GSM 03.40/1

CEPT/CCH/GSM

Version 2.01.01

Source: WP4

RECOMMENDATION : 03.40

TITLE : **Technical Realization of the Point-to-point Short Message Service**

DATE : November 18, 1988

LIST OF CONTENTS :

0. Scope
1. Introduction
2. Definitions and abbreviations
3. Services and service elements
4. Network Architecture
5. Service Centre and PLMN interconnection
6. Service Centre functionality
7. MS functionality
8. MSC functionality
9. Routing requirements
10. Protocols and protocol structure
11. Procedures within the point-to-point services

Annex 1: Use of ROSE SC <-> MSC

ORIGINAL LANGUAGE : English

NUMBER OF PAGES : 94

TABLE OF CONTENTS

Section	Page
0 Scope	1
1 Introduction	2
2 Definitions and abbreviations	3
2.1 Key definitions	3
2.2 Abbreviations	5
3 Services and service elements	6
3.1 Basic services	6
3.2 Service elements	8
3.2.1 Validity_Period	8
3.2.2 Service_Centre_Time_Stamp	8
3.2.3 Protocol_Identifier	8
3.2.4 More_Messages_to_Send	9
3.2.5 Messages_Waiting	9
3.2.6 Alert_SC	10
3.2.7 Options concerning MWF and MWD	11
3.3 Unsuccessful short message TPDU transfer SC -> MS	12
3.4 Unsuccessful short message TPDU transfer MS -> SC	14

Section	Page
4 Network architecture	16
5 Service Centre and PLMN interconnection	18
6 Service Centre functionality	22
6.1 Service Centre capabilities	22
6.2 SC functional requirements	22
7 MS functionality	24
7.1 MS capabilities	24
7.2 MS configuration	24
8 MSC functionality	25
8.1 MSC functionality related to SM_MT/PP	25
8.1.1 Functionality of the SMS-GMSC	25
8.1.2 Functionality of the MSC	26
8.2 MSC functionality related to SM_MO/PP	27
8.2.1 Functionality of the MSC	27
8.2.2 Functionality of the SMS-IWMSC	28

Section	Page
8.3 SMS-IWMSC functionality related to alerting	28
9 Routing requirements	29
9.1 Routing requirements concerning the SM_MT/PP	29
9.2 Routing requirements concerning the SM MO/PP	30
10 Protocols and protocol architecture	31
10.1 Protocol element features	32
10.1.1 Octet and Bit transmission order	32
10.1.2 Numeric representation	32
2.1 Integer representation	32
2.2 Octet representation	34
2.3 Semi-octet representation	34
2.4 Address fields	35
10.2 Service provided by the SM_TL	38
10.2.1 General	38
10.2.2 Service definition	38
10.2.3 Definition of primitives	40
3.1 TS_Deliver	40
3.2 TS_Report	41
3.3 TS_Submit	42
10.2.4 Definition of parameters	43
4.1 TS_Short_Message_Identifier	43
4.2 TS_Destination_Address	43
4.3 TS_Originating_Address	43
4.4 TS_Service_Centre_Address	43
4.5 TS_Protocol_Identifier	43
4.6 TS_Data_Coding_Scheme	44
4.7 TS_Service_Centre_Time_Stamp	44
4.8 TS_Messages_Waiting_Set	44

Section Page

4.9 TS_Priority 44
4.10 TS_Status_of_Report 44
4.11 TS_More_Messages_to_Send 44
4.12 TS_Validity_Period 45
10.2.5 PDU Type repertoire at SM_TL 46
5.1 SMS_DELIVER type 47
5.2 SMS_SUBMIT type 49
10.2.6 Definition of the SM_TPDU parameters 52
6.1 TP_Message_Type_Indicator (TP_MTI) 52
6.2 TP_More_Messages_to_Send (TP_MMS) 52
6.3 TP_Validity_Period_Format (TP_VPF) 52
6.4 TP_Message_Reference (TP_MR) 53
6.5 TP_Originating_Address (TP_OA) 53
6.6 TP_Destination_Address (TP_DA) 53
6.7 TP_Protocol_Identifier (TP_PID) 53
6.8 TP_Data_Coding_Scheme (TP_DCS) 53
6.9 TP_Service_Centre_Time_Stamp (TP_SCTS) 54
6.10 TP_Validity_Period 54
6.11 TP_User_Data_Length (TP_UDL) 55

10.3 Service provided by the SM_RL 56
10.3.1 General 56
10.3.2 Service definition 56
10.3.3 Definition of the primitives 61
3.1 RS_Data 61
3.2 RS_Report 62
3.3 RS_Error 62
3.4 RS_Alert 63
10.3.4 Definition of parameters 63
4.1 RS_Short_Message_Identifier 63
4.2 RS_Destination_Address 63
4.3 RS_Originating_Address 63
4.4 RS_Priority 63
4.5 RS_Reason 64
4.6 RS_Destination_Node_Address 64
4.7 RS_Alerting_MS 64
4.8 RS_Messages_Waiting_Set 64
4.9 RS_User_Information 64
10.3.5 PDU Type repertoire at SM_RL 65
5.1 RP_DATA 66

Section	Page
5.2 RP_ACK	68
5.3 RP_ERROR	69
5.4 RP_ALERT_SC	70
10.3.6 Definition of the SM_RPDU parameters	71
6.1 RP_Message_Type_Indicator (RP_MTI)	71
6.2 RP_Priority_Request (RP_PRI)	72
6.3 RP_MW_Set_Indication (RP_MSI)	72
6.4 RP_Message_Reference (RP_MR)	72
6.5 RP_International_MS_ISDN_Number (RP_MSIsdn)	72
6.6 RP_Number_of_MSIsdn_to_follow (RP_N_MSIsdn)	72
6.7 RP_Originating_Address (RP_OA)	73
6.8 RP_Destination_Address (RP_DA)	73
6.9 RP_Cause (RP_CS)	74
6.10 RP_User_Data_Length (RP_UDL)	74
11 Fundamental procedures within the point-to-point SMS	75
11.1 Short message mobile terminated	76
11.2 Short message mobile originated	88
11.3 Alert transfer	93

0 Scope

This recommendation describes the point-to-point Short Message Service (SMS) of the GSM PLMN system. It defines:

- the services and service elements,
- the network architecture,
- the Service Centre functionality,
- the MSC functionality (with regard to the SMS),
- the routing requirements,
- the protocols and protocol layering,

for the Teleservices 21 and 22, as specified in the Rec. GSM 02.03.

The use of radio resources for the transfer of short messages between the MS and the MSC is described in Rec. GSM 04.11 'Point-to-Point Short Message Services Support on Mobile Radio Interface', and is dealt with in that recommendation.

The network aspects of short message service provision are outside the scope of this recommendation (i.e. the provision of network connectivity between the PLMN subsystems). The required and assumed network service offered to the higher layers is defined in this recommendation.

The Cell Broadcast Short Message Service (Teleservice 23) is a separate service, and is described in Rec. GSM 03.41 'Technical Realization of Cell Broadcast Short Message Service'.

1 Introduction

The Point-to-Point Short Message Service (SMS) provides a means of sending messages of limited size to and from GSM mobiles. The provision of SMS makes use of a Service Centre, which acts as a store and forward centre for short messages. Thus a GSM PLMN needs to support the transfer of short messages between Service Centres and mobiles.

Two different point-to-point services have been defined: mobile originated and mobile terminated. Mobile originated messages will be transported from an MS to a Service Centre. These may be destined for other mobile users, or for subscribers on a fixed network. Mobile terminated messages will be transported from a Service Centre to an MS. These may be input to the Service Centre by other mobile users (via a mobile originated short message) or by a variety of other sources, e.g. speech, telex, or facsimile.

2 Definitions and abbreviations

2.1 Key definitions

Active MS: A switched-on mobile station with a SIM module attached.

Alert SC: Service element provided by a GSM PLMN to inform an SC which has previously initiated unsuccessful short message delivery attempt(s) to a specific MS, that the MS is now recognized by the PLMN to have recovered operation.

Gateway MSC for Short Message Service (SMS-GMSC): An MSC capable of receiving a short message from an SC, interrogating an HLR for routing information and SMS info, and delivering the short message to the VMSC of the recipient MS.

Interworking MSC for Short Message Servive (SMS-IWMSC): An MSC capable of receiving a short message from within the PLMN and submitting it to the recipient SC, either via the PSPDN or on a dedicated connection to that SC.

Messages Waiting (MW): Service element that makes a PLMN store information (Messages_Waiting_Indication), listing those SCs that have made unsuccessful short message delivery attempts to MSs in that PLMN.

Messages Waiting Indication (MWI): Data to be stored in the HLR and VLR with which an MS is associated, indicating that there is one or more messages waiting in a set of SCs to be delivered to the MS (due to unsuccessful delivery attempt(s)).

Messages Waiting Data (MWD): The part of the MWI to be stored in the HLR. MWD consists of an address list of the SCs which have messages waiting to be delivered to the MS.

Messages Waiting Flag (MWF): The part of the MWI to be stored in the VLR. MWF is a boolean parameter indicating if the address list of MWD is empty (no SC has any messages waiting to be delivered to the MS) or not.

More Messages to Send (MMS): Service element offering an MS receiving a short message from an SC the information whether there are still more messages waiting to be sent from that SC to the MS. The More_Messages_to_Send service element makes use of the TP_More_Messages_to_Send field within the SMS_DELIVER to convey this information.

Protocol Identifier: Service element by which the originator of a short message (either an SC or an MS) may refer to a higher layer protocol.

Report: Response from either the network or the recipient upon a short message being sent from either an SC or an MS. A report may be a delivery report, which confirms the delivery of the short message to the recipient, or it may be a failure report, which informs the originator that the short message was never delivered and the reason why.

Service Centre (SC): Function responsible for the relaying and store-and-forwarding of a short message between an SMT and an MS. The SC may or may not be part of the GSM PLMN.

Short Message Terminal (SMT): A terminal which may send or receive short messages. The SMT includes an SM_AL entity and may be located either in a fixed network, an MS, or an SC.

SMS DELIVER: Short message transfer protocol data unit containing user data (the short message), being sent from an SC to an MS.

SMS SUBMIT: Short message transfer protocol data unit containing user data (the short message), being sent from an MS to an SC.

Service Centre Time Stamp (SCTS): Service element offering the recipient of a short message the information of when the message arrived at the SM_TL entity of the SC. The time of arrival comprises the year, month, day, hour, minute, second and time zone. The SCTS makes use of the TP_SCTS field within SMS_DELIVER.

Validity Period (VP): Service element offering the origiator MS to indicate the time period during which the originator considers the short message to be valid. VP makes use of the TP_Validity_Period field of the SMS_SUBMIT to convey the information to the SC.

2.2 Abbreviations

CUG	: Closed User Group
MS	: Mobile Station
MSIsdn	: ISDN number of the mobile subscriber
MTO	: Mobile Terminal with support of no terminal interfaces
CSPDN	: Circuit Switched Public Data Network
ISDN	: Integrated Services Digital Network
PLMN	: Public Land Mobile Network
PSPDN	: Packet Switched Public Data Network
ROSE	: Remote Operations Service Element
MAP	: Mobile Application Part
SM MT/PP	: Short Message Mobile Terminated Point-to-Point
SM MO/PP	: Short Message Mobile Originated Point-to-Point
SM_AL	: Short Message Application Layer
SM_TL	: Short Message Transfer Layer
SM_RL	: Short Message Relay Layer
SM_LL	: Short Message Lower Layer
SM_AP	: Short Message Application layer Protocol
SM_TP	: Short Message Transfer layer Protocol
SM_RP	: Short Message Relay layer Protocol
SM_LP	: Short Message Lower layer Protocol
SM_TS	: Short Message Transfer Service
SM_RS	: Short Message Relay Service
SM_LS	: Short Message Lower Service
SMS	: Short Message Service
APDU	: Application protocol data unit
TPDU	: Transfer protocol data unit
RPDU	: Relay protocol data unit

3 Services and service elements

The SMS provides a means to transfer short messages between a GSM PLMN MS and an SMT via an SC. The SC is serving as an interworking and relaying function of the message transfer between the MS and the SMT.

This recommendation describes only the short message point-to-point services between the MS and SC. It may, however, refer to possible higher layer applications.

3.1 Basic services

The short message point-to-point services comprise two basic services:

SM MT/PP (Short Message Mobile Terminated Point-to-Point),
SM MO/PP (Short Message Mobile Originated Point-to-Point).

SM MT/PP denotes the capability of the GSM system to transfer a short message submitted by the SC to one single MS, and to provide information about the delivery of the short message either by a delivery report or a failure report with a specific mechanism for later delivery; see Figure 03.40/1.

SM MO/PP denotes the capability of the GSM system to transfer a short message submitted by the MS to one single SMT via an SC, and to provide information about the delivery of the short message either by a delivery report or a failure report. The message must include the address of that SMT to which the SC should eventually relay the short message; see Figure 03.40/2.

The text messages to be transferred by means of the SM MT/PP or SM MO/PP contain up to 180 octets.

Figure 03.40/1 The short message service mobile terminated, point-to-point.

Figure 03.40/2 The short message service mobile originated, point-to-point.

An active MS shall be able to receive a short message TPDU (SMS_DELIVER) at any time, independently of whether or not there is a speech or data call in progress. A report will always be returned to the SC; either confirming that the MS has received the short message, or informing the SC that it was impossible to deliver the short message TPDU to the MS, including the reason why.

An active MS shall be able to submit a short message TPDU (SMS_SUBMIT) at any time, independently of whether or not there is a speech or data call in progress. A report will always be returned to the MS; either confirming that the SC has received the short message TPDU, or informing the MS that it was impossible to deliver the short message TPDU to the SC, including the reason why.

NOTE: When the transmission or reception of a short message coincide with a change of state in the MS, i.e. from busy to idle or from idle to busy, or during a handover, the short message transfer might be aborted.

3.2 Service elements

The SMS comprises 6 service elements particular to the submission and reception of messages:

Validity_Period
Service_Centre_Time_Stamp
Protocol_Identifier
More_Messages_to_Send
Messages_Waiting
Alert_SC

3.2.1 Validity Period

The Validity_Period is the service element which gives an MS submitting an SMS_SUBMIT to the SC the possibility to include a specific time period value in the short message (TP_Validity_Period field, see section 10). The TP_Validity_Period parameter value indicates the time period for which the short message is valid, i.e. for how long the SC should guarantee its existence in the SC memory before delivery to the recipient has been carried out.

3.2.2 Service Centre Time Stamp

The Service_Centre_Time_Stamp is the service element by which the SC informs the recipient MS about the time of arrival of the short message at the SM_TL entity of the SC. The time value is included in every SMS_DELIVER (TP_Service_Centre_Time_Stamp field, see section 10) being delivered to the MS.

3.2.3 Protocol Identifier

The Protocol_Identifier is the service element by which the SM_TL refers to the higher layer protocol being used. The Protocol_Identifier service element makes use of a particular field in the message types SMS_SUBMIT and SMS_DELIVER, TP_Protocol_Identifier (TP_PID).

3.2.4 More Messages to Send

The More_Messages_to_Send is the service element by which the SC informs the MS that there is one or more messages waiting in that SC to be delivered to the MS. The More_Messages_to_Send service element makes use of a boolean parameter in the message SMS_DELIVER, TP_More_Messages_to_Send (TP_MMS).

3.2.5 Messages Waiting

The Messages_Waiting is the service element that enables the PLMN to provide the HLR and VLR with which the recipient MS is associated with the information that there is a message in the originating SC waiting to be delivered to the MS. The service element is only used in case of previous unsuccessful delivery attempt(s) due to temporarily absent mobile. This information, denoted the Messages_Waiting_Indication (MWI), consists of Messages_Waiting_-Data (MWD) located in the HLR and the Messages_Waiting_Flag (MWF) located in the VLR, as depicted in Figure 03.40/3.

Figure 03.40/3. Structuring of the Messages_Waiting_Indication (MWI) in the HLR and VLR.

The MWD is a list, where each list element is an E.164 or X.121 address (SC_Addr) of an SC which has made previous unsuccessful delivery attempts of a message destined for the actual MS.

The Messages_Waiting_Flag (MWF) within the VLR is a boolean parameter with the value FALSE when the list MWD is empty, and with the value TRUE when the list contains one or more list elements.

The MWD and MWF are updated in the following way:

1a. When an SC initiates a short message delivery attempt to an MS of which the MW_flag = FALSE and the MWD list is empty, and the attempt fails due to the MS being absent (i.e. either IMSI DETACH flag is set or there is no response from the MS on the paging request), the SC address is inserted in the MWD list and the MWF is set, as described in section 11.

1b. When an SC initiates a short message delivery attempt to an MS of which the MWD list is not empty, the following will occur:

- When RP_Priority_Request = TRUE: The delivery attempt will be carried out. If the delivery attempt fails, the SC address is inserted in the MWD list and the MWF is set, as described in section 11.

- When RP_Priority_Request = FALSE: The HLR inserts the SC address in the MWD list (if it is not already there), and rejects the message transfer attempt.

2. When either the HLR or VLR detects that the MS (with a non-empy MWD in the HLR and the MW_flag = TRUE in the VLR) has recovered operation (e.g. has responded to a paging request), the HLR directly or on request of the VLR will invoke operations to alert the SCs within the MWD (see section 3.2.6 and section 11).

3.2.6 Alert SC

The Alert_SC is the service element, which may be provided by some GSM PLMNs, to inform the SC that an MS

1) to which there has been an unsuccessful delivery attempt and
2) which is now recognized by the PLMN to have recovered operation (e.g. to have responded to a paging request),

is again attainable. The SC may - on reception of an Alert_SC - initiate the delivery attempt procedure for the queued messages destined for this MS.

In the cases where the mobile subscriber is identified by several MSIsdn identities (i.e. several MSIsdn identities are stored in the HLR), the Alert_SC shall provide the SC with all the MSIsdn identities.

NOTE: Repeated delivery attempts from the SC may be of two types:

i) A repeated delivery attempt because the SC has been informed that the MS is active and available to receive short messages.

ii) An autonomous repeated delivery attempt by the SC.

The application of these two options is defined by the providers of the SC and the network.

3.2.7 Options concerning MWF and MWD

Setting the Messages_Waiting_Flag (MWF) in the VLR is mandatory. It is also mandatory for the VLR to send the 'MS Present' message (see section 11) to the HLR when MS becomes active and then to clear MWF. The way to provide MS activity detection is described in Rec. GSM [03.01].

The Messages_Waiting_Data (MWD) within the HLR is optional. This is linked to the transmission of the 'Alert SC' message.

The following describes what happens when a delivery fails.

Case 1: MWD is implemented in the HLR

In the case of a delivery failure (to an MS), the MSC requests the HLR to add, if needed, a new entry in the MWD. This new entry contains the SC address. The SC is notified of the failure and also of the MWD setting in the HLR within the Report message (see section 11).

If the HLR indicates that it is able to store the SC address, then the SC will receive an Alert SC message when the MS becomes active.

If the HLR indicates that it is unable to store the SC address (e.g. because MWD is full), then the only way to ensure delivery is for the SC to try to retransmit the message periodically.

When the HLR receives the MS Present message, it sends an Alert SC message to the concerned SC and updates MWD.

Case 2: MWD is not implemented in the HLR

In the case of a delivery failure, the SC is notified that the

HLR is unable to store its address in the MWD. The SC must retransmit the short message periodically in order to ensure delivery.

The HLR discards the MS Present message received from the VLR without any failure or error report.

3.3 Unsuccessful short message TPDU transfer SC -> MS

Unsuccessful message transfer SC -> MS may be caused by the following errors:

1) Unknown subscriber. The PLMN is unable to identify a mobile subscriber from the MS ISDN value contained in the short message TPDU.

2) Subscription not provided. The PLMN rejects the short message TPDU because the recipient MS has no SMS subscription (cf description of 'Send routing information for SMS', Rec. GSM 09.02).

3) CUG reject. The PLMN rejects the short message TPDU due to the setting of the Closed User Groups (cf description of 'Send routing information for SMS', Rec. GSM 09.02, and description of the Closed User Group supplementary service, Rec. GSM 02.04 and 03.11).

4) Call barred. The PLMN rejects the short message TPDU due to barring of the MS (cf description of 'Send routing information for SMS', Rec. GSM 09.02, and description of the Barring supplementary service, Rec. GSM 02.04 and 03.11).

5) Forwarding violation. The PLMN rejects the short message TPDU due to violation of call forwarding (cf description of 'Send routing information for SMS', Rec. GSM 09.02, and description of the call forwarding supplementary service, Rec. GSM 02.04 and 03.11).

6) SMS low layers capabilities not provisioned. The MS rejects the short message TPDU due to being unable to establish connection at SAPI = 3 (cf Rec. GSM 04.08).

7) Teleservice not provisioned in the VPLMN. The VPLMN rejects the short message TPDU due to no provision of the SMS in the VPLMN (cf description of 'Forward MS terminated short message', Rec. GSM 09.02).

8) Absent subscriber. The PLMN rejects the short message TPDU due to no paging response (cf Rec. GSM 04.08) or IMSI DETACH (cf description description of 'Send information for I/C call set-up', Rec. GSM 09.02).

9) Roaming not allowed. The PLMN rejects the short message TPDU due to roaming restrictions (cf description of 'Send routing information for SMS', Rec. GSM 09.02).

10) Illegal subscriber. The PLMN rejects the short message TPDU due to incorrect authentication (cf Rec. GSM 04.08).

11) System failure. The PLMN rejects the short message TPDU due to any technical error occurring in the PLMNs.

12) Overflow. The PLMN rejects the short message TPDU due to temporary traffic overload.

13) MS not equipped for SMS. The PLMN or MS rejects the short message TPDU due to MS not being equipped to receive short messages. This information is contained in the classmark (see Rec. GSM 04.08).

14) MS memory capacity exceeded. The MS does not confirm to have stored the short message TPDU due to lack of free memory capacity.

15) Protocol error in MS. The MS rejects the short message TPDU due to protocol error discovered at the MS.

These error indications are passed through the PLMN, whereas a modified set of error indications are returned to the SC. The relation between the two sets of error indications is given in Table 03.40/1. Each error is classified as either 'Temporary' or 'Permanent'. This classification refers to the recommended actions to be taken by the SC, i.e. either to store the short message TPDU for later transfer attempts, or to discard it.

Error indication to be passed within PLMNs	Status (T: Temporary, P: Permanent)	Error indication to be passed to SC
Unknown subscriber	P	Unknown subscriber
CUG reject	P	CUG reject
Subscription not provided	P	Subscription not provided
Call barred	T	Call barred
Forwarding violation	T	Forwarding violation
Absent subscriber	T	MS not attainable
Roaming not allowed	T	
Teleservice not provisioned in the VPLMN	T	
System failure	T	PLMN failure
Illegal subscriber	T	
Overflow	T	
MS not equipped for SMS	T	MS unable to receive message
SMS low layer capab. not provisioned	T	
Memory capacity exceeded	T	Error in the MS
Protocol error at MS	T	

Table 03.40/1. Error indications related to mobile terminated short message transfer.

3.4 Unsuccessful short message TPDU transfer MS -> SC

Unsuccessful message transfer MS -> SC may be caused by the following errors:

1) Unknown SC. The PLMN is unable to identify the SC.

2) CUG reject. (Cf section 3.3 and description of 'Send information for O/G call set-up', Rec. GSM 09.02).

3) Call barred. (Cf section 3.3 and description of 'Send information for O/G call set-up', Rec. GSM 09.02).

4) No SC answer. The SC does not respond to the request by the PLMN to submit the short message TPDU.

5) SC reject. [For further study].

6) System failure. (Cf section 3.3).

7) Overflow. (Cf section 3.3).

8) Missing network contact. The MS does not manage to transfer the short message TPDU to the MSC (cf Rec. GSM 04.08 and 04.11). This error indication is a local error and will not be transferred in the network.

These error indications except 'Missing network contact' are passed through the PLMN, whereas a modified set of error indications are returned to the MS. The relation between the two sets of error indications is given in Table 03.40/2. Each error is classified as either 'Temporary' or 'Permanent'. This classification refers to the actions that might be taken by the MS, i.e. either to store the message for later transfer attempts, or to discard it.

Error indication to be passed within PLMNs	Status (T: Temporary, P: Permanent)	Error indication to be passed to MS
Unknown SC	P	Unknown SC
CUG reject	P	CUG reject
Call barred	T	Call barred
No SC answer	T	SC not attainable
SC reject	T	
System failure	T	PLMN failure
Overflow	T	

Table 03.40/2. Error indications related to mobile originated short message transfer.

4 Network architecture

The exchange of messages between an MS and an SMT involves the network entities shown in Figure 03.40/4.

The basic network structure of the SMS are depicted in Figure 03.40/5.

*) : SMS-GMSC when the short message is transferred from the SC to the MS, SMS-IWMSC when the short message is transferred from the MS to the SC.

Figure 03.40/4. Entities involved in the provision of SM MT/PP and SM MO/PP: SC, SMS-GMSC / SMS-IWMSC, MSC, BSS and MS.

The links of Figure 03.40/5 support the short message transfer in the following way:

- message transfer on link 1 is described in section 5,
- the operations performed on links 2 and 4 is described in Rec. GSM 09.02,
- message transfer on link 3 is described in section 5,
- message transfer on link 5 is supported by protocols described in Rec. GSM 04.11.

Figure 03.40/5. The main network structure serving as a basis for the short message transfer.

5 Service Centre and PLMN interconnection

This recommendation deals with the SC only as a relaying node in the interchange of messages between an SMT and an MS. As the SC is regarded as a node outside the PLMN, only the requirements put upon the SC by the SMS functionality are specified in this recommendation.

One SC may be connected to several PLMNs, and may be connected to several MSCs (SMS-GMSCs or SMS-IWMSCs) within one and the same PLMN.

The SC may be connected to a MSC (SMS-GMSCs or SMS-IWMSCs) in the following two ways:

1) Fixed SC <-> MSC interworking point
2) Variable SC <-> MSC interworking point.

Case 1) may be characterized by the following aspects:

- for mobile originated short message transfer, the SC is only accessible through one and only one SMS-IWMSC and is uniquely identified by an E.164 address. When the SC uses this connection for a mobile terminated short message transfer, it will use this E.164 address as the originator address. When the MS wants to address this SC for a mobile originated short message transfer, it will use this E.164 address as the destination address;

- the PLMN requires one E.164 address for each fixed SC <-> MSC interworking point;

- there may be an intermediate network between the PLMN and the SC; in this case, the PLMN must autonomously make a connection to the SC using the SC address in this intermediate network;

- the protocol between the SC and the MSC in case 1) is a matter between the operator(s) of the SC and the PLMN of the MSC, and will not be defined in this recommendation;

- in case 1) the SC and the MSC may technically be regarded as integrated.

Case 2) may be characterized by the following aspects:

- for mobile originated short message transfer, the SC is accessible via possibly many distinct SMS-IWMSCs and one or more PSPDNs;

- the SC is uniquely identified by an X.121 address. When the SC uses a PSPDN connection for a mobile terminated short message transfer, it will use this X.121 address as the originator address. When the MS wants to address this SC for a mobile originated short message transfer, it will use this X.121 address as the destination address;

- the protocol between the SC and the MSC in case 2) is based upon ROSE (CCITT Rec.X.219 and X.229), and is given in Annex 1.

Figure 03.40/6 shows some routing scenarios in the case of fixed and variable interworking points.

For the mobile terminated case:

- when the SC is connected to the PLMN via a fixed interworking point, the SC will indicate within the short message transfer to the PLMN the MSIsdn address; the short message may then be routed through one or more PLMNs;

- when the SC is connected to PLMN(s) via variable SC <-> MSC interworking points, and needs to route a short message to an MS (identified by MSIsdn address), it must retrieve the X.121 address of the required variable SC <-> MSC interworking point. In this case, the short message may be routed through one or more PSPDNs and PLMNs.

For the mobile originated case:

- when the destination of the short message (SC) sent by the MS is identified by an E.164 address the PLMN will route the short message to the relevant SC (SC(A) or SC(B)) via the fixed SC <-> MSC interworking point. In this case the short message may be routed through one or more PLMNs;

- when the destination of the short message (SC) sent by the MS is identified by an X.121 address the PLMN has various possibilities to route the short message to the relevant SC (SC(B)). The PLMN will use a variable SC <-> MSC interworking point as an exit point from the PLMN. In this case the short message may be routed through one or more PSPDNs and PLMNs.

Figure 03.40/6. Network structure showing the possible routing schemes between the SC and the MS.

Tables 03.40/3 and 03.40/4 give a summary of addresses used by the MS or the SC (in the mobile originated and mobile terminated case respectively) and used by the PLMN.

The SCs may have functionalities beyond what is required by the SMS described in this recommendation. These will be related to entities above the layers fully described in this recommendation. It could also well happen that SCs are interconnected, and that a message transfer could go via more than one SC. This is also outside the scope of this recommendation.

Type of interworking point	SC address provided by MS for mobile originated short message transfer	SC address in intermediate network used by PLMN
Fixed - direct conn.	E.164 (PLMN)	Not applicable
Fixed - switched conn. - PSPDN - CSPDN - ISDN	E.164 (PLMN)	 X.121 X.121 E.164 (ISDN)
Variable - PSPDN	E.164 (PLMN)	X.121

Table 03.40/3 SC addresses involved in SM MO/PP.

Type of interworking point	Recipient address (MS) used by the SC for mobile terminated short message transfer	SMS-GMSC address to be used by the SC
Fixed - direct conn.	MSIsdn	Not applicable
Fixed or variable - switched conn. - PSPDN - CSPDN - ISDN	MSIsdn	 X.121 X.121 E.164

Table 03.40/4 Addresses involved in SM MT/PP.

6 Service Centre functionality

In this recommendation, only the SC functionality related to the short message point-to-point service between the SC and the MS is specified.

6.1 Service Centre capabilities

The SC should be capable of

- submitting a short message to an MS, retaining the responsibility of the message until

  1) the report has been received, or

  2) the Validity_Period expires;

- receiving a report from the PLMN;

- receiving a short message from an MS;

- returning a report to the PLMN for a previously received short message.

6.2 SC functional requirements

The detailed functionality of the SC is outside the scope of this recommendation, and is for the SC operator to define. However, the following functional requirements are mandatory for all SCs in order to support the SM_TP (see section 10) towards the PLMN:

1) To identify each SMS_DELIVER sent to an MS in a unique way, a time stamp value is included in the field TP_Service_Centre_Time_Stamp, TP_SCTS, of the SMS_DELIVER. The time stamp gives the time when the message arrived at the SC with the accuracy of a second. If two or more messages to the same MS arrive at the SC within one second, the SC shall modify the time stamp of those messages in such a way that

   a) all messages to the MS contain different time stamps
   b) the modification of the time stamps is kept to a minimum.

   In the case that the SMS_DELIVER is originated by the SC and not by an SMT, the SCTS gives the time when the message is originated. The requirements a) and b) apply also in this case.

2) The SC is only allowed to have one outstanding SMS_DELIVER to a specific MS at a given time.

7 MS functionality

In this recommendation, only the MS functionality related to the short message point-to-point service between the SC and the MS is specified.

7.1 MS capabilities

The MS, when equipped for SMS, should be capable of

- submitting a short message TPDU to an SC, retaining the responsibility of the message until

  1) the report arrives from the network, or

  2) a timer expires;

- receiving a short message TPDU from an SC;

- returning a delivery report to the network for a previously received short message;

- receiving a report from the network.

7.2 MS configuration

The reference configuration is assumed as in picture 03.40/7, i.e. only the case where the terminal is integrated in the MS is considered.

Figure 03.40/7. Reference configuration of the MS which apply to the SMS.

Note: It is foreseen that a terminal interface may be offered, e.g. for higher layer protocols, memory capacity reasons or to be able to type in mobile originated messages. This terminal interface is regarded as an implementation option, although, where offered, it

must be based upon an R- or S-interface.

8 MSC functionality

The overall requirements to the MSC with respect to handling of the short message point-to-point service is to cater for the routing and necessary intermediate buffering of the short messages.

8.1 MSC functionality related to SM MT/PP

8.1.1 Functionality of the SMS-GMSC

When receiving a short message TPDU from the SC, the SMS-GMSC is responsible for the following operations:

- reception of the short message TPDU,

- inspection of the parameters,

  (Note: The SMS-GMSC may be identical to the MSC),

if parameters are incorrect:

- returning the appropriate error information to the SC in a failure report (cf section 10 and 11)

if errors are not found within parameters:

- interrogating the HLR ('Send Routing Information for SMS', cf Rec. GSM 09.02); retrieving routing information or possible error information,

if HLR is returning error information:

- returning the appropriate error information to the SC in a failure report (cf section 10 and 11)

if no errors are indicated by the HLR:

- transferring the short message TPDU to the MSC using the routing information obtained from the HLR ('Forward MS Terminated Short Message', cf Rec GSM 09.02).

When receiving the report associated with the short message from the MSC (positive or negative outcome of 'Forward MS Terminated Short Message', cf Rec. GSM 09.02), the SMS-GMSC is responsible for the following operations:

if the report is a failure report indicating 'absent subscriber' or 'roaming not allowed' (cf section 3.3): requesting the HLR to insert the address of the originating SC into the MWD (if implemented) ('Set Short Messages Waiting Data in HLR', cf rec GSM 09.02),

- creating and sending the report to the SC (cf section 10 and 11).

8.1.2 Functionality of the MSC

When receiving a short message TPDU from the SMS-GMSC ('Forward MS Terminated Short Message', cf 09.02), the MSC is responsible for the following operations:

- reception of the short message TPDU,

- retrieving information from the VLR ('Send Information for I/C call set-up', cf 09.02); location area address and, when appropriate, error information,

if errors are indicated by the VLR:

- returning the appropriate error information to the SMS-GMSC in a failure report (negative outcome of 'Forward MS Terminated Short Message' cf Rec. GSM 09.02),

if no errors are indicated by the VLR:

- transferring the short message to the MS (cf Rec. GSM 04.11).

When receiving a confirmation that the message is received by the MS (cf Rec GSM 04.11):

- relaying the delivery confirmation to the SMS-GMSC in a delivery report (positive outcome of 'Forward MS Terminated Short Message', cf Rec. GSM 09.02).

When receiving an failure report of the short message transfer to the MS (cf Rec. GSM 04.11):

- returning the appropriate error information to the SMS-GMSC in a failu-

re report (negative outcome of 'Forward MS Terminated Short Message', cf Rec. GSM 09.02).

8.2 MSC functionality related to SM MO/PP

8.2.1 Functionality of the MSC

When receiving a short message TPDU from the MS, the MSC is responsible for the following operations:

- reception of the short message TPDU[1]) (cf Rec GSM 04.11)

- inspection of the parameters,

  [1]) : the reception of the short message TPDU is followed by the VLR investigating the MWF (to be used in the alerting procedure, see section 11)

if parameters are incorrect:

- returning the appropriate error information to the MS in a failure report (cf Rec. GSM 04.11),

if no parameter errors are found:

- examination of the destination address,

  (Note: The SMS-IWMSC may be identical to the MSC),

- transferring the short message TPDU to the SMS-IWMSC ('Forward MS Originated Short Message', cf Rec. GSM 09.02).

When receiving the report of the short message from the SMS-IWMSC (positive or negative outcome of the 'Forward MS Originated Short Message', cf 09.02), the MSC is responsible for the following operations:

- relaying the report to the MS (cf Rec. GSM 04.11).

8.2.2 Functionality of the SMS-IWMSC

When receiving a short message TPDU from the MSC ('Forward MS Originated Short Message', cf 09.02), the SMS-IWMSC is responsible for the following operations:

- reception of the short message TPDU,
- examination of the destination address
- transferring the short message TPDU to the SC (if the address is valid).

If a report associated with the short message is received from the SC, the SMS-IWMSC is responsible for the following operations:

- relaying of the report to the MSC (positive or negative outcome of 'Forward MS Originated Short Message Transfer', cf Rec. GSM 09.02).

If a report assciated with the short message is not received from the SC before a timer expires or if the SC address is invalid, the SMS-IWMSC is responsible for the following operations:

- returning the appropriate error information to the MSC in a failure report (negative outcome of 'Forward MS Originated Short Message Transfer', cf 09.02).

The value of the timer is dependent on the protocol between the SC and the SMS-IWMSC.

8.3 SMS-IWMSC functionality related to alerting

When receiving an alert from the HLR ('Alert SC', cf Rec. GSM 09.02), the SMS-IWMSC is responsible for the following operations:

- inspect the SC address,
- generate an RP_Alert_SC (cf section 10),
- transferring the RP_Alert_SC to the SC.

Note that if the SC address is not valid, then no further action will be taken.

9 Routing requirements

9.1 Routing requirements concerning the SM MT/PP

The SC may connect to the GSM PLMN as described in section 5. When using the variable SC <-> MSC interworking point, the SC transfers the short message to the chosen SMS-GMSC (which may be any SMS-GMSC whose address is known to the SC).

The SC sends a short message with the MS ISDN address to the SMS-GMSC, which interrogates the HLR to retrieve routing information neccessary to forward the short message to the MSC. The procedures for interrogating the HLR [and forwarding the short message to the MSC] are specified in Rec. GSM 09.02.

The SC is in no case capable of interrogating the HLR. However, the SC and the SMS-GMSC may be integrated as described in section 5.

The SMS-GMSC sends the short message to the relevant MSC by means of operations [specified in Rec. GSM 09.02].

The routing of the short message being forwarded to the MSC is depicted in Figure 03.40/8.

Figure 03.40/8. Routing scheme for short message transfer SC -> MSC.

The route for a MSC -> MS message transfer is provided by the VLR.

The short message transfer is as depicted in Figure 03.40/9.

Figure 03.40/9. Routing scheme for short message transfer MSC -> MS.

9.2 Routing requirements concerning the SM MO/PP

The routing scheme for a MS -> MSC message transfer is in accordance with Rec. GSM 04.08 and 04.11.

The mobile subscriber may address the SC either by a E.164 or an X.121 address, as described in section 5.

When using an E.164 address, the message is routed via PLMN to a specific interworking point of a specific SMS-IWMSC. This interworking point operates towards one and only one SC.

When using an X.121 address, the PLMN routes the short message to an SMS-IWMSC. From here, the short message is routed via one or more PSPDNs to the SC.

10 Protocols and protocol architecture

The protocol layers of the SMS are structured as shown in Figure 03.40/10.

Figure 03.40/10 Protocol layer overview for the point-to-point services. (The area enclosed by the dotted line defines the responsibility of this recommendation).

Abbreviations used:

SM_AL : Short Message Application Layer
SM_AP : Short Message Application Protocol

(NOTE: All outside the scope of GSM 03.40)

SM_TL : Short Message Transfer Layer
SM_TP : Short Message Transfer Protocol
SM_TS : Short Message Transfer Service

(NOTE: All covered by GSM 03.40)

SM_RL : Short Message Relay Layer
SM_RP : Short Message Relay Protocol

(NOTE: The information to be transferred on the link SC <-> SMS-GMSC/SMS-IWMSC is covered by GSM 03.40. The link SMS-GMSC/SMS-IWMSC <-> MSC is covered by Rec. GSM 09.02; whereas MSC<->MS is covered by GSM 04.11)

SM_RS : Short Message Relay Service

SM_LL : Short Message Lower Layers
SM_LP : Short Message Lower Layer Protocol
SM_LS : Short Message Lower Layer Service

10.1 Protocol element features

10.1.1 Octet and Bit transmission order

The octets are transmitted according to their individual numbering; the octet with the lowest number being transmitted first. The bits within each octet are transmitted according to their individual numbering also; the bits with the lowest internal number being transmitted first.

10.1.2 Numeric representation

In the SMS, there are three ways of numeric representation: Integer representation, octet and semi-octet representation.

10.1.2.1 Integer representation

Wherever the bits from a number of octets, complete or in fractions, are to represent an integer, the interpretation will be according to the following:

1) Between octets: The octets with the lowest octet numbers will contain the most significant bits.
2) Within an octet: The bits with the highest bit numbers will be the most significant.

Below is given an example of octet and bit representation and transmission order of an integer represented field.

Let the 2 rightmost bits of octet no 5, the complete octet no 6 and 7, and the 3 leftmost bits of octet no 8 represent an integer, as shown in Figure 03.40/16.

α)

Oct.no.	7	6	5	4	3	2	1	0
.	.	.	.	.	.	.	.	.
5							$^{5}b_{1}$	$^{5}b_{0}$
6	$^{6}b_{7}$	$^{6}b_{6}$	$^{6}b_{5}$	$^{6}b_{4}$	$^{6}b_{3}$	$^{6}b_{2}$	$^{6}b_{1}$	$^{6}b_{0}$
7	$^{7}b_{7}$	$^{7}b_{6}$	$^{7}b_{5}$	$^{7}b_{4}$	$^{7}b_{3}$	$^{7}b_{2}$	$^{7}b_{1}$	$^{7}b_{0}$
8	$^{8}b_{7}$	$^{8}b_{6}$	$^{8}b_{5}$					
.	.	.	.	.	.	.	.	.

β)

$^{5}b_{1}$ $^{5}b_{0}$ $^{6}b_{7}$ $^{6}b_{6}$ . . . . $^{6}b_{1}$ $^{6}b_{0}$ $^{7}b_{7}$ $^{7}b_{6}$ . . . . $^{7}b_{1}$ $^{7}b_{0}$ $^{8}b_{7}$ $^{8}b_{6}$ $^{8}b_{5}$

γ)

$^{5}b_{0}$ $^{5}b_{1}$ $\boxed{^{5}b_{2}\ ^{5}b_{3}\ ^{5}b_{4}\ ^{5}b_{5}\ ^{5}b_{6}\ ^{5}b_{7}}$ $^{6}b_{0}$ $^{6}b_{1}$ $^{6}b_{2}$ $^{6}b_{3}$ $^{6}b_{4}$ $^{6}b_{5}$ $^{6}b_{6}$ $^{6}b_{7}$ →

→ $^{7}b_{0}$ $^{7}b_{1}$ $^{7}b_{2}$ $^{7}b_{3}$ $^{7}b_{4}$ $^{7}b_{5}$ $^{7}b_{6}$ $^{7}b_{7}$ $\boxed{^{8}b_{0}\ ^{8}b_{1}\ ^{8}b_{2}\ ^{8}b_{3}\ ^{8}b_{4}}$ $^{8}b_{5}$ $^{8}b_{6}$ $^{8}b_{7}$

*) : Bits not representing the integer.

Figure 03.40/16. 21 bits from the octets 5, 6, 7, and 8 in a short message α) will represent an integer as shown in β), and will be transmitted in an order as shown in γ).

10.1.2.2 Octet representation

A field which is octet represented, will always consist of a number of complete octets. Each octet within the field represent one decimal digit. The octets with the lowest octet numbers will contain the most significant decimal digits.

10.1.2.3 Semi-octet representation

A field which is semi-octet represented, will consist of a number of complete octets and - possibly - one half octet. Each half octet within the field represent one decimal digit. The octets with the lowest octet numbers will contain the most significant decimal digits. Within one octet, the half octet containing the bits with bit numbers 0 through 3, will represent the most significant digit.

In the case where a semi-octet represented field comprises an odd number of digits, the bits with bit numbers 4 through 7 within the last octet are fill bits and should always be set to '1111'.

Below is given an example:

Octet no:

n+1	Digit 2	Digit 1
n+2	Digit 4	Digit 3
n+3	1 1 1 1	Digit 5

10.1.2.4 Address fields

Each address field of the SM_TL and SM_RL consists of the following sub-fields: An Address_Length field of one octet, a Type-of-Address field of one octet, and one Address_Value field of variable length; as shown below:

The Address_Length field indicates the number of decimal digits within the Address_Value field.

The Type_of_Address field format is as follows:

1	Type_of_number	Numbering_plan_identification

Type_of_number:

Bits 6 5 4

0 0 0	Unknown[1]
0 0 1	International number[2]
0 1 0	National number[3]
0 1 1	Network specific number[4]
1 0 0	Short number[5]
1 0 1 through 1 1 1	Not specified

[1]) : 'Unknown' is used when the user or network has no a priori information about the numbering plan. In this case, the Address_Value field is organized according to the network dialling plan, e.g. prefix or escape digits might be present.

[2]) : The international format shall be accepted also when the message is destined to a recipient in the same country as the MSC.

[3]) : Prefix or escape digits shall not be included.

[4]) : 'Network specific number' is used to indicate administration/service number specific to the serving network, e.g. used to access an operator.

[5]) : 'Short number' is used when a specific short number representation is stored in one or more SCs as part of a higher layer application. (Note that 'Short number' shall only be used in connection with the proper PID referring to this application).

Numbering_plan_identification (applies for Type_of_number = 000,001,010)

Bits 3 2 1 0	
0 0 0 0	Unknown
0 0 0 1	ISDN / telephone numbering plan (CCITT Rec E.164/E.163)
0 0 1 1	Data numbering plan (CCITT Rec.X.121)
0 1 0 0	Telex numbering plan
1 0 0 0	National numbering plan
1 0 0 1	Private numbering plan
1 1 1 1	Reserved for extension

All other values are unspecified.

Note that for addressing either of the entities MSC or MS, Numbering_plan_identification = 0001 will always be used. For addressing an SC Numbering_plan_identification = 0001 or 0011 may be used. However, for addressing the SMT, any specified Numbering_plan_identification value may be used.

Within the Address_Value field, a semi-octet representation applies.

The maximum length of the full address field (Address_Length, Type_of_Address and Address_Value) is 12 octets.

10.2 Service provided by the SM TL

10.2.1 General

This section defines the service provided by SM-TL to offer Short Message Service to the SM_AL in the MS or SC. The service description includes:

- The service definition
- The definition of the primitives
- The definition of the parameters of the primitives and the options attached to the parameters
- The definition of the protocol elements
- The definition of the parameters of the protocol elements
- A description of what SM-TL has to provide (in the MS and in the SC) when receiving or issuing primitives.

10.2.2 Service definition

The service which SM_TL offers to SM_AL in the SM MT/PP and SM MO/PP cases is shown in Figure 03.40/11.

a) The SM MT/PP case

b) The SM MO/PP case

Figure 03.40/11. Relationship between SM_TS primitives and SM_TPDUs. Note that whereas SMS_DELIVER and SMS_SUBMIT are SM_TPDUs, the report is a piece of information carried in the SM_RPDUs RP_ACK or RP_ERROR.

10.2.3 Definition of primitives

This section describes the primitives of service and associated parameters provided by the SM_TL.

10.2.3.1 TS Deliver

Parameter	TS_Deliver	
	Request	Indication
TS_Short_Message_Identifier	M	M
TS_Destination_Address	M	-
TS_Originating_Address	M	M
TS_Service_Centre_Address	O	O
TS_Protocol_Identifier	M	M
TS_Data_Coding_Scheme	M	M
TS_More_Messages_to_Send	-	O ([1])
TS_Service_Centre_Time_Stamp	M	M
TS_Priority	O	O
TS_Short_Message_Information	M	M

NOTE [1] : The TS_More_Messages_to_Send parameter may be present in a TS_Deliver.Indication issued by the SM_TL at the MS.

TS_Deliver.Request is used by the SM_AL entity of the SC to send a short message.

When the SM_TL receives this primitive, SM_TL forms a SMS_DELIVER element of protocol and sends it to the SM_RL in a RS_Data.Request.

TS_Deliver.Indication is sent by SM_TL entity to SM_AL entity of MS when receiving the SMS_DELIVER element of protocol.

10.2.3.2 TS Report

Parameter	TS_Report
	Indication
TS_Short_Message_Identifier	O ([1])
TS_Status_of_Report	M
TS_Messages_Waiting_Set	**O ([2])**
TS_More_Messages_to_Send	*O ([3])*

NOTE [1] : The TS_Short_Message_Identifier parameter may not be present in the TS_Report.Indication; in this case the status of report is a failure report

NOTE [2] : The TS_Messages_Waiting_Set parameter may be present in a TS_Report.Indication issued by the SM_TL at the SC.

NOTE [3] : The TS_More_Messages_to_Send parameter may be present in a TS_Report.Indication issued by the SM_TL at the MS.

TS_Report.Indication is used by SM_TL to provide a local acknowledgement or failure report to the SM_AL.

- Case I: Normal Situation

The TS_Status_of_Report parameter indicates successful transfer and the TS_Short_Message_Identifier parameter allows to link with a previous TS_Deliver.Request or TS_Submit.Request. SM_TL sends this primitive when receiving the RS_Report.Indication.

- Case II: Abnormal Situation

When receiving the RS_Error.Indication, the SM_TL sends a TS_Report.Indication with a TS_Status_of_Report parameter specifying the failure. The TS_Short_Message_Identifier parameter may not be present if it is not possible to link the report failure with a previous short message delivery. Further Study is necessary on the use of the primitive RS_Error.Indication in the SC.

10.2.3.3 TS Submit

Parameter	TS_Submit	
	Request	Indication
TS_Short_Message_Identifier	M	M
TS_Destination_Address	**M**	**M**
TS_Service_Centre_Address	**O (1)**	**-**
TS_Originating_Address	M	M
TS_Protocol_Identifier	M	M
TS_Data_Coding_Scheme	**M**	**M**
TS_Validity_Period	O	O
TS_Short_Message_Information	M	M

NOTE 1 : **May be omitted if a default SC address resides within the SM_TL entity of the MS.**

TS_Submit.Request is used by the SM_AL entity of the MS to send a short message.

When the SM_TL receives this primitive, the SM_TL forms a SMS_SUBMIT element of protocol and sends it to the SM_RL in a RS_Data.Request (see section 10.3).

TS_Submit.Indication is sent by the SM_TL entity to the SM_AL entity of the SC when receiving the SMS_SUBMIT element of protocol.

10.2.4 Definition of parameters

10.2.4.1 TS Short Message Identifier

TS_Short_Message_Identifier links a result to a previous command. A TS_Short_Message_Identifier cannot be re-used during a period called the frozen period, in order to ensure that all the reports (normal or not) have arrived.

10.2.4.2 TS Destination Address

TS_Destination_Address defines the address of the destination entity. When TS_Destination_Address is included in a primitive issued by the SC, it contains the MSIsdn of the recipient MS. When TS_Destination_Address is included in a primitive issued by the MS, it contains the SMT address.

10.2.4.3 TS Originating Address

TS_Originating_Address defines the address of the originating entity. When TS_Originating_Address is included in a primitive issued by the SC, it contains the SMT address. When TS_Originating_Address is included in a primitive issued by the MS, it contains the MSIsdn.

10.2.4.4 TS Service Centre Address

TS_Service_Centre_Address defines the address of the SC. The TS_Service_Centre_Address may be either an X.121 or an E.164 address, cf section 5.

10.2.4.5 TS Protocol Identifier

The TS_Protocol_Identifier parameter refers to the protocol used by the SM_AL.

10.2.4.6 TS Data Coding Scheme

The TS_Data_Coding_Scheme parameter refers to the coding used for the short message.

10.2.4.7 TS Service Centre Time Stamp

The TS_Service_Centre_Time_Stamp parameter contains the time stamp given by the SC to be included in each short message delivered to an MS, cf section 3.3.2.

10.2.4.8 TS Messages Waiting Set

The TS_Messages_Waiting_Set parameter is used to indicate to the SM_AL entity within the SC that the MS is not attainable and that the SC address has been included in the MWD list in the HLR, cf section 3.2.5.

10.2.4.9 TS Priority

The TS_Priority parameter is used by the SM_AL entity within the SC to indicate to the network whether or not a message transfer attempt shall be carried out in the case that the MWD list in HLR is not empty, cf section 3.2.5.

10.2.4.10 TS Status of Report

The TS_Status_of_Report parameter is information provided to the SM_AL which defines the report either as a delivery report or as a failure report.

10.2.4.11 TS More Messages to Send

The TS_More_Messages_to_Send parameter informs the MS that one or more messages are waiting in the SC to be delivered to the MS.

10.2.4.12 TS Validity Period

The TS_Validity_Period parameter indicates the time period for which the short message is valid i.e. the time period during which the SC should keep the short message in case the SMT is temporarily out of operation.

10.2.5 PDU Type repertoire at SM TL

The SM_TL comprises the following two PDUs:

SMS_DELIVER, conveying a short message from the SC to the MS
SMS_SUBMIT, conveying a short message from the MS to the SC.

10.2.5.1 SMS DELIVER type

Abbr.	Reference	P[1])	R[2])	Description
TP_MTI	TP_Message_Type_Indicator	M	I	Parameter describing the message type.
TP_MMS	TP_More_Messages_to_Send	M	I	Parameter indicating whether or not there are more messages to send.
TP_OA	TP_Originating_Address	M	I/S	Address of the originating SMT.
TP_PID	TP_Protocol_Identifier	M	I	Parameter identifying the above layer protocol, if any.
TP_DCS	TP_Data_Coding_Scheme	M	I	Parameter identifying the coding scheme within the TP_User_Data.
TP_SCTS	TP_Service_Centre_Time_Stamp	M	S	Parameter identifying time when the SC received the message.
TP_UDL	TP_User_Data_Length	M	I	Parameter indicating the length of the TP_User_Data field to follow.
TP_UD	TP_User_Data	O[3])	[4])	

[1]) : Provision; Mandatory (M) or Optional (O).
[2]) : Representation; Integer (I), Semi-octet (S) or Octet (O) representation
[3]) : The TP_UD is optional because TP_UDL may be zero.
[4]) : Dependent on the TP_DCS

Layout of SMS_DELIVER:

10.2.5.2 SMS SUBMIT type

Basic elements of the SMS_SUBMIT type:

Abbr.	Reference	P[1])	R[2])	Description
TP_MTI	TP_Message_Type_Indicator	M	I	Parameter describing the message type.
TP_VPF	TP_Validity_Period_Format	M	I	Parameter indicating whether or not the TP_VP field is present.
TP_MR	TP_Message_Reference	M	I	Parameter identifying the SMS_SUBMIT.
TP_OA	TP_Originating_Address	M	I/S	Address of the originating MS.
TP_DA	TP_Destination_Address	M	I/S	Address of the destination SMT.
TP_PID	TP_Protocol_Identifier	M	I	Parameter identifying the above layer protocol, if any.
TP_DCS	TP_Data_Coding_Scheme	M	I	Parameter identifying the coding scheme within the TP_User_Data.
TP_VP	TP_Validity_Period	O	I/S	Parameter identifying the time from where the message is no longer valid.
TP_UDL	TP_User_Data_Length	M	I	Parameter indicating the length of the TP_User_Data field to follow.
TP_UD	TP_User_Data	O[3])	[4])	

[1]) : Provision; Mandatory (M) or Optional (O).
[2]) : Representation; Integer (I), Semi-octet (S) or Octet (O) representation
[3]) : The TP_UD is optional because TP_UDL may be zero.

[4]) : Dependent on the TP_DCS

Layout of SMS_SUBMIT:

5) : λ is either 1 or 7, see below.

10.2.6 Definition of the SM TPDU parameters

10.2.6.1 TP Message Type Indicator (TP MTI)

The TP_Message_Type_Indicator is a 2-bit field, located within bit no 0 and 1 of the first octet of SMS_DELIVER or SMS_SUBMIT, and to be given the following values:

Bit no 0,1:	00	Message type: SMS_DELIVER
	01	Message type: SMS_SUBMIT
	10	Spare
	11	Message type: SMS_BROADC

10.2.6.2 TP More Messages to Send (TP MMS)

The TP_More_Messages_to_Send is a 1-bit field, located within bit no 2 of the first octet of SMS_DELIVER, and to be given the following values:

Bit no 2:	0	More messages are waiting for the MS in this SC
	1	No more messages are waiting for the MS in this SC

10.2.6.3 TP Validity Period Format (TP VPF)

The TP_Validity_Period_Format is a 2-bit field, located within bit no 3 and 4 of the first octet of SMS_SUBMIT, and to be given the following values:

Bit no 3,4:	00	TP_VP field not present
	01	TP_VP field present and integer represented (relative)
	10	Spare
	11	TP_VP field present and semi-octet represented (absolute)

10.2.6.4 TP Message Reference (TP MR)

The TP_Message_Reference field gives an integer representation of a reference number of the SMS_SUBMIT submitted to the SC by the MS. The MS increments TP_Message_Reference by 1 for each SMS_SUBMIT being submitted. The reference number may possess values in the range 0 through 255.

10.2.6.5 TP Originating Address (TP OA)

The TP_Originating_Address field is formatted according to the formatting rules of address fields.

10.2.6.6 TP Destination Address (TP DA)

The TP_Destination_Address field is formatted according to the formatting rules of address fields.

10.2.6.7 TP Protocol Identifier (TP PID)

The TP_Protocol_Identifier field gives an integer representation of a protocol identifier for a possible higher layer protocol. The TP_Protocol_Identifier may possess values in the range 0 through 255. The value 0 indicates that no specific higher layer protocol is provided. Further mapping between the different TP_Protocol_Identifier values and the possible higher layer protocols is beyond the scope of this recommendation.

[The description of TP_PID is for further study].

10.2.6.8 TP Data Coding Scheme (TP DCS)

The TP_Data_Coding_Scheme field gives an integer representation of a data coding scheme of the TP_UD field. The TP_Data_Coding_Scheme may possess values in the range 0 through 255. The value 0 indicates that the TP_UD consists of IA5 (International Alphabet no 5) characters. Further mapping between the different TP_Data_Coding_Scheme values and the possible encoding schemes to be applied is beyond the scope of this recommendation.

[The description of TP_DCS is for further study].

10.2.6.9 TP Service Centre Time Stamp (TP SCTS)

The TP_Service_Centre_Time_Stamp field is given in semi-octet representation, and represents the time in the following way:

	Year	Month	Day	Hour	Minute	Second	Time Zone
Digits: (Semi-octets)	2	2	2	2	2	2	2

The Time Zone indicates the difference, expressed in quarters of an hour, between the local time and the GMT. In the first of the two semi-octets, the first bit (bit 7 of the seventh octet of the TP_Service_Centre_Time_Stamp field) represents the algebraic sign of this difference (0 : positive, 1 : negative). Negative numbers will use the two's complement representation. The Time Zone may be a number in the range -47 through +48.

10.2.6.10 TP Validity Period

The TP_Validity_Period field is given in either integer or semi-octet representation. In the first case, the TP_Validity_Period comprises 1 octet, giving the length of the validity period, counted from when the SMS_SUBMIT is received by the SC. In the second case, the TP_Validity_Period comprises 7 octets, giving the absolute time of the validity period termination.

In the first case, the representation of time is as follows:

TP_VP value	Validity period value
0 to 143	(TP_VP + 1) x 5 minutes (i.e. 5 minutes intervals up to 12 hours)
144 to 167	12 hours + ((TP_VP -143) x 30 minutes)
168 to 196	(TP_VP - 166) x 1 day
197 to 255	(TP_VP - 192) x 1 week

In the second case, the representation of time is identical to the representation of the TP_Service_Centre_Time_Stamp.

10.2.6.11 TP User Data Length (TP UDL)

The TP_User_Data_Length field gives an integer representation of the number of octets (0 through 180) within the TP_User_Data field to follow.

10.3 Service provided by the SM_RL

10.3.1 General

This section describes the primitives of service and associated parameters provided by the SM_RL and used by the SM_TL to offer the Short Message Service to the SC and the MS.

The service description includes:

- The service definition
- The definition of the primitives
- The definition of the parameters of the primitives and the options attached to the parameters
- The definition of the protocol elements
- The definition of the parameters of the protocol elements
- A description of what SM_RL has to provide (in the MS and in the SC) when receiving or issuing primitives.

10.3.2 Service definition

Rec. GSM 04.11 defines the service provided by SM_RL in the MS. The figures 03.40/12 through 03.40/15 give only an overview of message exchange between SC and MS. If discrepancies exist in nomenclature at the MS side, it is the Rec. GSM 04.11 that will be the reference.

Figure 03.40/12a. Relationship between SM_RS primitives and SM_RPDUs in the SM MT/PP case.

Figure 03.40/12b. Relationship between SM_RS primitives and SM_RPDUs in the SM MO/PP case.

Figure 03.40/13. Relationship between SM_RS primitives and SM_RPDUs in the Alert case.

Figure 03.40/14. Error Service

Figure 03.40/15. Example of an abnormal situation: A report does not reach the SC.

Editor's note: Whether or not the time out should be set at SM_RL or SM_TL is for further study.

10.3.3 Definition of the primitives

This section defines the primitives and the parameters of the primitives.

10.3.3.1 RS Data

Parameter	RS_Data	
	Request	Indication
RS_Short_Message_Identifier	M	M
RS_Destination_Address	M	-
RS_Originating_Address	M	M
RS_Destination_Node_Address	O ([1])	-
RS_Priority	**M**	**O**
RS_User information	M	M

NOTE [1] : This parameter may be present in a RS_Data.Request issued by the SM_TL in the SC to cater for an SC connected to more than one SMS-GMSC.

Editor's note : The inclusion of the time out parameter is for further study.

RS_Data.Request is used by the SM_TL of the MS or SC to send a message. The primitive contains an indication of the address of the recipient. The parameter RS_Short_Message_Identifier has to be stored by the SM_RL in order to be able to link this request to the report expected by SM_TL.

Because the SM_TL waits for a report, the resources involved in the message transfer shall not be released.

RS_Data.Indication is issued by the SM_RL of the SC or MS. SM_RL has to provide the Short_Message_Identifier parameter in order to be able to link this primitive to a previous RS_Data.Request.

10.3.3.2 RS Report

Parameter	RS_Report Indication
RS_Short_Message_Identifier	M

RS_Report.Indication is issued by the SM_RL when receiving an RP_ACK. When sending this primitive, SM_RL releases the resources involved by the short message transfer.

10.3.3.3 RS Error

Parameter	RS_Error Indication
RS_Short_Message_Identifier	O ([1])
RS_Messages_Waiting_Set	**O ([2])**
RS_Reason	M

NOTE [1] : In the RS_Error.Indication the parameter Short_Message_Identifier is not present when the SM_TL is unable to link an occurrence of a problem on the MS-SC link with a message previously sent.

NOTE [2] : Relevant only in the direction SMS-GMSC -> SC.

RS_Error.Indication is issued by the SM_RL. When the primitive is issued, the SM_RL informs the SM_TL that a problem (identified by the 'RS_Reason' parameter) has occurred in the transmission of a previously issued RS_Data.Request. If SM_RL is unable to find the link, the parameter RL_Short_Message_Identifier is not present. The RS_Error.Indication terminates the message transfer, and the resources are released.

10.3.3.4 RS Alert

Parameter	RS_Alert Indication
RS_Alerting_MS	M

RS_Alert.Indication is issued by the SM_RL at the SC on receipt of an RP_ALERT PDU from the SMS-GMSC. The primitive is used to inform the SM_TL that an MS which was previously unattainable has recovered operation.

10.3.4 Definition of parameters

10.3.4.1 RS Short Message Identifier

The RS_Short_Message_Identifier parameter links a result to a previously submitted short message. A RS_Short_Message_Identifier cannot be re-used during a period called the frozen period, in order to ensure that all the reports (normal or not) have arrived.

10.3.4.2 RS Destination Address

The RS_Destination_Address parameter defines the address of the destination entity (either SC or MS).

10.3.4.3 RS Originating Address

The RS_Originating_Address parameter defines the address of the originating entity (either SC or MS). This parameter is always mandatory even if the originating entity is the default SC.

10.3.4.4 RS Priority

The RS_Priority parameter is used by the SM_TL entity within the SC to indicate to the network whether or not a message transfer attempt shall be carried out in the case that the MWD list in HLR is not empty, cf section 3.2.5.

10.3.4.5 RS Reason

The RS_Reason parameter is transferred from the SM_RL to the SM_TL when a problem occurs on the link between the SC and the MS, indicating the reason.

10.3.4.6 RS Destination Node Address

The RS_Destination_Node_Address parameter defines the address of the SMS-GMSC that the SC will use as an entrance point to the PLMN for short message transfer.

10.3.4.7 RS Alerting_MS

The RS_Alerting_MS parameter defines the MS which is recognized to have recovered operation. The RS_Alerting_MS parameter may contain several MSIsdns.

10.3.4.8 RS Messages Waiting Set

The RS_Messages_Waiting_Set parameter is used to indicate to the SM_TL entity within the SC that the MS is not attainable and that the SC address has been included in the MWD list in the HLR, cf section 3.2.5.

10.3.4.9 RS User Information

The RS_User_Information parameter deals with the data included in the TS primitives. These data are an element of protocol of the SM_TL. The RS_User-_Information parameter denotes both the data and the length of these data.

10.3.5 PDU Type repertoire at SM_RL

The SM_RL comprises the following 4 PDUs:

RP_DATA	for transferring the SM_TPDUs between the PLMN entities
RP_ACK	for acknowledging a RP_DATA
RP_ERROR	for informing of an unsuccessful RP_DATA transfer attempt
RP_ALERT_SC	for alerting the SC that the MS has recovered operation

10.3.5.1 RP DATA

Basic elements of the RP_DATA type.

Abbr.	Reference	P[1])	R[2])	Description
RP_MTI	RP_Message_Type_Indicator	M	I	Parameter describing the message type.
RP_PRI	RP_Priority_Request	M	I	Parameter indicating whether or not the short message transfer should be stopped if the originator SC address is already contained in the MWD. (The information is only relevant in the direction SC -> MS).
RP_MR	RP_Message_Reference	M	I	Parameter identifying the RP_DATA.
RP_OA	RP_Originating_Address	O	I/S	Address of the originating SC (omitted in the direction MS -> SC).
RP_DA	RP_Destination_Address	M	I/S	Address of the destination SC or MS.
RP_UDL	RP_User_Data_Length	M	I	Parameter indicating the length of the RP_User_Data field to follow.
RP_UD	RP_User_Data	O[3])	-	

[1]) : Provision; Mandatory (M) or Optional (O).
[2]) : Representation; Integer (I), Semi-octet (S) or Octet (O) representation
[3]) : The RP_UD is optional because RP_UDL may be zero.

Layout of RP_DATA:

10.3.5.2 RP ACK

Basic elements of the RP_ACK type.

Abbr.	Reference	P[1])	R[2])	Description
RP_MTI	RP_Message_Type_Indicator	M	I	Parameter describing the message type.
RP_MR	RP_Message_Reference	M	I	Parameter identifying the previous RP_DATA.

[1]) : Provision; Mandatory (M) or Optional (O).
[2]) : Representation; Integer (I), Semi-octet (S) or Octet (O) representation

Layout of RP_ACK:

Bit no.	7	6	5	4	3	2	1	0	
Oct.no. 1									RP_MTI
1									RP_MR

10.3.5.3 RP_ERROR

Basic elements of the RP_ERROR type.

Abbr.	Reference	P[1])	R[2])	Description
RP_MTI	RP_Message_Type_Indicator	M	I	Parameter describing the message type.
RP_MSI	RP_MW_Set_Indication	O[3])	I	Parameter indicating whether or not the MWI has been updated.
RP_MR	RP_Message_Reference	M	I	Parameter identifying the previous RP_DATA.
RP_CS	RP_Cause	M	I	Parameter identifying the error type.

[1]) : Provision; Mandatory (M) or Optional (O).
[2]) : Representation; Integer (I), Semi-octet (S) or Octet (O) representation
[3]) : **Only present when the RP_ERROR is transferred from the SMS-IWMSC to the SC.**

Layout of RP_ERROR:

Bit no.		7	6	5	4	3	2	1	0	
Oct.no.	1									RP_MTI, RP_MSI
	1									RP_MR
	1									RP_CS

10.3.5.4 RP_ALERT_SC

Basic elements of the RP_ALERT_SC type:

Abbr.	Reference	P[1])	R[2])	Description
RP_MTI	RP_Message_Type_Indicator	M	I	Parameter describing the message type.
RP_N_ MSIsdn	RP_Number_of_MSIsdn _to_follow	M	I	Number of RP_MSIsdn fields to follow.
RP_ MSIsdn	RP_International_MS_ISDN _Number	M	I/S	MSIsdn of the MS.
.	.			
.	.			
.	.			
RP_ MSIsdn	RP_International_MS_ISDN _Number	M	I/S	MSIsdn of the MS.

[1]) : Provision; Mandatory (M) or Optional (O).
[2]) : Representation; Integer (I), Semi-octet (S) or Octet (O) representation

Layout of RP_ALERT_SC:

10.3.6 Definition of the SM RPDU parameters

10.3.6.1 RP Message Type Indicator (RP MTI)

The RP_Message_Type_Indicator is a 3-bit field, always located within bit no 0 and 2 of the first octet of each SM_RPDU and to be given the following values:

Bit no 0 - 2:	000	RP_DATA	(towards SC)
	001	RP_DATA	(towards MS)
	010	RP_ACK	(towards SC)
	011	RP_ACK	(towards MS)
	100	RP_ERROR	(towards SC)
	101	RP_ERROR	(towards MS)
	110	RP_ALERT_SC	
	111	Spare	

10.3.6.2 RP Priority Request (RP PRI)

The RP_Priority_Request is a 1-bit field, located within bit no 6 of the first octet of the RP_DATA, which may take the following values:

0	RP_Priority_Request is FALSE (cf section 3.2.5)
1	RP_Priority_Request is TRUE (cf section 3.2.5).

10.3.6.3 RP MW Set Indication (RP MSI)

The RP_MW_Set_Indication is a 1-bit field, located within bit no 4 of the first octet of the RP_ERROR, which may take the following values:

Bit no 4:	0	RP_MW_Set_Indication is FALSE
	1	RP_MW_Set_Indication is TRUE.

10.3.6.4 RP Message Reference (RP MR)

The RP_Message_Reference field gives an integer representation of a reference number of the RP_DATA submitted to the MS or SC by the SC or MS, respectively. The originator increments RP_Message_Reference by 1 for each RP_DATA being submitted. The reference number may possess values in the range 0 through 255.

10.3.6.5 RP International MS ISDN Number (RP MSIsdn)

The RP_International_MS_ISDN_Number field contains the ISDN address of the MS, and is formatted according to the formatting rules of the address fields (cf section 10.1.2.4).

10.3.6.6 RP Number of MSIsdn to follow (RP N MSIsdn)

The RP_Number_of_MSIsdn_to_follow field contains the number of the consecutive RP_MSIsdn fields to follow (1 through 32). The RP_Number_of_MSIsdn_to_-follow is a 5-bit field located within bit no 3 and 7 of the first octet of RP_ALERT.

10.3.6.7 RP Originating Address (RP OA)

Originating entity address, being either the SC or the MS in the SM MT/PP or SM MO/PP. The RP_Originating_Address field are formatted according to the formatting rules of address fields (cf section 10.1.2.4).

10.3.6.8 RP Destination Address (RP DA)

Destination entity address, being either the SC or the MS in the SM MT/PP or SM MO/PP. The RP_Destination_Address field are formatted according to the formatting rules of address fields (cf section 10.1.2.4).

10.3.6.9 RP Cause (RP_CS)

The RP_Cause field gives the reason why a short message transfer attempt fails. The RP_Cause is a 1-octet field which may take the values indicated below.

Within the RP_ERROR being transferred from the SMS-GMSC to the SC (SM MT/PP), from the MSC to the MS (SM MO/PP) or between MSCs:

00000001	Cause:	Unknown subscriber
00000010	Cause:	Unknown SC
00000011	Cause:	CUG reject
00000100	Cause:	Subscription not provided
00000101	Cause:	Call barred
00000110	Cause:	Forwarding violation
00000111	Cause:	Absent subscriber
00001000	Cause:	Roaming not allowed
00001001	Cause:	Teleservice not provisioned in the VPLMN
00001010	Cause:	System failure
00001011	Cause:	Illegal subscriber
00001100	Cause:	Overflow
00001101	Cause:	MS not equipped for SMS
00001110	Cause:	SMS low layer capabilities not provisioned
00001111	Cause:	Memory capacity exceeded
00010000	Cause:	Protocol error at the MS
00010001	Cause:	MS not attainable
00010010	Cause:	PLMN failure
00010011	Cause:	MS unable to receive message
00010100	Cause:	Error in the MS
00010101	Cause:	No SC answer
00010110	Cause:	SC reject
00010111	Cause:	SC not attainable

10.3.6.10 RP User Data Length (RP UDL)

The RP_User_Data_Length field gives an integer representation of the number of octets (0 through 255) within the RP_User_Data field to follow.

11 Fundamental procedures within the point-to-point SMS

The point-to-point SMS comprises 3 fundamental procedures:

1) Short message mobile terminated. This procedure consists of all necessary operations to

   a) transfer a short message from the SC to the MS
   b) return a report to the SC, containing the result of the message transfer attempt.

2) Short message mobile originated. This procedure consists of all necessary operations to

   a) transfer a short message from the MS to the SC
   b) return a report to the MS, containing the result of the message transfer attempt.

3) Transfer of an Alert. This procedure consists of all necessary operations for an HLR or a VLR to initiate a transfer of an Alert to a specific SC, informing the SC that the MS has recovered operation.

NOTE : For all references to RL PDUs, see section 10.7

Rec. GSM 09.02 defines the operations necessary for the provision of the point-to-point short message service. If discrepancies exist in nomenclature, it is the Rec. GSM 09.02 that will be the reference.

11.1 Short message mobile terminated

The interfaces involved in this procedure are depicted in Figure 03.40/17.

Figure 03.40/17. Interfaces involved in the Short message mobile terminated procedure. The interfaces A, B, C, D and E refer to the interfaces between PLMN components defined in Rec. GSM 03.02. X is the interface between an MSC and an SC as defined in section 5.

In figure 03.40/18, sequence diagrams are shown for the following basic situations of short message mobile terminated transfer attempt:

- SMS-GMSC reject
- HLR reject
- MSC reject
- VLR reject, or no paging response, or faulty authentication, or erroneous message transfer MSC -> MS
- successful message transfer.

Figure 03.40/18 a) Short message transfer attempt rejected by SMS-GMSC.

Figure 03.40/18 b) Short message transfer attempt failing after HLR information retrieval.

Figure 03.40/18 c) Short message transfer attempt rejected by MSC.

Figure 03.40/18 d) Short message transfer attempt failing after either

1) VLR information retrieval
2) paging attempt
   or
3) authentication attempt

Figure 03.40/18 e) Short message transfer attempt failing after failing message transfer attempt on the radio path.

Figure 03.40/18 f) Successful short message transfer attempt.

Operation 1: Message transfer SC -> SMS-GMSC

This operation is used to transfer a short message from an SC to an SMS-GMSC via a connection as described in section 5.

The operation consists of

- the transfer of a message containing the RS_User_Information and other parameters as defined in section 10.3.3.1 from the SC to the SMS-GMSC (cf '1a. Message transfer' in Figure 03.40/18); and

- the return of either an 'Failure report' (cf 1c. in Figure 03.40/18) or a 'Delivery report' (cf 1b. in Figure 03.40/18).

'Failure report' is returned to the SC when the SMS-GMSC has received indication from another entity (MSC or HLR) the procedure was unsuccessful. The SMS-GMSC may receive either of the following error indications which may or may not be provided to the SC:

Unknown subscriber
CUG reject
Subscription not provided
Call barred
Forwarding violation
Absent subscriber
Roaming not allowed
Teleservice not provisioned in the VPLMN
System failure
Illegal subscriber
Overflow
MS not equipped for SMS
SMS low layer capabilities not provisioned
Memory capacity exceeded
Protocol error at the MS

The operation may be achieved by either

a) a protocol agreed by the operators of the SC and the PLMN, which is not specified in this recommendation (only when a 'Fixed SC <-> MSC interworking point' is used, cf section 5)
b) the protocol described in Annex 1.

Operation 2: Send routing information for SMS

The operation is an interrogation of the HLR by the SMS-GMSC by means of MAP to retrieve information neccessary to forward the short message.

The operation is defined in Rec. GSM 09.02.

Operation 3: Set Messages Waiting Data in HLR

This is a MAP procedure which provides a means for the SMS-GMSC to request the HLR to add an SC address to the MWD. The procedure is defined in Rec. GSM
09.02. The procedure is activated when the SMS-GMSC receives an absent subscriber indication from the MSC.

Operation 4: Forward MS Terminated Short Message

This is a MAP procedure which provides a means for the SMS-GMSC to transfer a short message to the MSC at which the MS is currently located.

The procedure is defined in Rec. GSM 09.02.

The procedure works in tandem with the forwarding of the short message from the MSC to the MS. Thus, the outcome of the operation comprises either success, i.e. that the message has been delivered to the MS; or a failure that may be caused by several reasons, e.g. failure in the transfer SMS-GMSC -> MSC, IMSI DETACH, or no paging response.

Operation 5: Send information for I/C call set-up

This is a MAP procedure by which the MSC retrieves subscriber information from VLR for mobile terminated short message transfer. This procedure may be associated with an authentication procedure, as shown in Figure 03.40/19. The procedure is the same as is used for incoming call set-up and is defined in Rec. GSM 09.02. Unsuccessful retrieval (e.g. absent subscriber, MS not equipped) is indicated by a cause indication to the SMS-GMSC.

Note that the MSC will receive the positive response of 'Send information for I/C call set-up' as a separate operation, 'Complete call', cf Rec. GSM 09.02. (In Figure 03.40/19 d) and e) represented by '5b. Complete call').

An overall description of operation 5 is given in Figure 03.40/19.

Figure 03.40/19 a) Erroneous case: IMSI DETACH.

Figure 03.40/19 b) Erroneous case: No paging response.

1) : Described in Rec. GSM 04.08

Figure 03.40/19 c) Incorrect authentication.

1) : Described in Rec. GSM 04.08

Figure 03.40/19 d) Erroneous message transfer.

1) : Described in Rec. GSM 04.08
2) : 'Complete call' is a separate operation
3) : Described in Rec. GSM 04.11

Figure 03.40/19 e) Error free case.

1) : Described in Rec. GSM 04.08
2) : 'Complete call' is a separate operation
3) : Described in Rec. GSM 04.11

It should be noted that the MWF setting is implicitly carried out when the message transfer is denied due to IMSI DETACH.

Operation 6. Message transfer (on the radio path)

This operation is described in Rec. GSM 04.11.

If the transfer is not successful, e.g. due to the MS losing radio coverage after having successfully authenticated, a failure report (RP_ERROR) is returned to the SMS-GMSC. In this case, neither MWD nor MWF will be updated.

11.2 Short message mobile originated

The interfaces involved in this procedure is depicted in Figure 03.40/21.

Figure 03.40/21. Interfaces involved in the Short message mobile originated procedure. The interfaces A, B and E refer to the interfaces between PLMN components defined in Rec. GSM 03.02. X is the interface between an MSC and an SC as defined in chapter 5.

In figure 03.40/22, sequence diagrams for the following basic situations of short message mobile terminated transfer attempt:

- MSC reject
- SMS-IWMSC reject
- SC reject
- successful message transfer.

Figure 03.40/22 a) Short message transfer attempt rejected by MSC.

Figure 03.40/22 b) Short message transfer attempt rejected by SMS-IWMSC.

Figure 03.40/22 c) Short message transfer attempt rejected by SC.

Figure 03.40/22 d) Successful short message transfer attempt.

Operation 6: Message transfer MS -> MSC

This operation is used to transfer a short message from the MS to the MSC, and is defined in Rec. GSM 04.11.

Operation 7: Forward MS Originated Short Message

This is a MAP procedure which provides a means for the MSC to transfer a short message to the SMS-IWMSC.

The procedure is defined in Rec. GSM 09.02.

The procedure is required if the serving MSC cannot access the SC directly, e.g. because it has no access connection to the type of network to which the SC is connected (cf section 5).

The procedure works in tandem with the forwarding of the short message from

the SMS-IWMSC to the SC. Thus, the outcome of the operation comprises either success, i.e. that the message has been delivered to the SC; or a failure that may be caused by several reasons, e.g. failure in the transfer MSC -> SMS-IWMSC, SC does not comply.

Operation 8: Message transfer SMS-IWMSC -> SC

This operation is used to transfer a short message from an SMS-IWMSC to an SC via a connection as described in section 5.

The operation consists of

- the transfer of a message containing the RS_User_Information and other parameters as defined in section 10.3.3.1 from the SMS-IWMSC to the SC (cf '8a. Message transfer' in Figure 03.40/22); and

- the return of either an 'Failure report' (cf 8c. in Figure 03.40/18) or a 'Delivery report' (cf 8b. in Figure 03.40/18).

'Failure report' is returned to the MS when the SMS-IWMSC has received indication from the network or the SC that the procedure was unsuccessful.

11.3 Alert transfer

The interfaces involved in this procedure is depicted in Figure 03.40/23.

Figure 03.40/23. Interfaces involved in the Alert procedure. The interfaces D and E refer to the interfaces between PLMN components defined in Rec. GSM 09.02. X is the interface between an SC and an MSC as defined in section 5.

This procedure consists of the operations shown in Figure 03.40/24.

Figure 03.40/24. The alert procedure.

Operation 9: MS present

This is a MAP procedure which is used to transfer alert information from VLR to HLR.

The procedure is defined in Rec. GSM 09.02.

The procedure is activated when the VLR detects that the MS is active, i.e. when the MS responds to a paging request.

Operation 10: Alert SC

This is a MAP procedure which is used to transfer alert information from HLR to MSC.

The operation is defined in Rec. GSM 09.02.

Operation 11: Alert SC

This operation is used to transfer alert information from an SMS-IWMSC to an SC via a connection as described in section 5.

The operation consists of transfer of a message ('RP_ALERT_SC') containing the parameters as defined in section 10.3.3.4 from the SMS-IWMSC to the SC.