

# Messaging Services (SMS) Interface Description

INTERWORKING DESCRIPTION



## NOTICE

The information contained in this document is believed to be accurate in all respects but is not warranted by Mitel Networks™ Corporation (MITEL®). Mitel makes no warranty of any kind with regards to this material, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. The information is subject to change without notice and should not be construed in any way as a commitment by Mitel or any of its affiliates or subsidiaries. Mitel and its affiliates and subsidiaries assume no responsibility for any errors or omissions in this document. Revisions of this document or new editions of it may be issued to incorporate such changes.

No part of this document can be reproduced or transmitted in any form or by any means - electronic or mechanical - for any purpose without written permission from Mitel Networks Corporation.

## TRADEMARKS

The trademarks, service marks, logos and graphics (collectively "Trademarks") appearing on Mitel's Internet sites or in its publications are registered and unregistered trademarks of Mitel Networks Corporation (MNC) or its subsidiaries (collectively "Mitel") or others. Use of the Trademarks is prohibited without the express consent from Mitel. Please contact our legal department at [legal@mitel.com](mailto:legal@mitel.com) for additional information. For a list of the worldwide Mitel Networks Corporation registered trademarks, please refer to the website: <http://www.mitel.com/trademarks>.

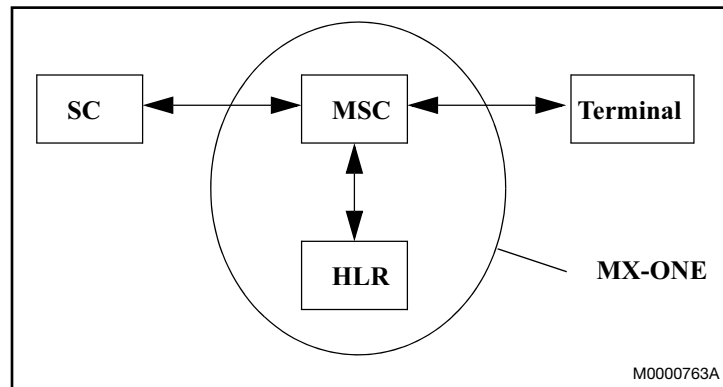
© Copyright 2016, Mitel Networks Corporation

All rights reserved

## 1

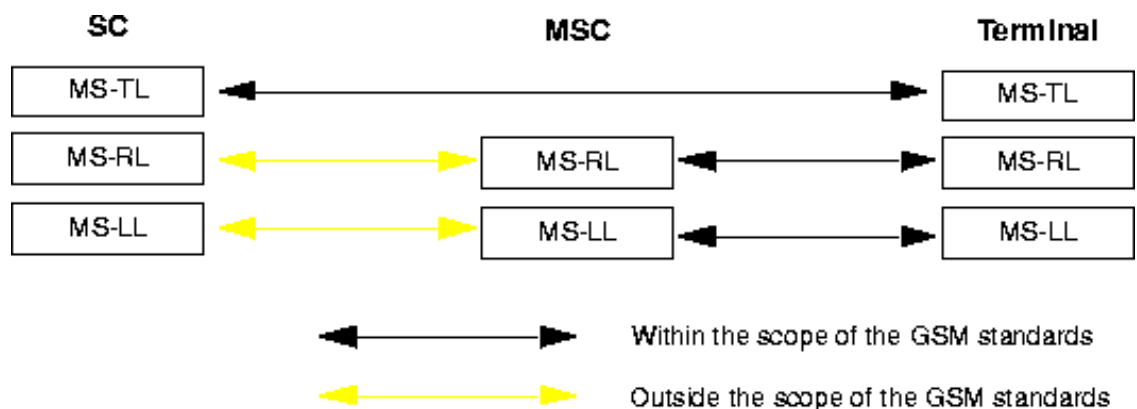
## INTERFACE DESCRIPTIONS

The Short Message Service for the MX-ONE is adapted from the SM Service for GSM.



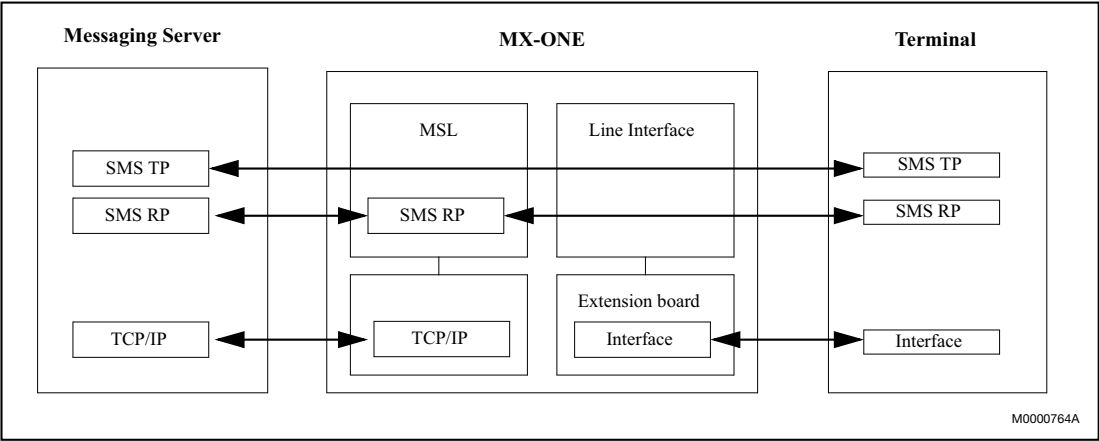
**Figure 1: GSM SM Service reference configuration**

The MX-ONE replaces the MSC and the HLR in the GSM scenario.



**Figure 2: GSM protocol layer for the SMS point-to-point**

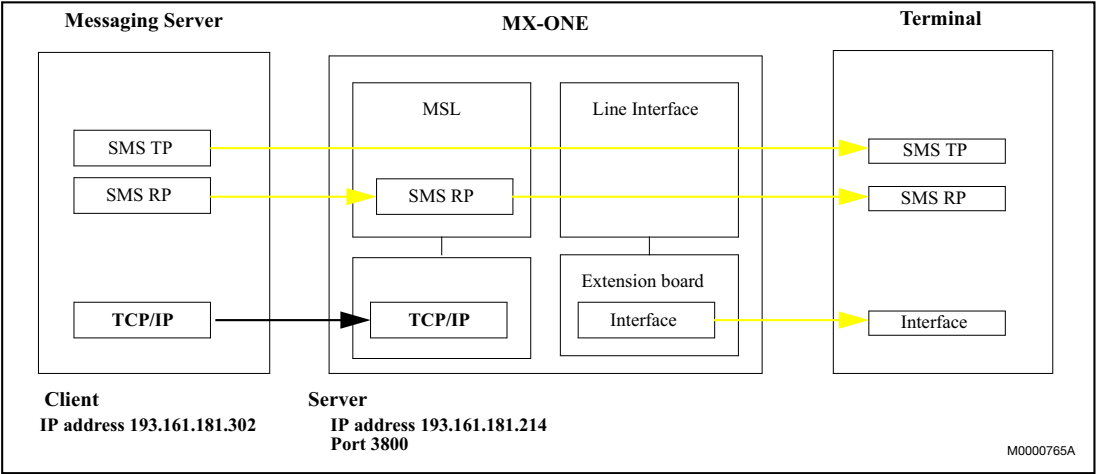
The Relay Layer and Protocol between the MSC and the SC are outside the scope of the GSM standards. A recommendation for the interface exists GSM 03.47 [5]. In the MX-ONE scenario the GSM standard for the air interface is extended to also apply to the MX-ONE-SC interface. The coding of the Relay Protocol is kept as specified in GSM 04.11[1] with additions for the messages that are only applicable to the MSC(MX-ONE) - SC interface. The additions are as far as possible consistent with the recommendations in GSM 03.47 [5]. In MX-ONE the lower layers are terminal dependent.



**Figure 3: Messaging services overview**

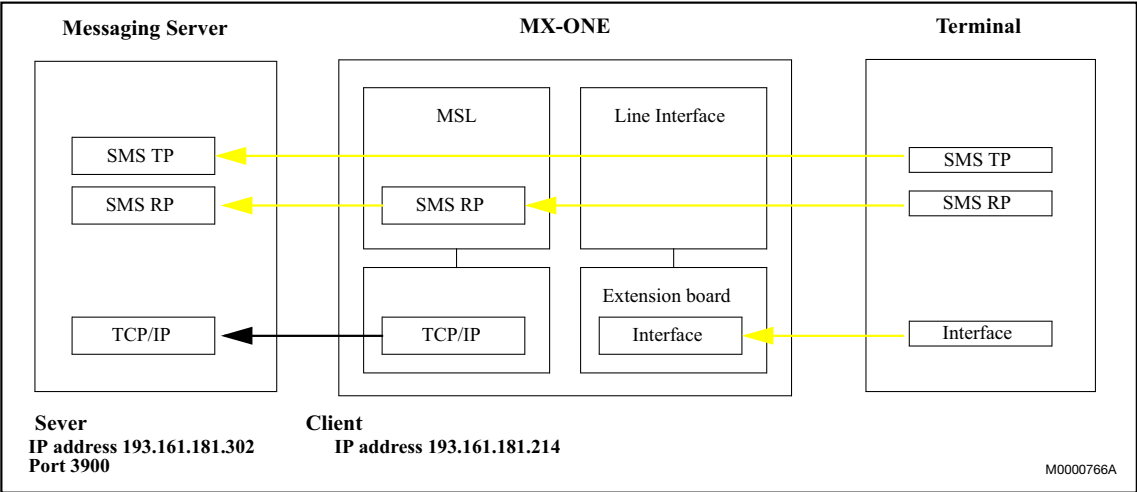
The subsequent chapters give a short overview of each of the protocol layers. Note that any IP addresses and port numbers are for illustration purposes only.

1.1 TCP/IP LAYER



**Figure 4: TCP configuration, MX-ONE connected as a TCP server**

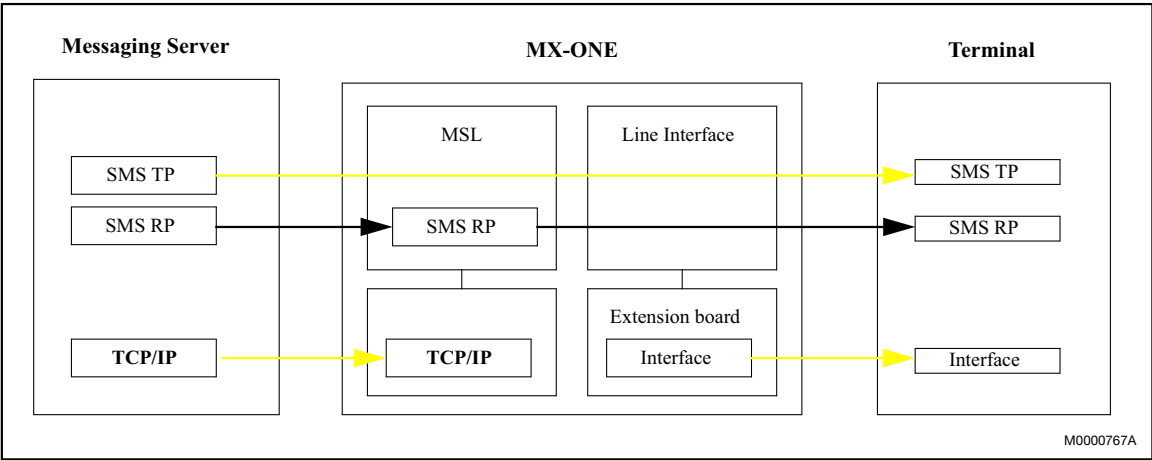
When MX-ONE (in this situation working as a TCP server), at any time shall be able to receive messages from the Messaging Server (in this situation working as a TCP client), the port is initiated by O&M procedures and remains open until closed by O&M procedures.



**Figure 5: TCP configuration, MSL connected as a TCP client**

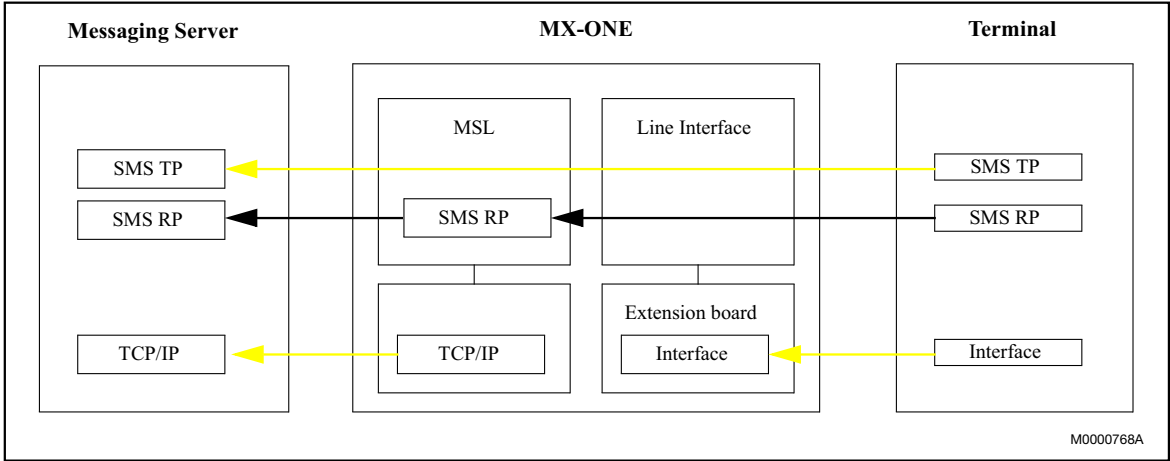
When MX-ONE (in this situation working as a TCP client) receives a non-B-channel, SMS call from a terminal MX-ONE shall set up a TCP/IP connection to the Messaging Server (in this situation working as a TCP server). MX-ONE will then transfer the data, wait, receive the answer, and disconnect the TCP/IP connection.

1.2 SMS RP LAYER



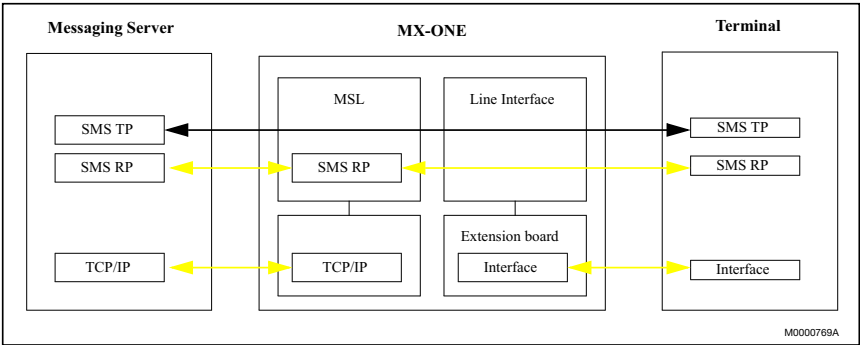
**Figure 6: SMS RP layer, sending message to terminal**

MSL extracts the directory number of the receiving terminal from the SMS RP layer. This directory number is used to route the message to the correct terminal.



**Figure 7: SMS RP layer, receiving message from terminal**  
The directory number of the terminal is added to the SMS RP header by MSL.

1.3 SMS TP LAYER



**Figure 8: SMS TP layer**  
The SMS TP layer is transparent to MX-ONE.

## 2 ALLOCATION OF FUNCTIONS

### 2.1 PROTOCOL LAYERS

The figure below illustrates how all the different protocol layers are packaged within each other.

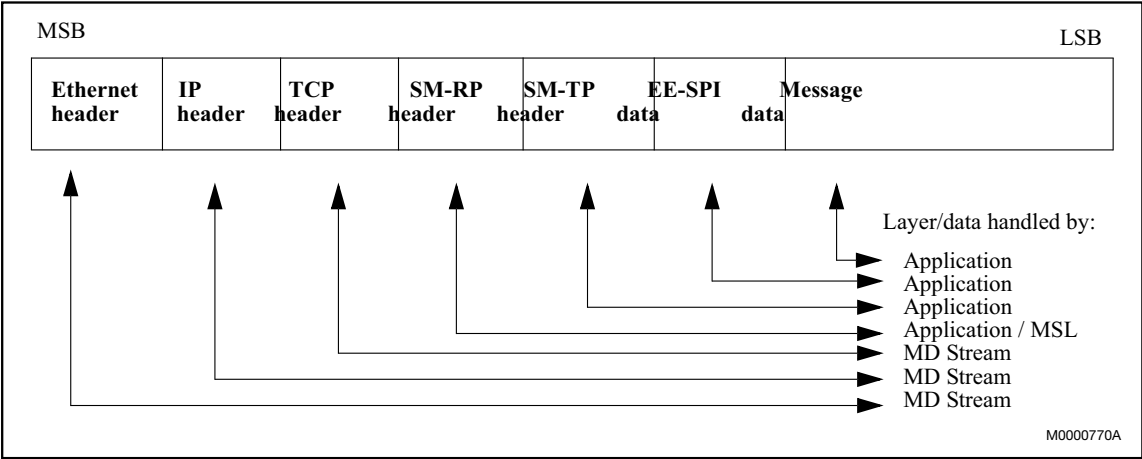


Figure 9: Protocol layers

RP hdr: RP-MT-DATA	RP user data		
	TP hdr: SMS-DELIVER	TP user data	
		TP user data hdr: EE-SPI	Message

Figure 10: Protocol layer example: Mobile terminated message

The SM Relay Layer is described in subsequent chapters.

### 2.2 THE SM RELAY PROTOCOL

#### 2.2.1 MESSAGES

The SM-RL comprises the following messages:

<b>RP-MO-DATA</b>	for transferring a TPDU from terminal to SC. The message is modified by MSL.
<b>RP-MT-DATA</b>	for transferring a TPDU from SC to terminal. The message is modified by MSL.
<b>RP-MO/MT-ACK</b>	for acknowledging an RP-MO-DATA, an RP-MT-DATA or an RP-SMMA. The message is transparent to MSL. The message is also generated by MSL as a response to a RP-SMMA.
<b>RP-MO/MT-ERROR</b>	for informing of an unsuccessful RP-MO-DATA or an RP-MT-DATA transfer attempt. The message is generated by MSL if the transfer attempt is unsuccessful and the failure is in the MX-ONE and the transfer attempt has reached beyond MSL. The transfer attempt will be rejected without a RP-MO/MT-ERROR message if the transfer attempt fails before reaching MSL. The message is sent transparently through the MX-ONE if generated by the SC or the terminal.
<b>RP-ALERT-SC</b>	for alerting the SC that the terminal has recovered operation (information sent from the MX-ONE i.e. MSL, to the SC). The message is generated by MSL.
<b>RP-SMMA</b>	for notifying the network that the terminal has memory available to accept one or more short messages (information sent from the terminal to the MX-ONE i.e. MSL). The message is terminated in MSL and a RP-ALERT-SC is generated towards the SC. RP-MO-ACK or RP-MO-ERROR is generated by MSL as response to the RP-SMMA.
<b>RP-HEARTBEAT</b>	Allows the SC to check that the application in the MX-ONE is up and running. The message is returned by MSL.

	8	7	6	5	4	3	2	1
	spare					MTI I.E.		
Octet 1	0	0	0	0	0	x	x	x
Octet 2	Message reference I.E.							
:	Other Information Elements							

**Figure 11: RP message header**

The coding of the Message Type Indicator Information Element Identifier is shown in the table below. Note that the MTI value is dependent upon the direction of the message.

The message Reference IE contains a number identifying the transaction. The number is chosen by the part initiating the transaction.



**Table 1 Coding of Message Type Indicator I.E.**

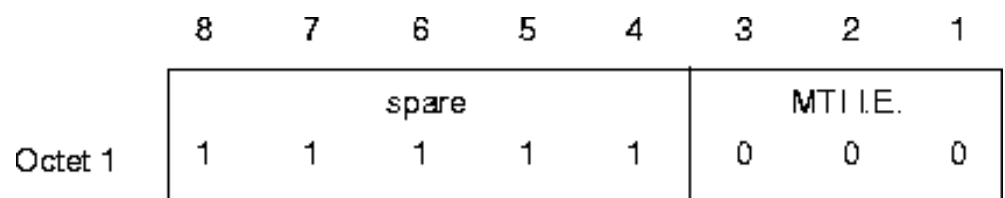
	MTI	Direction	Message
0 0 0 0 0	0 0 0	terminal -> SC	RP-MO-DATA
0 0 0 0 0	0 0 1	SC I -> terminal	RP-MT-DATA
0 0 0 0 0	0 1 0	terminal -> SC	RP-MT-ACK **
0 0 0 0 0	0 1 1	SC/MSL -> terminal	RP-MO-ACK **
0 0 0 0 0	1 0 0	terminal/MSL -> SC	RP-MT-ERROR **
0 0 0 0 0	1 0 1	SC/MSL -> terminal	RP-MO-ERROR **
0 0 0 0 0	1 1 0	terminal -> MSL	RP-SMMA
0 0 0 0 0	1 1 1 *	MSL -> SC	RP-ALERT-SC
1 1 1 1 1 *	0 0 0 *	MSL -> SC	RP-HEARTBEAT
1 1 1 1 1 *	0 0 0 *	SC -> MSL	RP-HEARTBEAT

\* MX-ONE proprietary coding.

\*\* The terms MO and MT is used to describe the direction of the whole transaction and not the direction of each message i.e. the response messages to an RP-MO-DATA is RP-MO-ACK OR RP-MO-ERROR.

The recommended Message Type Indicator value for RP-ALERT-SC in GSM 03.47 [5] is in conflict with the Message Type Indicators specified in GSM 04.11 [1]. The reserved value 7 has been chosen instead.

A new message RP-HEARTBEAT has been defined to allow the SMS-SC to check whether the application in the MX-ONE is up and running or not. The spare bits in octet 1 has been utilized to differentiate this message from the messages defined by the GSM standards. The messages consists of 1 octet only.

**Figure 12: RP-HEARTBEAT**

### 2.2.1.1

#### *Messages decoded by MSL*

Some messages will be manipulated by MSL although they are functionally transparent to MX-ONE.

A standard GSM information element may have the following parts, in that order:

- an information element identifier (IEI);
- a length indicator (LI);
- a value part.

A standard information element has one of the formats shown below:

**Table 2 Information element formats; GSM 04.07 [6]**

Format	Meaning	IEI present	LI present	Value part present
T	Type only	Y	N	N
V	Value only	N	N	Y
TV	Type and Value	Y	N	Y
LV	Length and Value	N	Y	Y
TLV	Type, Length and Value	Y	Y	Y

All Information Elements that can be included in the message are shown in the figures even though they are of no interest to MSL.

**Table 3 Contents of RP-MT-DATA**

IEI	Information Element	Presence	Format	Comments
	RP-Message-Type	M	V	
	RP-Message-Reference	M	V	
	RP-Originating-Address	M	LV	
	RP-Destination-Address	M	LV	The directory number of the receiving terminal is extracted from this information element. The length is set to 0 before the message is sent on to the terminal.
	RP-User-Data	M	LV	

Only RP-Destination Address I.E. is of interest to MSL. The destination address is used to set up the SMS call to the correct terminal.

**Table 4 Contents of RP-MO-DATA**

IEI	Information Element	Presence	Format	Comments
	RP-Message-Type	M	V	
	RP-Message-Reference	M	V	
	RP-Originating-Address	M	LV	The length of this information element is 0 when received from the terminal. MSL enters the calling party number in the information element before the message is sent to SC.
	RP-Destination-Address	M	LV	
	RP-User-Data	M	LV	

Only RP-Originating Address I.E. is of interest to MSL. The calling party number is not included in the RP-Originating Address I.E. when an RP-MO-DATA message is

received from the terminal. MSL enters the calling party number in the RP-Originating Address I.E. before the message is sent to SC.

**Table 5 Contents of RP-SMMA**

IEI	Information Element	Presence	Format	Comments
	RP-Message-Type	M	V	
	RP-Message-Reference	M	V	

The message is terminated in MSL and MSL generates a RP-ALERT-SC. The terminal is informed whether MSL was able to send the RP-ALERT-SC in a RP-MO-ACK or RP-MO-ERROR message generated by MSL. The calling party number is included in the RP-ALERT-SC message.

**Table 6 Contents of RP-HEARTBEAT**

IEI	Information Element	Presence	Format	Comments
	RP-Message-Type	M	V	

The message is terminated in MSL and MSL returns the message to the SMS-SC.

#### 2.2.1.2

#### *Messages generated by MSL*

Only the Information Elements generated by MSL are shown. The messages may contain additional Information Elements when the messages are sent transparently through MX-ONE.

**Table 7 Contents of RP-MO/MT-ACK**

IEI	Information Element	Presence	Format	Comments
	RP-Message-Type	M	V	
	RP-Message-Reference	M	V	

**Table 8 Contents of RP-MO/MT-ERROR**

IEI	Information Element	Presence	Format	Comments
	RP-Message-Type	M	V	
	RP-Message-Reference	M	V	
	RP-Cause	M	LV	

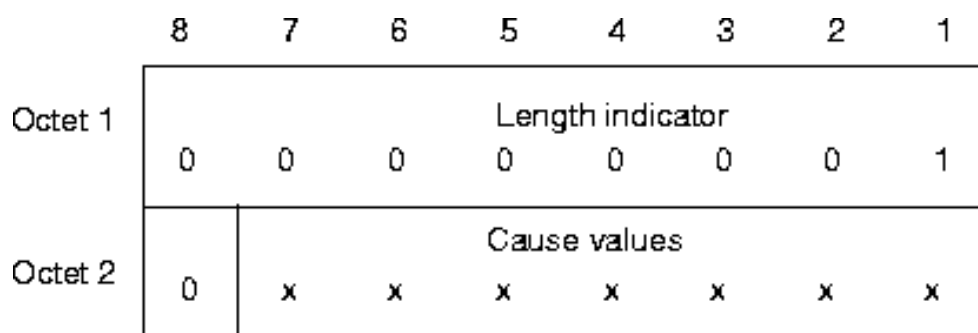
**Table 9 Contents of RP-ALERT-SC**

IEI	Information Element	Presence	Format	Comments
	RP-Message-Type	M	V	
	RP-Message-Reference	M	V	
	RP-Originating-Address	M	LV	The RP-Originating-Address I.E. is used to convey the directory number of the terminal (RP-MSIsdn in GSM 03.40 [2]).

The RP-Originating Address I.E. contains the directory number of the terminal that are now available for receiving SMS messages.

## 2.2.2 INFORMATION ELEMENTS

### 2.2.2.1 RP-Cause information element

**Figure 13: RP-Cause information element**

Cause values used to and from the terminal are specified in GSM 04.11 [1]. Recommended cause values to use to and from the SC are found in GSM 03.47 [5]. Note that there are not a one-to-one mapping between the cause values. Some values do only exist in one document and not in the other document. Some values exist in both documents but have different values. RP-MT/MO-ERROR messages are sent transparently through MX-ONE including cause values.

A limited set of cause values are used in the instances where MSL generates an RP-MT/MO-ERROR message. The cause values are shown in the tables below. The cause values chosen from GSM 03.47 [5] are not in conflict with the cause values specified in GSM 04.11 [1].

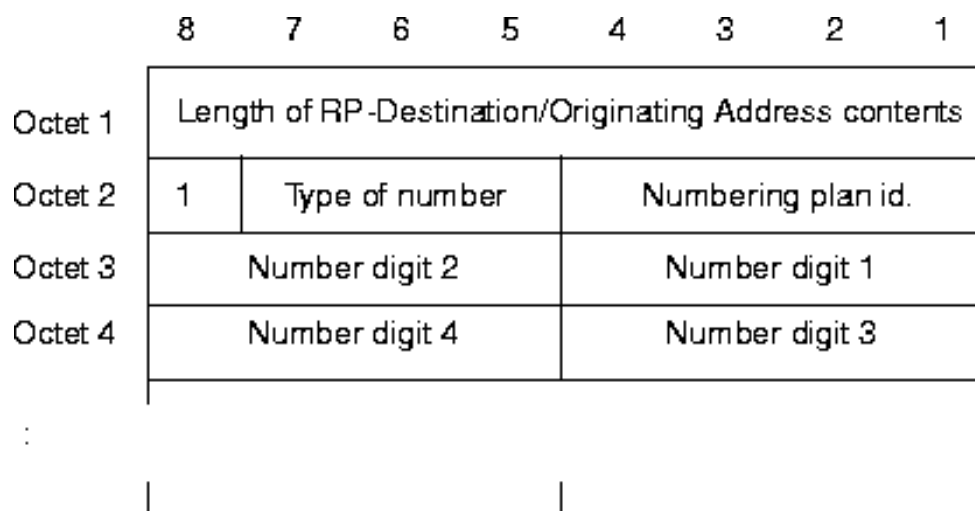
**Table 10 Cause values used by MSL when sent to SC; GSM 03.47 [5]**

Cause value	Cause #	Cause	Recommended action by receiver
0 0 0 0 0 0 1	1	Unknown subscriber	Abort (definitive rejection)
0 0 0 1 1 0 1	13	Call barred	Abort (definitive rejection)
0 0 1 1 1 0 1	29	Absent subscriber	Wait for subscriber to resume operation (RP-ALERT-SC)
0 1 0 0 1 0 0	36	System failure	Retry (temporary rejection)

**Table 11 Cause values used by MSL when sent to terminal; GSM 04.11 [1]**

Cause value	Cause #	Cause	Recommended action by receiver
0 1 0 1 0 0 1	41	Temporary failure	Retry (temporary rejection)

## 2.2.2.2

*RP-Destination/Originating Address information element***Figure 14: RP-Destination/Originating Address information element**

Note that the RP-Destination/Originating Address I.E. are of type LV and does not contain an IEI.

The RP-Destination Address I.E. contains the directory number of the receiving terminal in a RP-MT-DATA message sent by the SC. The length of the information element is set to 0 by MSL before the message is sent further on to the terminal by MX-ONE, GSM 04.11 [1].

The RP-Originating Address I.E. does not contain the directory number of the sending terminal in a RP-MO-DATA message sent by the terminal, GSM 04.11 [1]. MSL fills in the calling party number in the RP-Originating Address I.E. before sending the message to the SC.

## 2.3

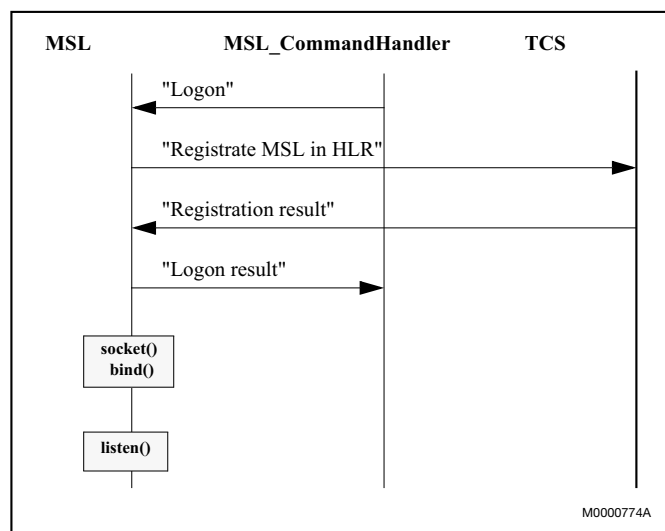
## TRANSFER OF SMS MESSAGES IN THE MX-ONE

<b>connect()</b>	The client identifies a server's IP address and port. TCP will attempt to establish a connection with the server.
<b>socket()</b>	The client identifies the type of communication (TCP in this case). The local system creates an appropriate TCB data structure for communication and returns a local socket descriptor(e.g. transaction identifier).

<b>bind()</b>	The server establishes the local IP address and port that it wants to use. The host may have multiple IP addresses. The server may specify one IP address or else indicate that it is willing to accept connections arriving at any local IP address. The server may ask for a specific port or else let the bind call obtain a free port that it can use.
<b>listen()</b>	The server sets the length of the client queue.
<b>accept()</b>	The server is ready to accept client connections. If the queue is not empty, the first client connection request is accepted. The accept () call creates a new TCB that will be used for this client's connection and returns a new descriptor to the server.
<b>read()</b>	Receives a buffer of data from a socket.
<b>write()</b>	Writes a buffer of data to the socket.
<b>close()</b>	Closes the connection.

## 2.3.1

## INITIATION OF PORT AND REGISTRATION OF MSL IN HLR

**Figure 15: TCP server passive open**

MX-ONE acts as both server and client in the TCP/IP net. MSL must be registered in HLR and a port must be opened as a TCP server before MX-ONE can send or receive messages.

## 2.3.2 MESSAGE RECEIVED FROM THE SC

## 2.3.2.1 Successful transfer of SMS message

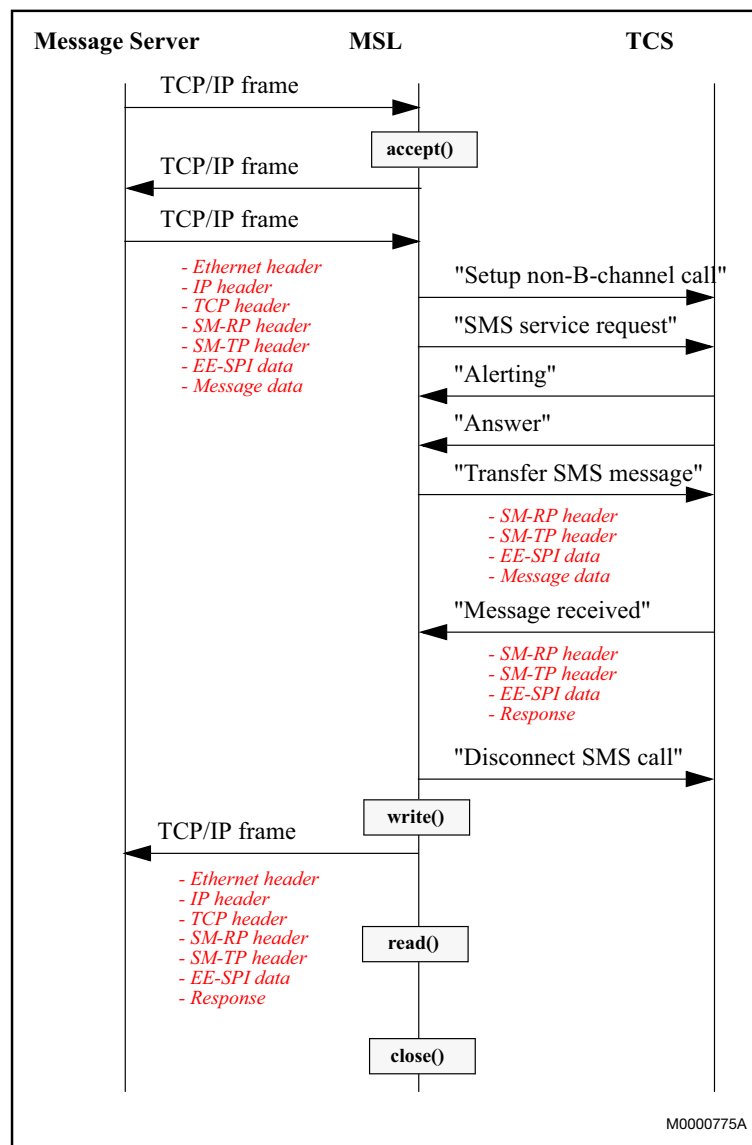
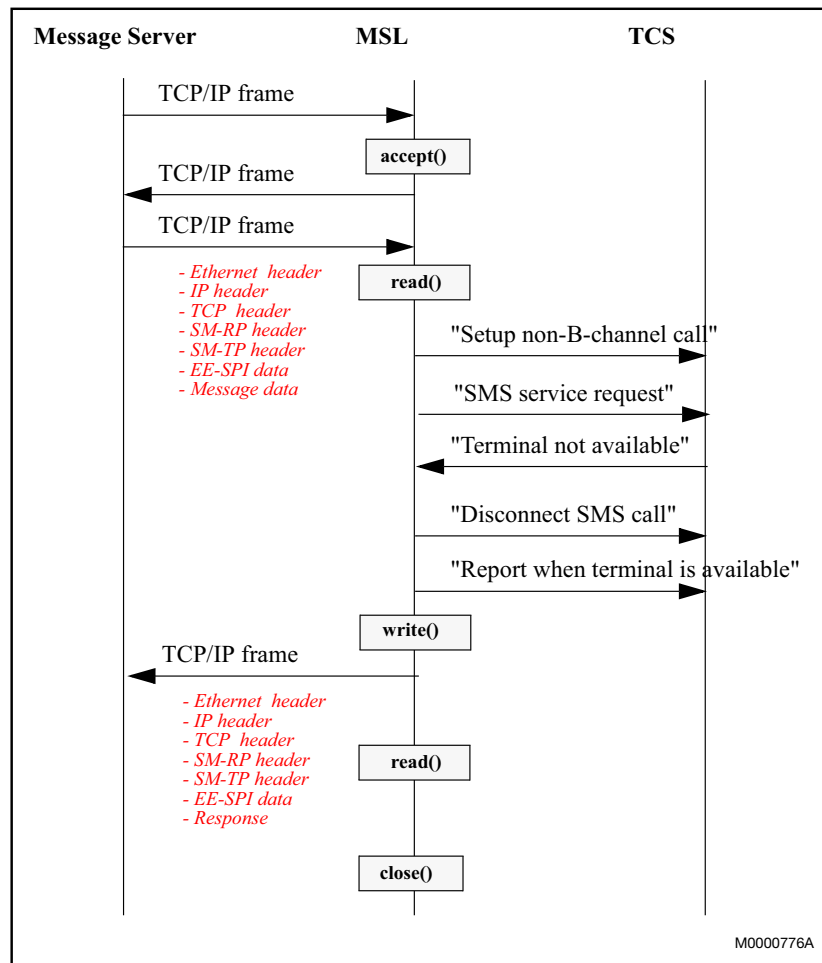


Figure 16: RP-MT-DATA message received from SC

The MD Stream removes the Ethernet-, IP- and TCP-headers before the data is conveyed to MSL in the databuffer in `>readsigares>`. MSL checks that the message is a RP-MT-DATA message before extracting the directory number from the RP-Destination Address I.E. The extracted number is sent to TCS as called party number in the SMS service request. The length of the RP-Destination Address is set to 0 by MSL before the message is transferred to the receiving party.

## 2.3.2.2

## Receiver not available



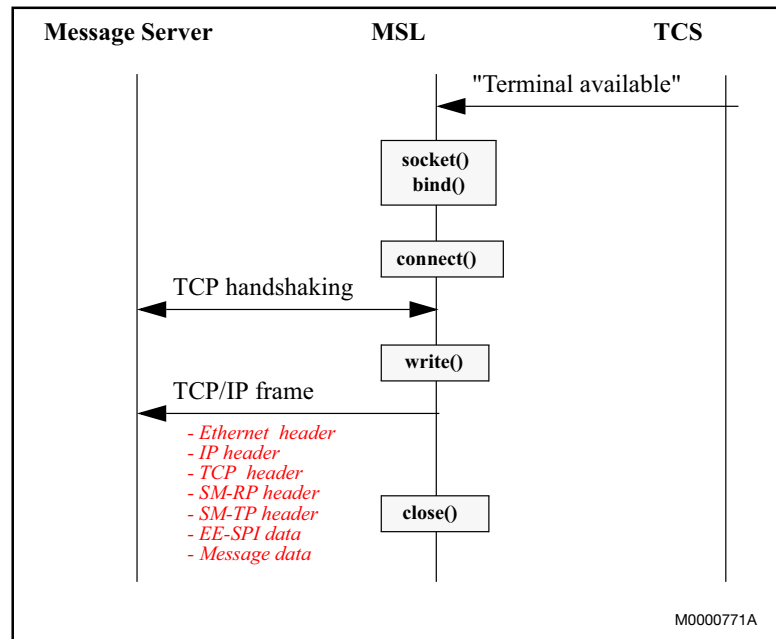
**Figure 17: RP-MT-DATA message received from SC, Terminal not available**

The MD Stream removes the Ethernet-, IP- and TCP-headers before the data is conveyed to MSL in the databuffer in `>readsigares>`. MSL checks that the message is a RP-MT-DATA message before extracting the directory number from the RP-Destination Address I.E. The extracted number is sent to TCS as called party number in the SMS service request.

MSL disconnect the call towards TCS when MSL is informed that the sought terminal is not available and request monitoring of the unavailable terminal.

A RP-MT-ERROR message is sent to the SC with cause value "Absent subscriber".





**Figure 18: Terminal becomes available**

MSL opens a port when the terminal is reported as available. The directory number of the terminal is inserted in the RP-Originating Address I.E. which is sent to the SC in a RP-ALERT-SC message.

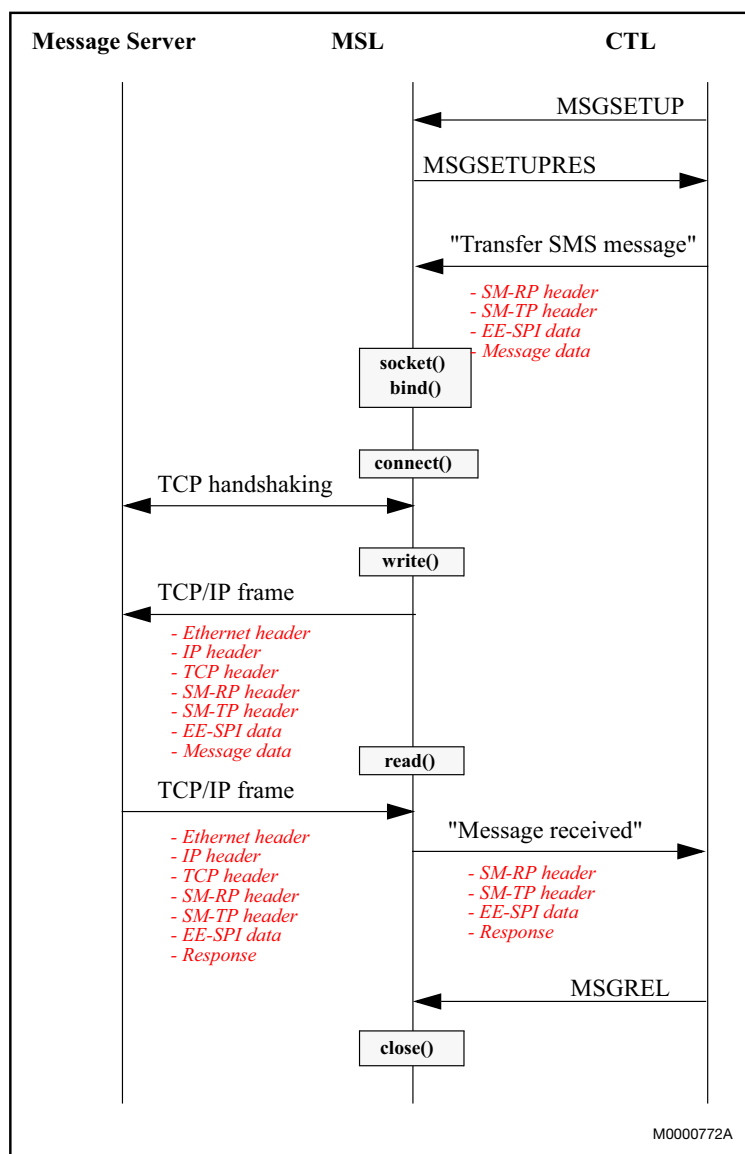
The SC may or may not resend the message. The message might have been deleted or expired in the SC.

## 2.3.3

## MESSAGE RECEIVED FROM TERMINAL

## 2.3.3.1

## Successful transfer of SMS message

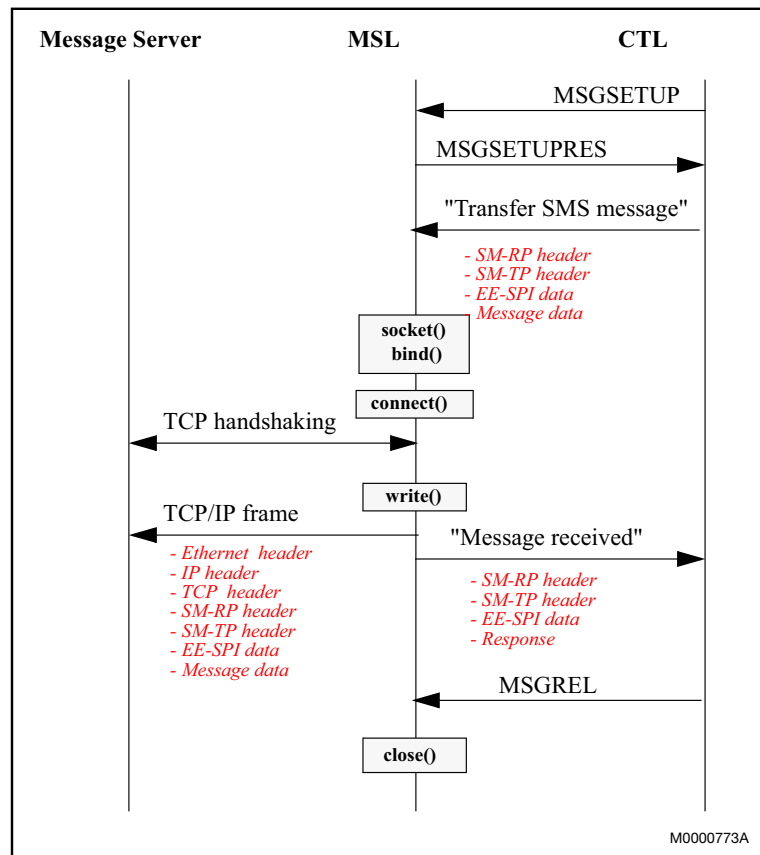


**Figure 19: RP-MO-DATA message received from terminal**

MSL checks that the SMS message is a RP-MO-DATA message before opening the TCP/IP port. The calling party number received from TCS at call setup, is inserted in the RP-Originating Address I.E. before the SMS message is sent to the SC.

## 2.3.3.2

## Memory available indication received from terminal

**Figure 20: RP-SMMA message received from terminal**

MSL checks that the SMS message is a RP-SMMA message before opening the TCP/IP port. The calling party number received from TCS at call setup, is inserted in the RP-Originating Address I.E. which is sent to the SC in a RP-ALERT\_SC message. MSL generates an RP-MO-ACK which is sent to the terminal.

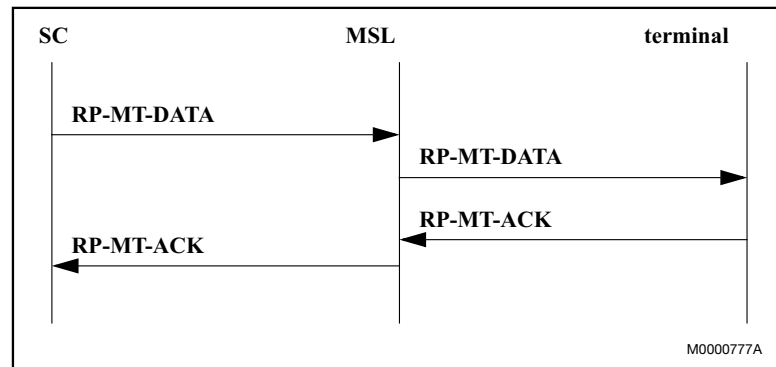
## 3

## RELAY PROTOCOL EXAMPLES

The Relay Layer is used to route the point-to-point call to the correct end point i.e. either the terminal or the SC. In case of sending a message from one terminal to another the Transfer Layer is used to address the receiving terminal.

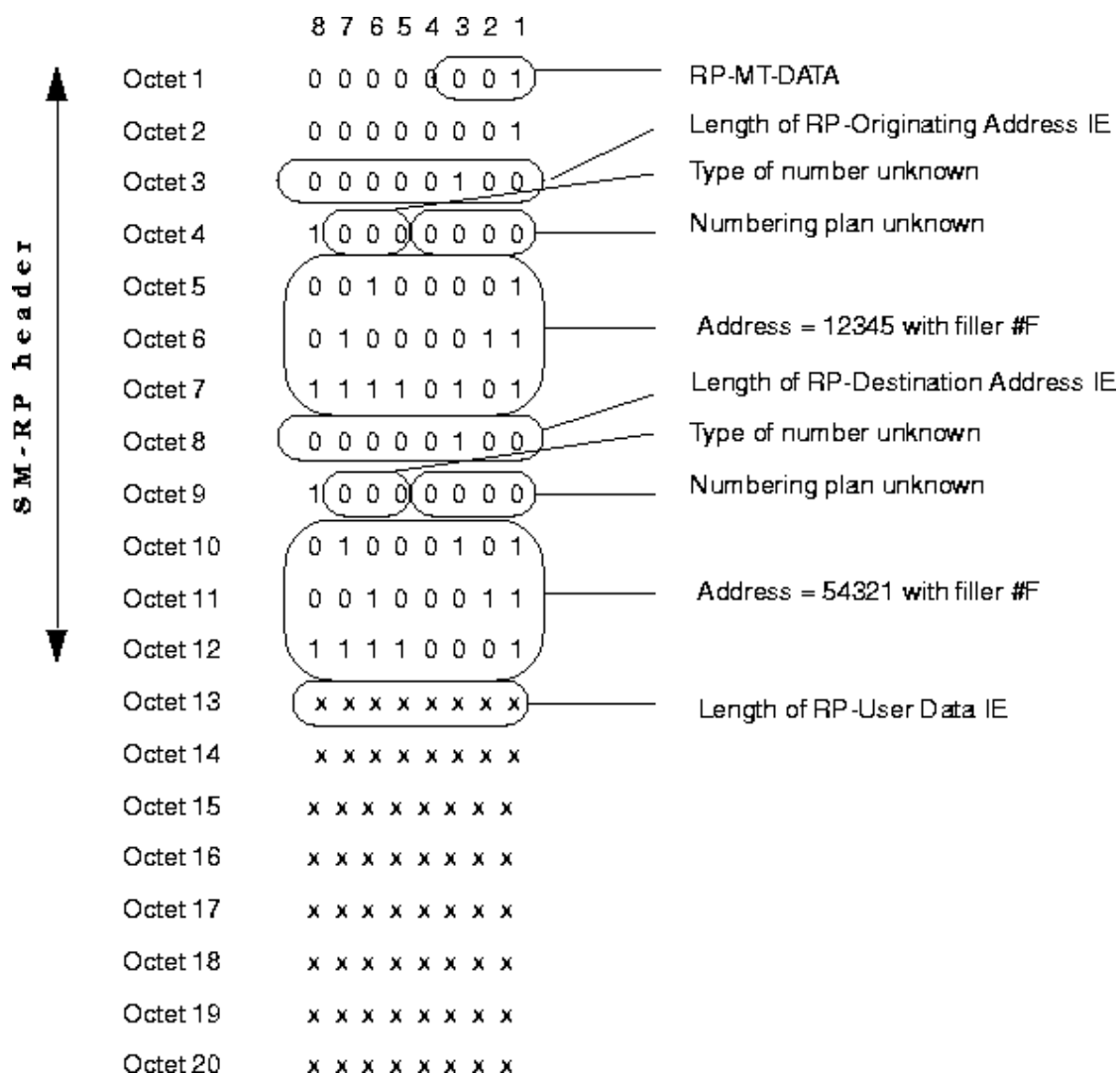
## 3.1

## MESSAGE RECEIVED FROM THE SC



**Figure 21: Mobile terminated SMS message**

The directory number of the terminal is extracted from the RP-MT-DATA message and the message is sent to the terminal. The acknowledge from the terminal is sent transparently through MX-ONE.

**Figure 22: RP-MT-DATA; SC -> MSL**

The directory number of the terminal is extracted from the RP-Destination Address IE. MSL will at the same time set the length of the RP-Destination Address IE to 0 and remove bytes 9-12 in the example above. The resulting RP-MT-DATA sent on to the terminal is shown in the figure below.

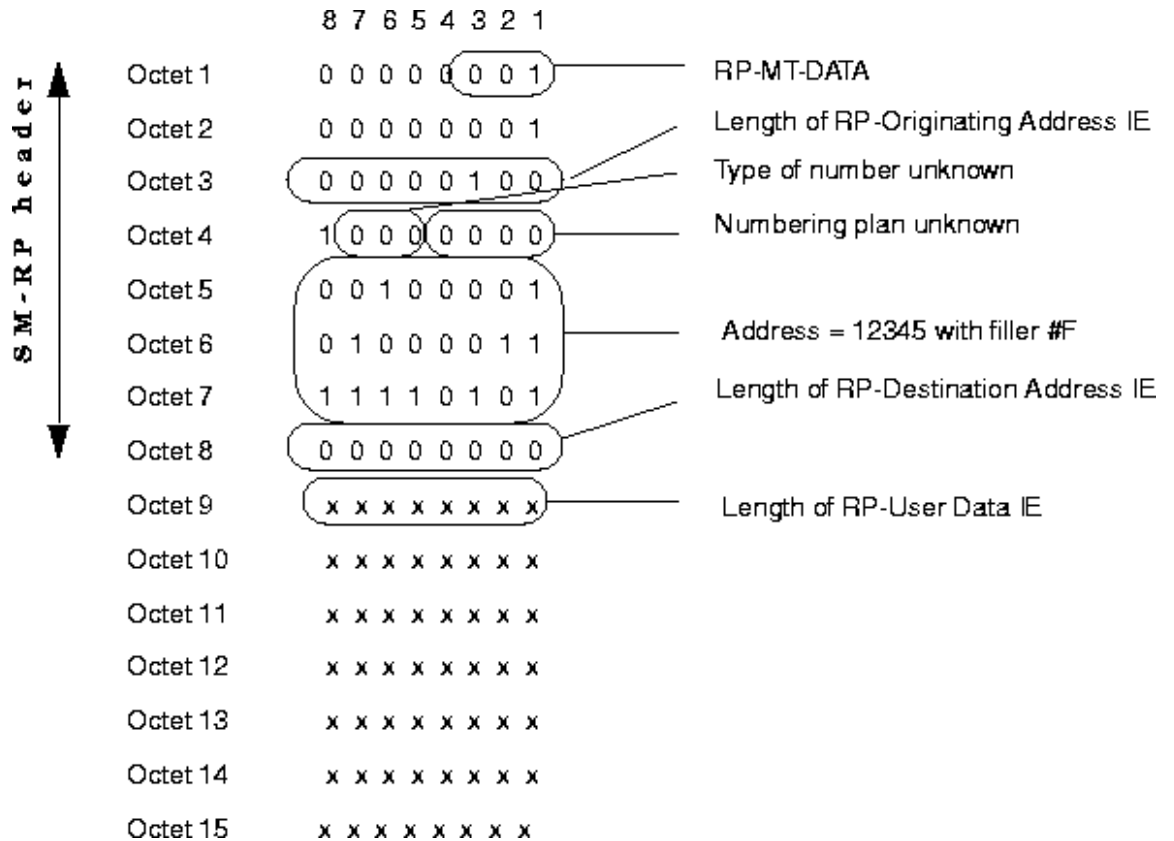


Figure 23: RP-MT-DATA; MSL -&gt; terminal

### 3.2

### MESSAGE RECEIVED FROM TERMINAL

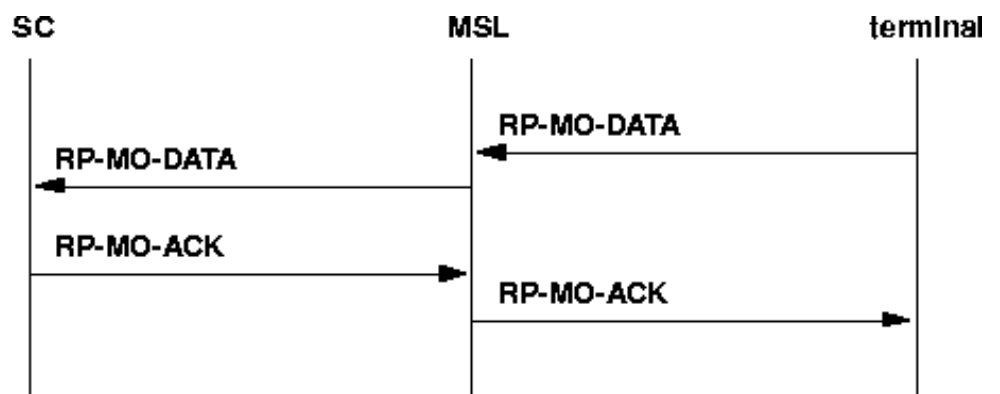
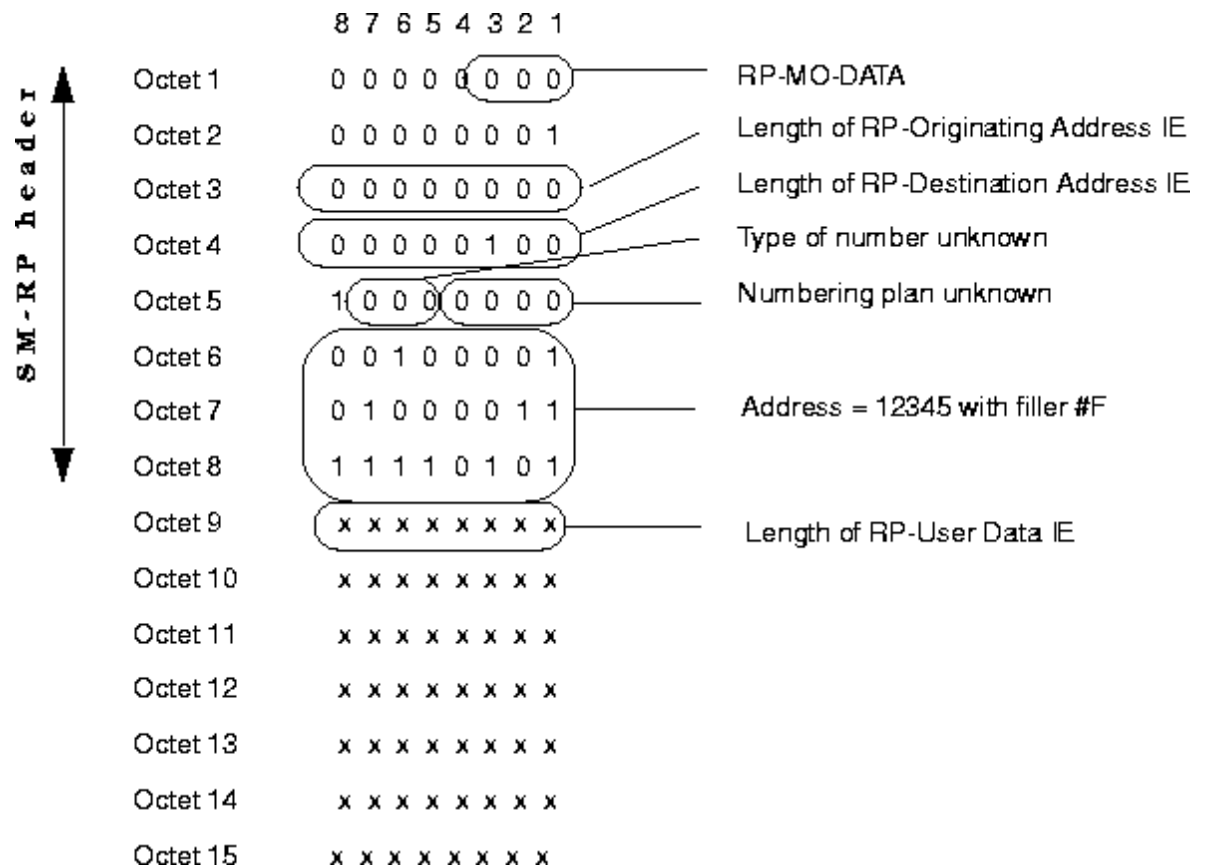


Figure 24: Mobile originated SMS message



**Figure 25: RP-MO-DATA; terminal -> MSL**

MSL will fill in the originators directory number, as received over the Extension API, in the RP-Originating Address IE. The RP-MO-DATA is then sent to the SC. See example below.

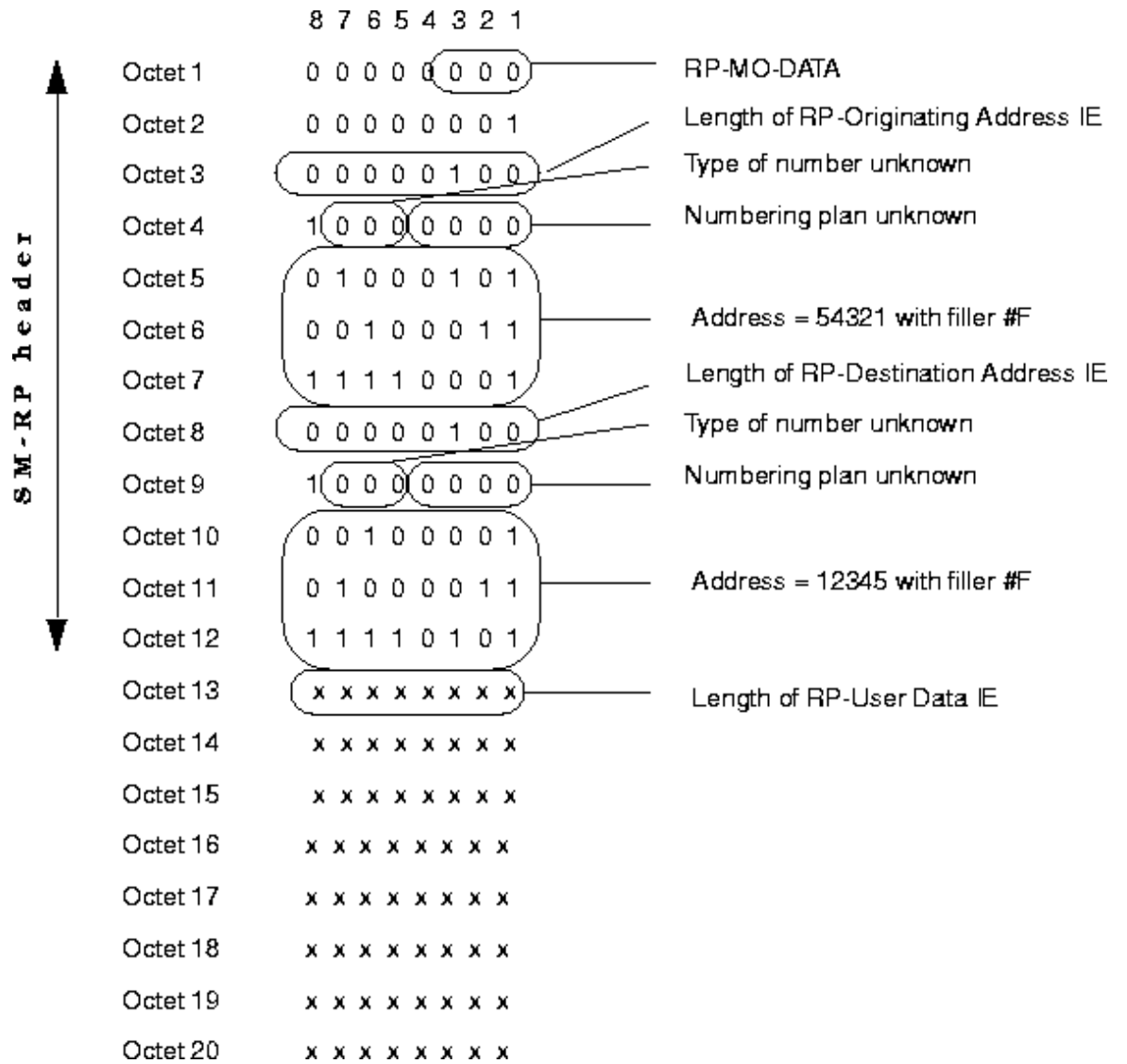


Figure 26: RP-MO-DATA; MSL -&gt; terminal

### 3.3

### MEMORY AVAILABLE INDICATION

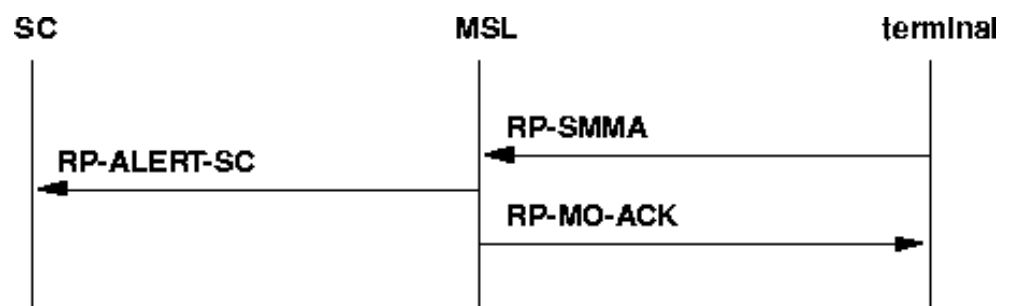


Figure 27: Mobile terminated SMS message



The terminal may indicate to the network that memory has become available for storing of SMS messages if a SMS transfer has previously failed due to lack of memory in the terminal.

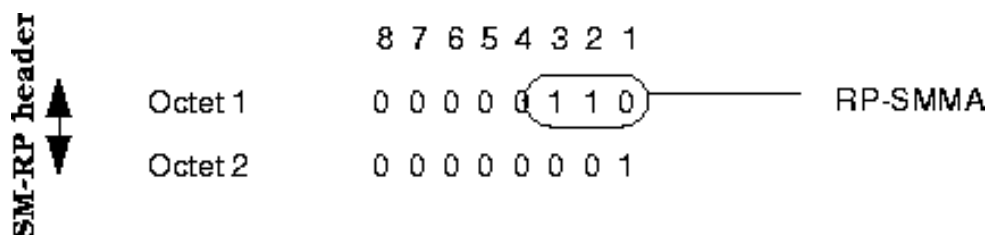


Figure 28: RP-SMMA

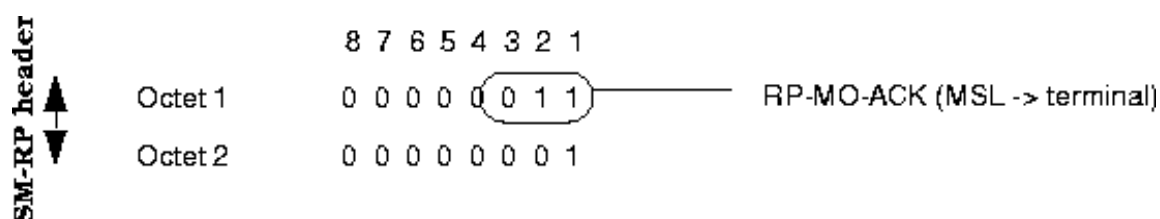


Figure 29: RP-MO-ACK; MSL -> terminal

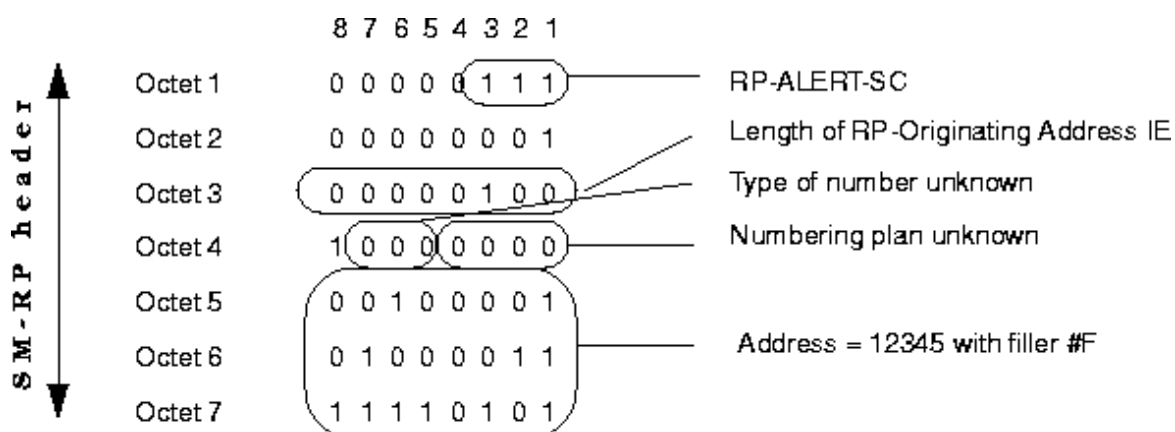
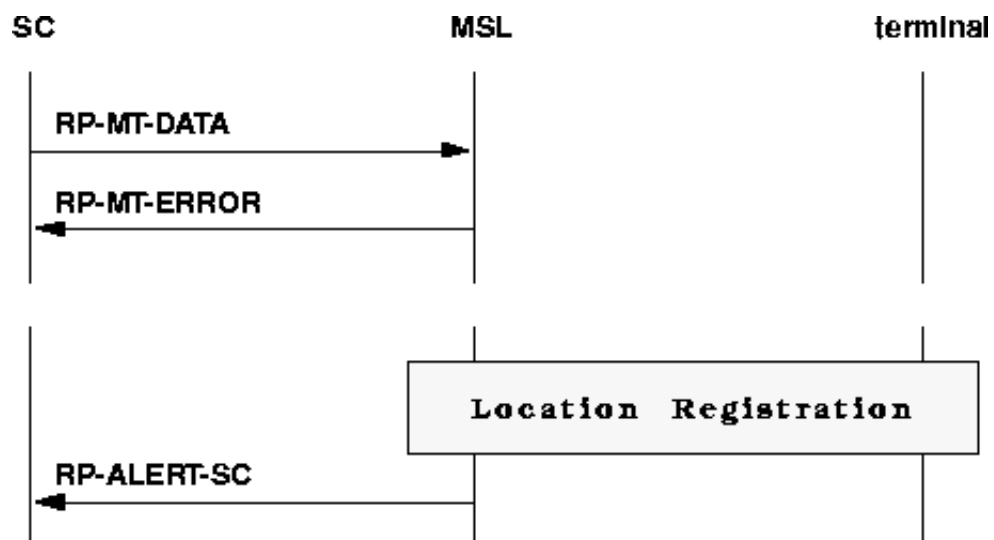


Figure 30: RP-ALERT-SC

The RP-ALERT-SC contains the directory number of the terminal that is now ready to receive SMS messages.

## 3.4

## TERMINAL (TEMPORARY) NOT AVAILABLE



**Figure 31: Terminal (temporary) not available**

The SC may transmit any waiting messages when RP-ALERT-SC is received, 3.1 Message received from the SC on page 20 . For coding of the RP-ALERT-SC message 30 RP-ALERT-SC on page 25 .

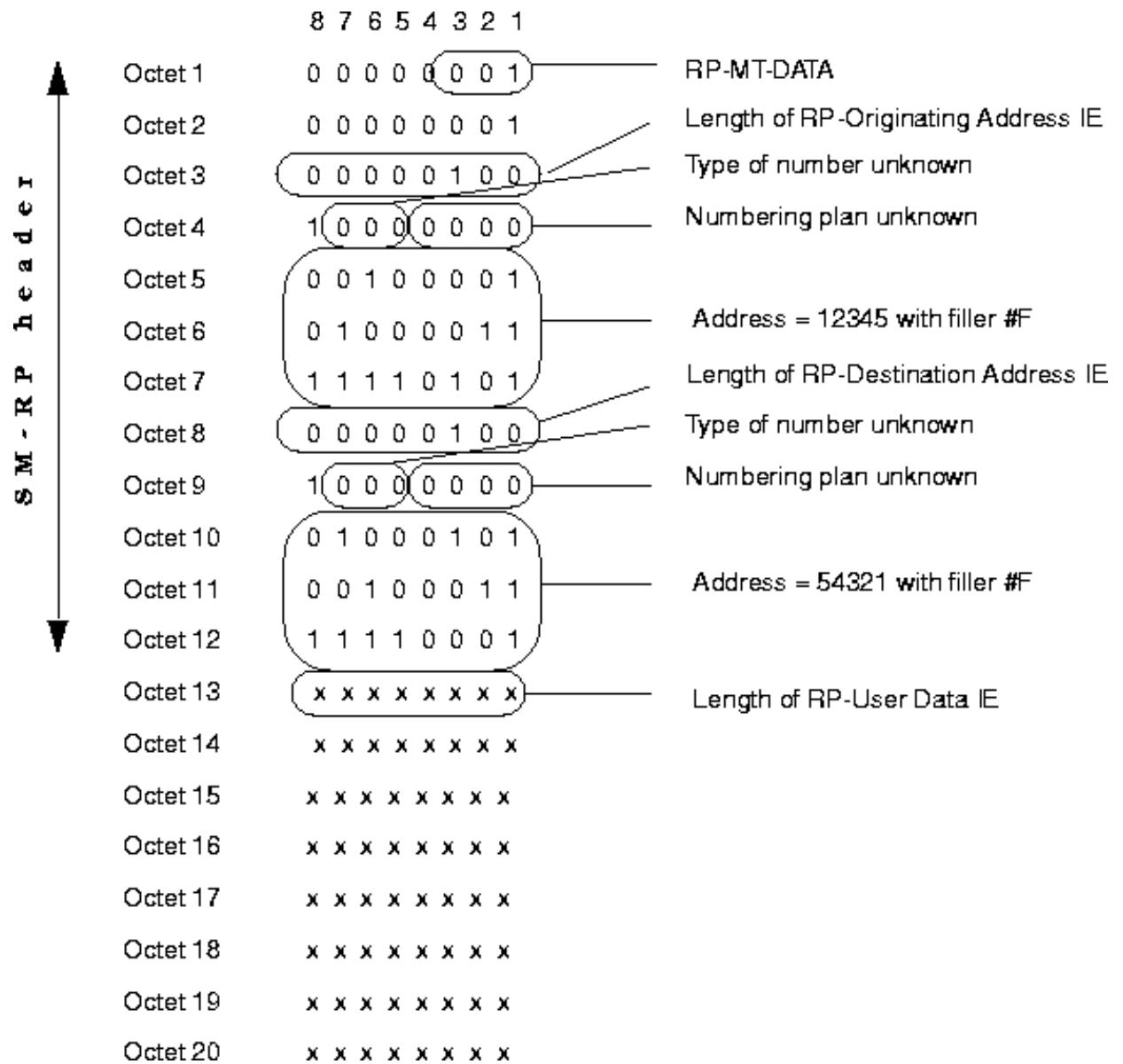


Figure 32: RP-MT-DATA; SC -> MSL

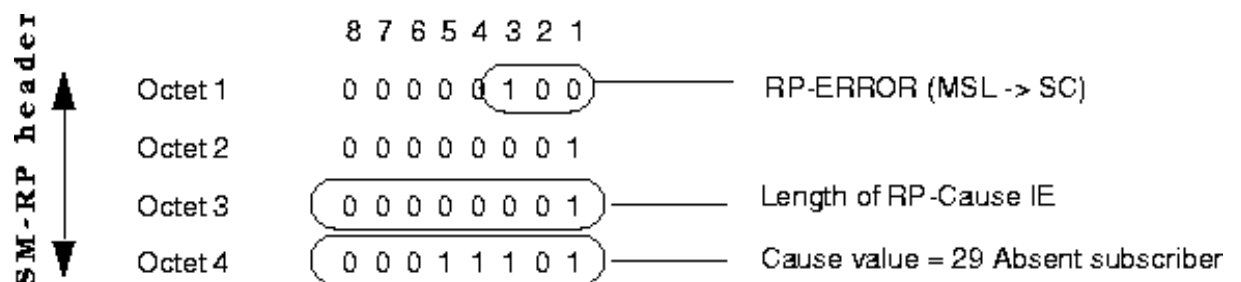


Figure 33: RP-MT-ERROR; MSL -> SC

## 3.5

## REFERENCES

- |     |           |   |
|-----|-----------|---|
| [1] | Title:    | Digital cellular telecommunications system (Phase 2+);<br>Point-to-Point (PP) Short Message Service (SMS) support on mobile radio interface<br>(GSM 04.11 version 6.0.1 Release 1997) |
|     | Doc. no:  | TS 100 942  |
|     | Revision: | v6.0.1 (1998-08)  |
- 
- |     |           |  |
|-----|-----------|--|
| [2] | Title:    | Digital cellular telecommunications system (Phase 2+);<br>Technical realization of the Short Message Service (SMS; Point-to-Point (pp)<br>(GSM 03.40 version 6.1.0 Release 1997) |
|     | Doc. no:  | TS 100 901   |
|     | Revision: | v6.1.0 (1998-07)   |
- 
- |     |           |  |
|-----|-----------|--|
| [3] | Title:    | Digital cellular telecommunications system (Phase 2+);<br>Numbering, addressing and identification<br>(GSM 03.03 version 6.1.0 Release 1997) |
|     | Doc. no:  | TS 100 927   |
|     | Revision: | v6.1.0 (1998-07)   |
- 
- |     |           |  |
|-----|-----------|--|
| [4] | Title:    | Digital cellular telecommunications system (Phase 2+);<br>Mobile radio interface layer 3 specification<br>(GSM 04.08 version 6.2.0 Release 1997) |
|     | Doc. no:  | EN 300 940   |
|     | Revision: | v6.2.0 (1998-11)   |
- 
- |     |           |   |
|-----|-----------|---|
| [5] | Title:    | Digital cellular telecommunications system;<br>Example protocol stacks for interconnecting Service Centre(s) (SC) and<br>Mobile-services Switching Centre(s) (MSC)<br>(GSM 03.47 version 5.0.0) |
|     | Doc. no:  | ETR 354   |
|     | Revision: | November 1996   |

[6]	Title:	Digital cellular telecommunications system (Phase 2+); Mobile radio interface signaling layer 3; General aspects (GSM 04.07 version 6.2.1 Release 1997)
	Doc. no:	TS 100 939
	Revision:	v6.2.1 (1998-11)