMI will send a facility information to the infrastructure without releasing the connection.

(MM 1)

SS code the facility information element into a SS FACILITY message and forwards it to the infrastructure.

4.3 Connection Release

4.3.1 Call Reestablishment



(SS 1)

MM indicates an error in the lower layer with the possibility to reestablishment in the cell.

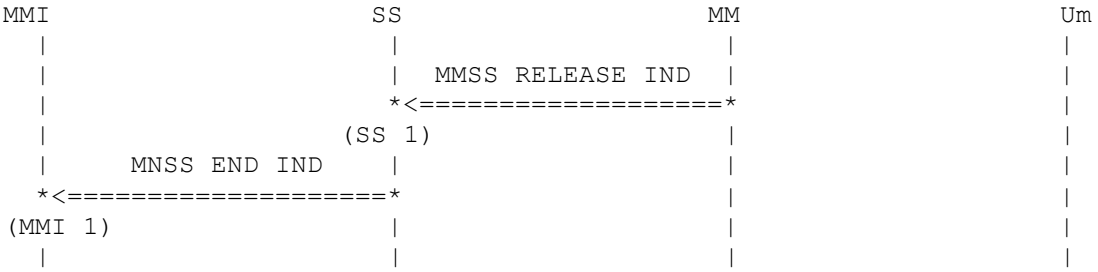
(MMI 1)

SS will not process reestablishment in general. MMI is informed about the end of the transaction.

(MM 1)

MM is informed about the end of transaction.

4.3.2 Release by Mobility Management



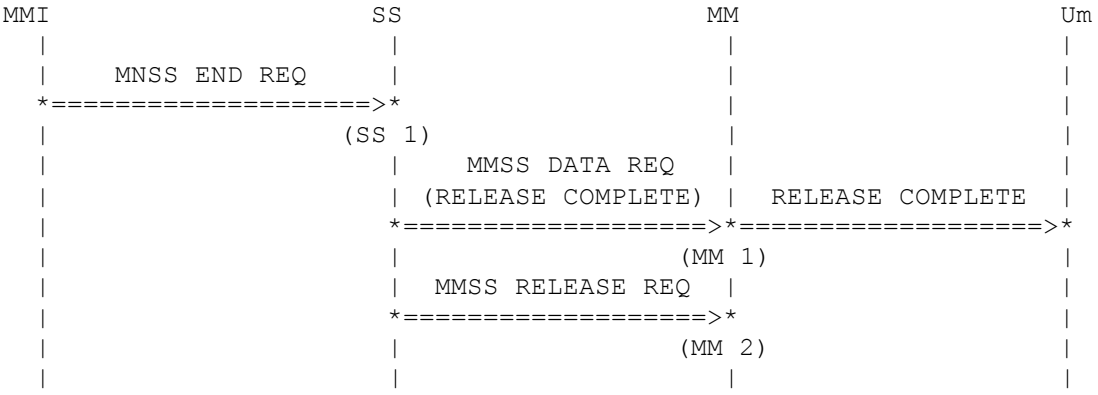
(SS 1)

MM indicates the connection release.

(MMI 1)

MMI is informed about the end of transaction.

4.3.3 Mobile Originated Connection Release



(SS 1)

MMI will release the transaction. The last message of a SS transaction is the SS RELEASE COMPLETE message.

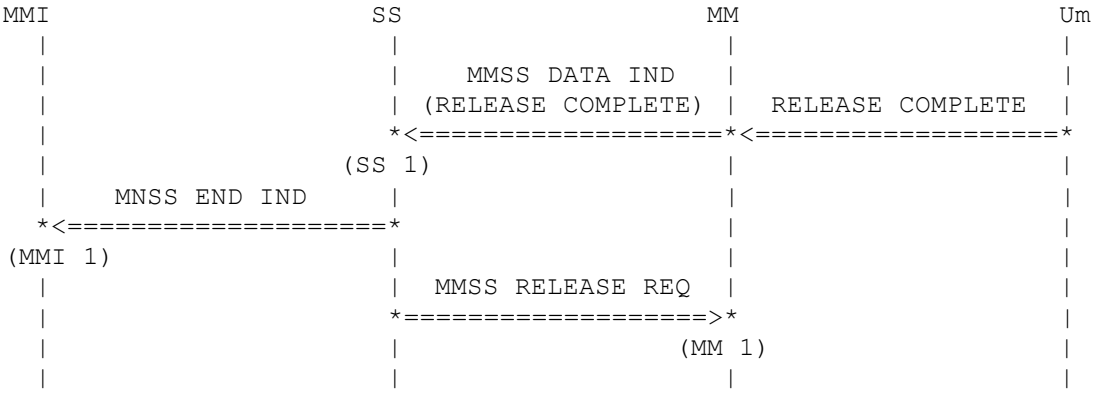
(MM 1)

SS codes the message and forwards it to the infrastructure.

(MM 2)

MM is informed about the end of transaction.

4.3.4 Mobile Terminated Connection Release



(SS 1)

The infrastructure will release the transaction. The last message of a SS transaction is the SS RELEASE COMPLETE message.

(MM 1)

SS decodes the message and forwards the content to MMI.

(MM 2)

MM is informed about the end of transaction.

Appendices

A. Acronyms

DS-WCDMA	Direct Sequence/Spread Wideband Code Division Multiple Access

B. Glossary

International Mobile Telecommunication 2000 (IMT-2000/ITU-2000)	Formerly referred to as FPLMTS (Future Public Land-Mobile Telephone System), this is the ITU's specification/family of standards for 3G. This initiative provides a global infrastructure through both satellite and terrestrial systems, for fixed and mobile phone users. The family of standards is a framework comprising a mix/blend of systems providing global roaming. <URL: http://www.imt-2000.org/>