ANNEX 24 to NMT Doc. 450-3 and NMT Doc. 900-3

SMS

NMT Short Message Service (SMS)

Using the DMS Feature

Contents:

1. Sending Short Messages in the NMT

SMS transmission is based on DMS data signalling on the speech path which is specified in ANNEX 21 (1997-01-31) of NMT Doc.450-3 and Doc.900-3. The structure of the SMS packets is defined according to the same principles as for GSM. The SMS packets are exchanged between the MS and the SMS Center.

When an MS is sending a message to another MS, it calls the 'home' SMSC of the receiving MS, i.e. the SMSC where the recepient is registered.

1.1 SMS Call Establishment and Clearing

The reception of the SMS by the MS (SMS DELIVER) is done either after the SMSC has called the MS or after the MS has called (automatically or maually) the SMSC. In the latter case the MS has received information (in frame 5c before a clearing sequence) from the MTX (MTXV) on pending messages and initiates a call automatically, or the user starts manually a call to the SMSC for delivery of messages to the MS.

The SMS call (SMS DELIVER) from the SMS Center (SMSC) to the MS is established using automatic answer according to a modified MTX-MS call procedure as specified in para 4.4.1.14 of NMT Doc.900-1 and Doc.450-1. The speech path will remain muted in this case. If after answering to the SMS call, the MS receives no DMS frames within 10 seconds, it will clear the call. If the MTX does not support the automatic answer procedure, the ordinary MTX-MS call procedures (4.4.1.2.1) will be used. In this case, the user answers manually, the same way as when receiving a normal incoming voice call. The speech path will be opened and stay open until FFSK data (using the DMS feature) is received by the MS from the SMSC. After exchanging the SMS packets, the MS will remain in normal conversation state until cleared by the calling end or by the user.

When sending a message from the MS (SMS SUBMIT) or when the MS calls the SMSC for pending messages (SMS DELIVER), the SMSC is called using the ordinary MS-MTX call procedures (4.4.1.1). The speech path may remain muted. The telephone number to the SMSC shall be preprogrammable to the MS by the user.

The SMS packets are sent and received as DMS data during the conversation state of the MS (audio muted or not).

Normally, the calling entity will always clear the call. If the MS makes an SMS call but gets no response (RR/NR) to the DMS frames sent within 10 seconds after starting to send the DMS frames, it will clear the call. If it reaches the DMS connection but gets no response to a sent SMS packet within 20 seconds, it will clear the call. If in a successful case, the entity which sends the last SMS packet is the one to clear the call (MS when it calls the SMSC for pending messages) it shall wait at least 5 seconds before clearing to allow time for the last acknowledgement to reach the SMSC (due to buffering on the data link), or

until all DMS acknowledgement frames (RR) have been received (if this information is available).

1.2 DMS Signalling and SMS

In SMS calls from the MS to the SMSC, the SMS packets are sent as DMS data directly after the connection (speech path) to the SMSC is established. In SMS calls to the MS, and during coversation state of the MS, SMS messages and ordinary DMS data are distinguished in the MS by the use of an SMS Header before each received SMS data packet.

It is recommended that an MS with SMS capability will display any other DMS data (no Header), than SMS messages, as received (plain characters) during the call and is able to send DMS data as well by using the MS key pad. Only 8-bit DMS data format is required in this case (same as for SMS)

The DMS data connection on the speech path, between the SC (Service Center having a DMS modem) and the MS, is accomplished by the normal DMS initiating sequence of control frames (CT(N)) ID and RAND. The idle frame IDLE CT(0) will be used by the calling entity for checking the connection between peer entities. When the terminating entity is ready to receive data, it acknowledges the first control frame by an RR (Ready to Receive) frame. Both terminals have now established the data link and the procedure may continue.

A positive response by the MS to the RAND received indicates that 8-bit format is accepted and that encryption can be used, as specified in ANNEX 21. Note that the SC or MS may, however, select SMS data transmission without encryption (but using 8-bit data) by sending a negative response to the RAND.

Examples of starting procedures of <u>standard DMS signalling</u>:

CASE 1: Encryption activated in the SC and MS:

	SC	**MS**	
IDLE	CT(0)	RR(1)	
ID	CT(1)		
RAND	CT(2)	RRp(2)	
RAND	CT(2)	RRp(3)	
		CT(0)	RAND
	RRp(1)	RRp(3)	
DATA+MASK	DT(3)	CT(0)	RAND
	RRp(1)	RRp(4)	
	DT(4)		
	DT(5)	RRp(5)	

In the case above, both 7-bit and 8-bit data format can be used. It can be applied to SMS by choosing the 8-bit format (parameter in RAND).

CASE 2: Encryption not in use, SC requests but the MS denies:

	SC	**MS**
IDLE	CT(0)	RR(1)
ID	CT(1)	
RAND	CT(2)	RR(2)
RAND	CT(2)	RR(3)
	DT(3)	RR(3)
	DT(4)	RR(4)
	DT(5)	RR(5)

<u>This method is not applied to SMS</u> because it always results in 7-bit format.

<u>Exception for the DMS having the SMS function:</u>

To be able to use the 8-bit format in all cases (terminating or originating, encryption or no encryption), the MS (DMS) with SMS capabilities shall always send a RAND when initiating data transfer or SMS transfer, even when denying encryption. Before sending any data frames (DT), on the other hand, it shall wait until it has received a RAND or at least one data frame (DT). In addition, to avoid 7-bit mode, the answering MS (direction bit = 1), when operating in 8-bit no scrambling mode, is not allowed to send any RR/RRp frames before getting a response (RR/RRp) to the RAND sent. The mode (7/8 bits) is selected according to the corresponding parameter in the RANDs exchanged, as specified in ANNEX21. If no RAND is received before data frames (DT), 7-bit data is used but this is valid only for other data than SMS messages.

1.2.1 SMS with No Encryption

1.2.1.1 Mobile Terminated SMS (MT-SMS) with No Encryption

SC starts data transmission by sending encryption request which is denuded by the MS. After that SC starts to send non encrypted DT frames:

	SC	**MS**	
IDLE	CT(0)		
IDLE	CT(0)	RR(1)	
ID	CT(1)	RR(1)	
RAND	CT(2)	RR(2)	
RAND	CT(2)	CT(0)	RAND
	RRp(1)	RR(3)	
	DT(3)		
	DT(3)	RR(4)	
	DT(4)	RR(5)	

MS should find out from received data (DTs) the type and length (see 2.2) of the delivered packet for further actions.

In the case the MS is not capable of receiving delivery (memory full or some other malfunction) the transmission is interrupted by sending NR(N) and a NACK (see paragraph 2.2.2.2) in DT(N),DT(N+1) to the SC:

SC	**MS**	
DT(N)	RR(N)	
DT(N+1)	NR(N+1)	e.g. MS's memory full
	DT(N)	MS sends NACK (data)
RR(1)	DT(N+1)	

When SMS-DELIVER is sent correctly (all RRs received), the SMS call is cleared.

1.2.1.2 Mobile Originated SMS (MO-SMS) with No Encryption

The MS starts data transmission by first requesting encryption which is acknowledged by the SC by sending RRp (or RR if the SC does not use encryption). After RRp (or RR), the SC sends RAND but MS does not use encryption and will send RR. MS starts then transmitting SMS-SUBMIT.

SC	**MS**	
	CT(0)	IDLE
RR(1)	CT(0)	IDLE
	CT(1)	ID
RRp(2)	CT(2)	RAND

	RRp(3)	CT(2)	RAND
RAND	CT(0)		
	RRp(3)	RR(1)	MS does not want to use encryption.
RAND	CT(0)	RR(1)	
		DT(3)	

.

In the case of illegal destination in the message or some other malfunction the transmission is interrupted by sending NR(N) and a NACK in DT(N),DT(N+1) to the MS:

SC	**MS**	
RR(N)	DT(N)	
NR(N+1)	DT(N+1)	Error condition appeared
DT(N)		SC sends NACK
DT(N+1)	RR(3)	

When SMS-SUBMIT is sent correctly (all RRs received), the SMS call is cleared.

1.2.2 SMS with Encryption

After the encryption is acknowledged to be active, Mobile Originated and Mobile Terminated SMS calls are executed as described in section SMS with No encryption.

SMS data encryption is based on the DMS signalling specified in ANNEX 21 (1994-06-01) of NMT Doc. 450-3 and 900-3.

	SC	**MS**	
IDLE	CT(0)		
IDLE	CT(0)	RR(1)	
ID	CT(1)	RR(1)	
$RAND_A$	CT(2)	RR(2)	
$RAND_A$	CT(2)	RRp(3)	
		CT(0)	$RAND_B$
DATA	RRp(1)	RRp(3)	
+MASK	DT(3)	CT(0)	$RAND_B$
	RRp(1)	RRp(4)	
	DT(4)		
	DT(5)	RRp(5)	

1.3 DMS Scrambling Key Management and SMSC Numbering

It shall be possible, preferrably by the user, to set the value of, as well as activate/deactivate, a DMS encryption key (8 hex characters). This is a common key for incoming and outgoing SMS calls routed via the home SMS Center of the MS. Once set, the key value shall not be readable (visible). In MSs with the SMS capability, the scrambling key values are always entered as decimal numbers by the user (e.g. key 10F753D2 is presented and entered as 284644306). Key value ‘0’ corresponds to no scrambling case and key value ‘*’ (asterisk) activates the ‘key OFF’ mode described below.

In addition, when sending Short Messages to an MS registered in another SMS Center, it shall be possible in the sending MS to select the home SMS Center telephone number of the receiving MS, the DMS scrambling key (individual key or default key) for that SMSC and the destination MS telephone number for each call. It shall also be possible to deactivate scrambling for calls to other SMSCs than the home SMSC of the calling MS (being the basic setting if no key is entered for the call).

For each MS, a scrambling key can be provided for accessing an SMSC. The SMS scrambling key as well as the SMSC telephone number are provided by the SMSC operator. The key can be unique (individual key) to each MS calling the SMSC (‘key ON’ in the MS).

It is also possible to use the default DMS scrambling keys for all MSs (based on the dialled B-number) if decided by the SMSC operator in case key management is not desired. In this case the key in the MS must be in deactivated state (‘key OFF’ in the MS) but scrambling activated.

The DMS telephone line modems of the SMSC are typically capable of managing the ‘key OFF’ scrambling case automatically. In the ‘key ON’ case, the SMSC must pass the key of the called MS to the modem together with the dialling command. The scrambling for incoming calls can be managed by the DMS telephone line modem in all cases.

If the MS calls an SMSC (other than its home SMSC) which uses individual keys (the ‘key ON’ case) but for which it has not got the scrambling key, it can always send the Short Message with the scrambling function deactivated. In this case the message in not scrambled on the radio path from the sending MS to the nearest Base Station. The home SMSC of the receiving MS, however, will be able use scrambling when sending the message further to the receiving MS.

2 SMS Protocols and Protocol Architecture

All transmission is executed by using Relay-Layer-protocol.
Transmission layers should work according to the GSM 03.40 (SM-TL) and GSM 04.11 (SM-RL) except link SC <-> MS specified below.

2.1 Protocol Element Features

Physically, on the radio path, the bits are sent using 8-bit transmission mode of the DMS. In direction SMSC to MS, before each SMS packet (SM-RL + SM-TL), there is an SMS Header to separate between ordinary DMS data and SMS message protocol elements. The SMS Header consists of at least 8 characters: 01h 18h 53h 4Dh 53h 48h 18h XXh... XXh 02h (XXh = spare for information,

any number of any characters except 02h, do not care unless specified). When detecting a start of incoming DMS data, the MS shall check for the 7 first characters of this Header and then wait for the last character 02h (= end of Header). The appearance of the SMS Header during a continuous data reception should not cause any action for SMS reception. In direction MS to SMSC, no SMS Header is used. See also Paragraph 2.5.

2.1.1 Octet and Bit Transmission Order

In the SMS packets, 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 highest internal number being transmitted first.

Example of the octet and bit order (SMS Submit packet):

Octets 1 and 2 contain 8-bit data. Octets 3 and 4 contain two 7-bit characters represented as an integer:

character 1 = c7 c6 c5 c4 c3 c2 c1, character 2 = d7 d6 d5 d4 d3 d2 d1

x = don't care or these bits meaningless (normally zeroes 0).

Oct.no.		
	1	a7 a6 a5 a4 a3 a2 a1 a0
	2	b7 b6 b5 b4 b3 b2 b1 b0
	3	d1 c7 c6 c5 c4 c3 c2 c1
	4	x x d7 d6 d5 d4 d3 d2

2.1.2 Numeric and Alphanumeric Representation

For parameters within the TPDUs, there are four ways of numeric representation: Integer representation, octet, semi-octet and alphanumeric representation.

2.1.2.1 Integer Representation

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 3.

a)

	Bit number							
Octet number	7	6	5	4	3	2	1	0
5							5b1	5b0
6	6b7	6b6	6b5	5b4	6b3	6b2	6b1	6b0
7	7b7	7b6	7b5	7b4	7b3	7b2	7b1	7b0
8	8b7	8b6	8b5					

b)

$^{5}b_1\ ^{5}b_0\ ^{6}b_7\ ^{6}b_6 \ldots . \ ^{6}b_1\ ^{6}b_0\ ^{7}b_7\ ^{7}b_6 \ldots . \ ^{7}b_1\ ^{7}b_0\ ^{8}b_7\ ^{8}b_6\ ^{8}b_5$

|--------------*--------------|

c) $^{5}b_7\ ^{5}b_6\ ^{5}b_5\ ^{5}b_4\ ^{5}b_3\ ^{5}b_2\ ^{5}b_1\ ^{5}b_0\ ^{6}b_7\ ^{6}b_6\ ^{6}b_5\ ^{6}b_4\ ^{6}b_3\ ^{6}b_2\ ^{6}b_1\ ^{6}b_0 >$

|----------*----------|

$^{7}b_7\ ^{7}b_6\ \ ^{7}b_5\ ^{7}b_4\ ^{7}b_3\ ^{7}b_2\ ^{7}b_1\ ^{7}b_0\ ^{8}b_7\ ^{8}b_6\ ^{8}b_5\ ^{8}b_4\ ^{8}b_3\ ^{8}b_2\ ^{8}b_1\ ^{8}b_1$

*) Bits not representing the integers

21 bits from the octets 5, 6, 7, and 8 in a short message a) will represent an integer as shown in b), and will be transmitted in an order as shown in c).

2.1.2.2 Octet Representation

According to GSM Rec. 03.40 9.1.2.2 .

2.1.2.3 Semi-octet Representation

According to GSM Rec. 03.40 9.1.2.3 .. In NMT SMS, the semi-octet presentation for zero (e.g. in MS Identity or Time Stamp) is binary 1010. Characters *, # and + are coded 1011, 1100 and 1101 in the Address Fields.

2.1.2.4 Alphanumeric Representation

A field which using alphanumeric representation will consist of a number of 7-bit characters represented as the default alphabet defined in Annex 2 of GSM Rec. 03.40. NMT-specific character sets are additionally defined to enable presentation of national letters (see also paragraph 2.2.3.10). See chapter 4 for NMT Character Sets and minimum requirements for supporting them.

2.1.2.5 Address Fields

Each address field of the SM-TL consists of the following sub-fields:

-An address-length field of one octet
-A Type-of-Address field of one octet
-One Address-Value field of variable length; as shown below:

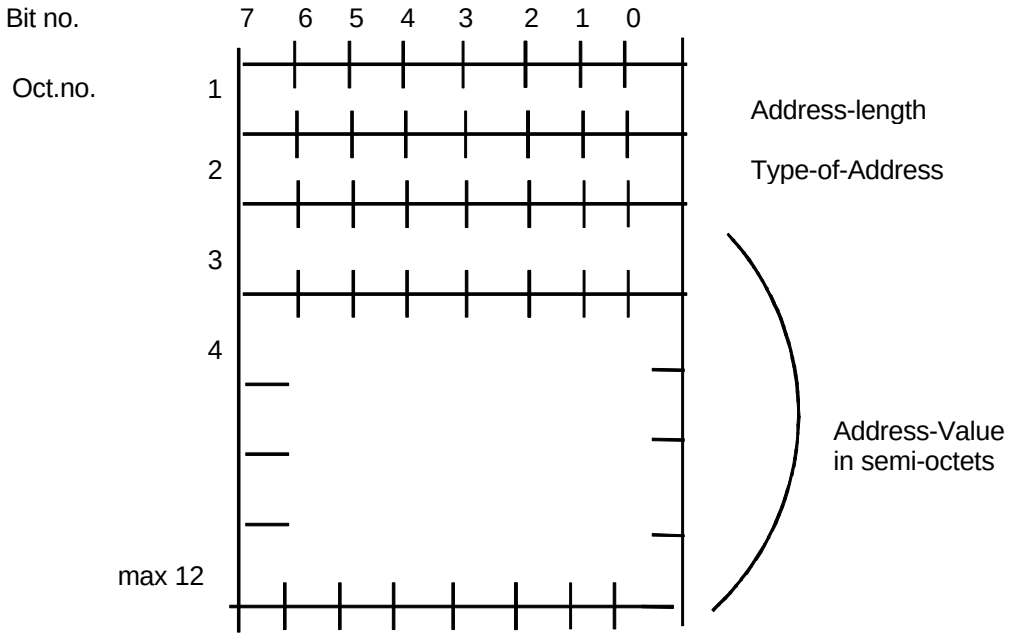


Figure 2.

The address-Length field is an integer representation of the number of useful semi-octets within the Address-Value field, i.e. excludes any semi octet containing only fill bits.

The Type-of-Address field format:

```
bit 7 = 1

bits 6,5,4 indicate Type-of-number:
000       Unknown
001       International number
010       National number
011       Network Specific number
100       Subscriber number
101       Alphanumeric
110       Abbreviated number
111       Reserved for extension
```

```
bits 3,2,1,0 indicate Numbering-plan-identification:
0000      Unknown
0001      ISDN/telephone numbering plan (E.164/E.163)
0011      Data numbering plan (X.121)
0100      Telex numbering plan
1000      National numbering plan
1001      Private numbering plan
1010      ERMES numbering plan (ETSI DE/PS 3 01-3)
1111      Reserved for extension
```

For more details, see GSM Rec. 03.40 9.1.2.5 .

2.2 Service Provided by the SM-TL.

2.2.1 General

The Short Message Transfer Layer (SM-TL) provides a service to the Service Layer (SM-SL). This service enables the Application Layer (SM-AL) to transfer short messages to its peer entity, receive short messages from its peer entity and receive reports about earlier requests for short messages to be transferred.

2.2.2 PDU Type Repertoire at SM-TL

The SM-TL comprises the following six PDUs. For each PDU, in direction SMSC to MS, an SMS Header (01h 18h 53h 4Dh 53h 48h 18h XXh... XXh 02h) is sent before the SMS Package (SM-RL + SM-TL).

SMS-DELIVER, conveying a short message from the SC to the MS
SMS-DELIVER-REPORT, conveying a failure cause (if necessary)
SMS-SUBMIT, conveying a short message from the MS to the SC
SMS-SUBMIT-REPORT, conveying a failure cause (if necessary)
SMS-STATUS-REPORT, conveying a status report from the SC to the MS (Not used in this phase)
SMS-COMMAND, conveying a command from the MS to the SC (not used in this phase).

2.2.2.1 SMS-DELIVER Type (TP-MTI bit1,bit0: 0,0)

TP-MTI	TP-Message-Type-Indicator: -Parameter describing the message type.	(M , 2b)
TP-MMS	TP-More-messages-to-Send: -parameter indicating whether or not there are more messages to send.	(M , b)
TP-RP	TP-Reply-Path - Parameter indicating that Reply Path exists.	(O , b)
TP-SRI	TP-Status-Report-Indication -Parameter indicating if the SME has requested a	(O , b)

status report.

TP-OA	TP-Originating-address -Number of A-subscriber.	(M , 2-12o)
TP-PID	TP-Protocol-Identifier -Parameter identifying the above layer protocol, if any.	(M , o)
TP-DCS	TP-Data-Coding-Scheme -Parameter identifying the coding scheme within the TP-User-Data.	(M , o)
TP-SCTS	TP-Service-Centre-Time-Stamp -Parameter identifying time when the SC received the message.	(M , 7o)
TP-UDL	TP-User-Data-Length -Parameter indicating the length of the TP-User-Data field to follow.	(M , i)
TP-UD		(M , Dependent on the TP-DCS)

M = Mandatory, O = Optional
i = Integer, b = bit, 2b = 2 bits, 7o = 7 octets, 2-12o = 2 to 12 octets.

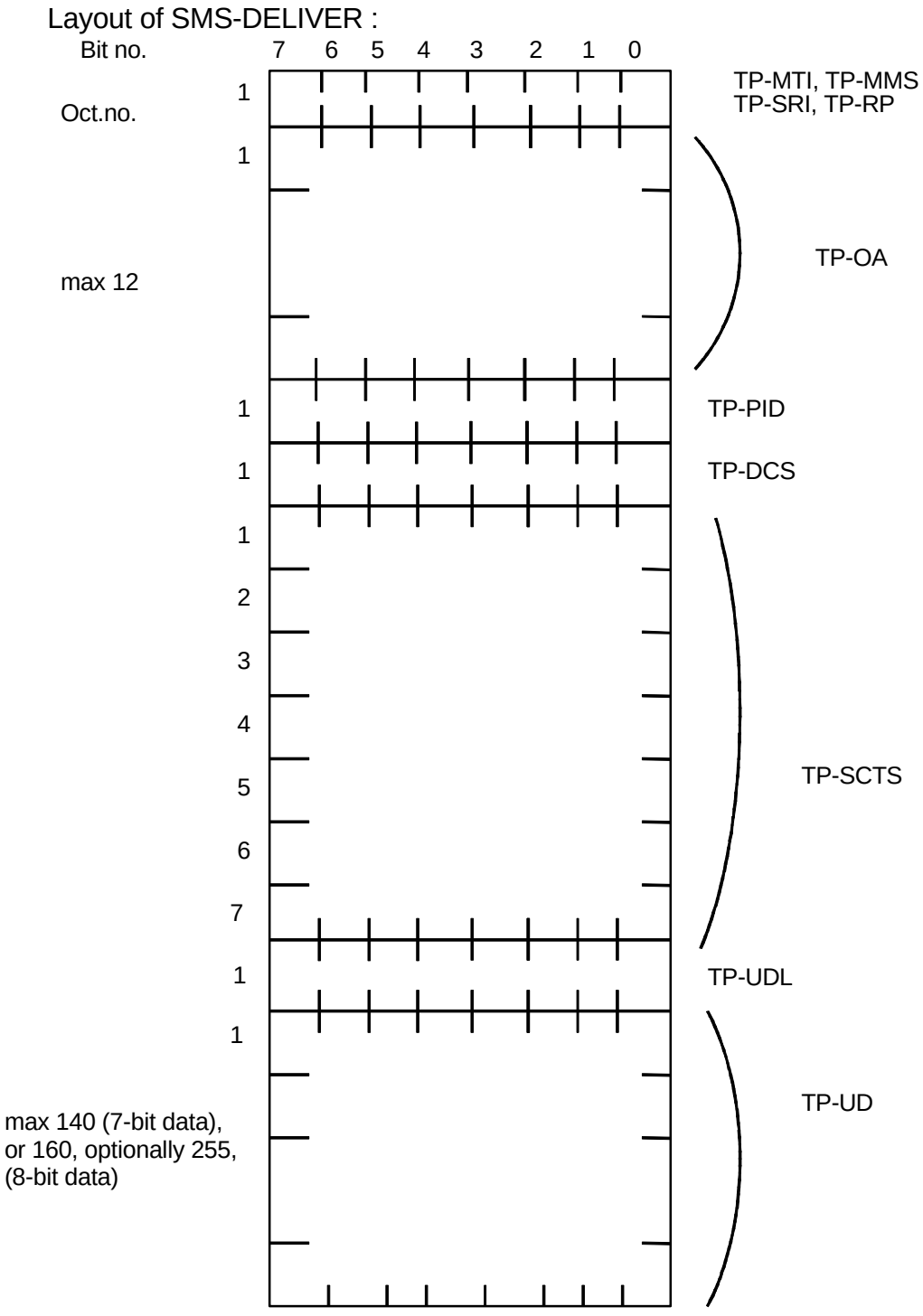


Figure 3.

Any unused bits will be set to zero by the sending entity and will be ignored by the receiving entity.

2.2.2.2 SMS-DELIVER-REPORT Type (TP-MTI bit1,bit0: 0,0)

Basic elements of the SMS-DELIVER-REPORT type:

TP-MTI	TP-Message-Type-Indicator: -Parameter describing the message type.	(M , 2b)
TP-FCS	TP-Failure-Cause	(M , I)

M = Mandatory, O = Optional
i = Integer, b = bit, 2b = 2 bits, 7o = 7 octets, 2-12o = 2 to 12 octets. Layout of

SMS-DELIVER-REPORT:

Bit no.		7	6	5	4	3	2	1	0	
Oct. No.	1.	|	|	|	|	|	|	|	|	TP-MTI
	1.	|	|	|	|	|	|	|	|	TP-FCS

SMS-DELIVER-REPORT is used as NACK in SMS-MT call and is sent as data in the DMS DT(N) frames.

2.2.2.3 SMS-SUBMIT Type (TP-MTI bit1,bit0: 0,1)

TP-MTI	TP-Message-Type-Indicator (bits 1,0): -Parameter describing the message type.	(M , 2b)
TP-VPF	TP-Validity-Period-Format (bits 4,3): -Parameter indicating whether or not the TP-VP field is present.	(M , 2b)
TP-RP	TP-Reply-Path (bit 7): -Parameter indicating the request for reply Path.	(O , i)
TP-SRR	TP-Status-Report-Request (bit 5): -Parameter indicating if the MS is requesting a status report.	(O , b)
TP-MR	TP-Message-Reference: -Parameter identifying the SMS-SUBMIT.	(M , i)
TP-DA	TP-Destination-Address -Number of B-subscriber	(M , 2-12o)
TP-PID	TP-Protocol-Identifier: -Parameter identifying the above layer protocol, if any.	(M , o)
TP-DCS	TP-Data_coding-Scheme:	(M , i)

-Parameter identifying the coding scheme within the TP-User-Data field.

TP-VP TP-Validity-period: (O , o/7o)
-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: (M ,Dependent on the TP-DCS)

M = Mandatory, O = Optional
i = Integer, b = bit, 2b = 2 bits, 7o = 7 octets, 2-12o = 2 to 12 octets.

Layout of SMS-SUBMIT :

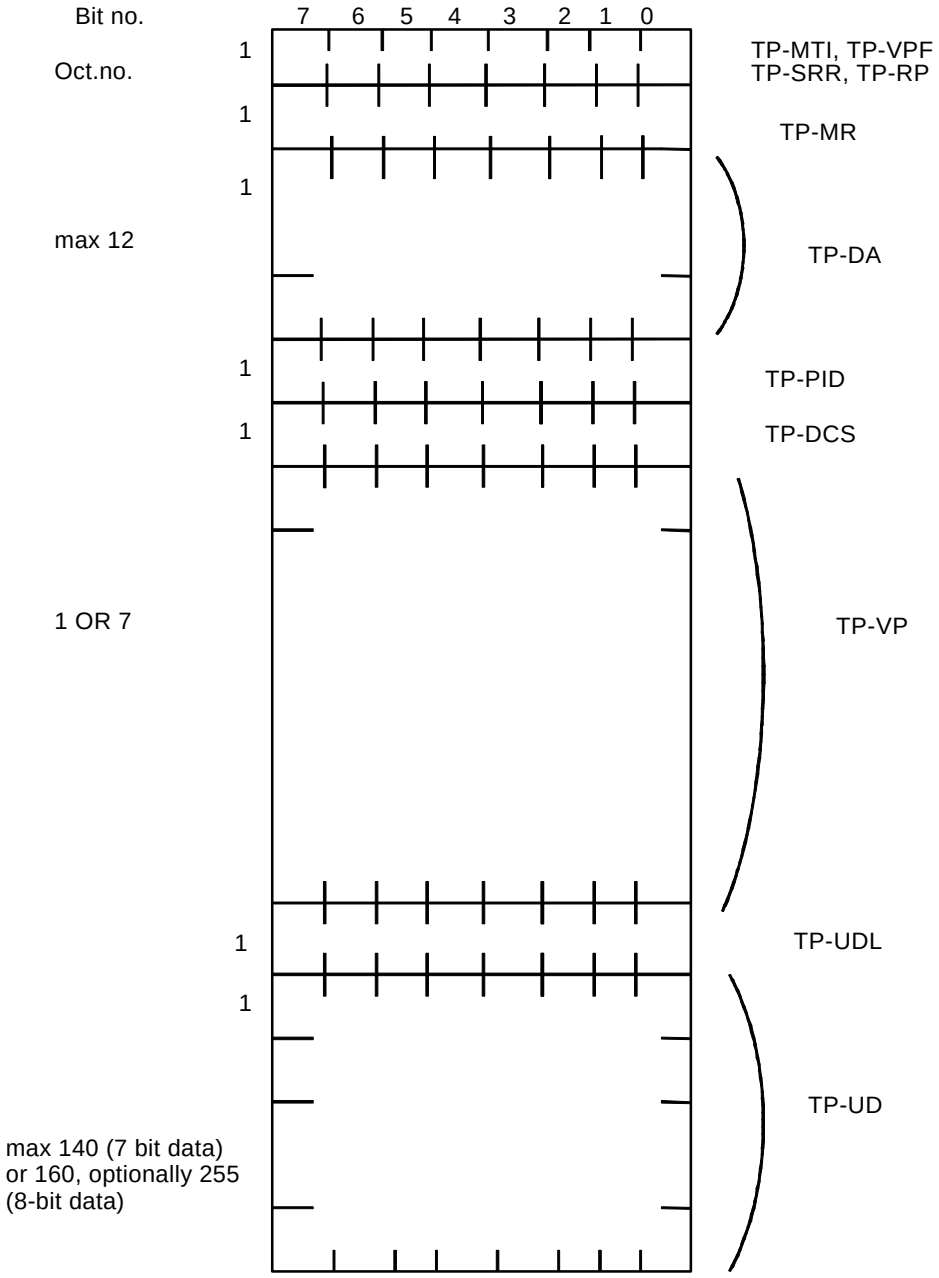


Figure 4.

Any unused bits will be set to zero by the sending entity and will be ignored by the receiving entity.

2.2.2.4 SMS-SUBMIT-REPORT Type (TP-MTI bit1,bit0: 0,1)

Basic elements of the SMS-SUBMIT-REPORT type:

TP-MTI	TP-Message-Type-Indicator: -Parameter describing the message type.	(M , 2b)
TP-FCS	TP-Failure-Cause	(M , I)

M = Mandatory, O = Optional
i = Integer, b = bit, 2b = 2 bits, 7o = 7 octets, 2-12o = 2 to 12 octets.

Layout of SMS-SUBMIT-REPORT:

Bit no.		7	6	5	4	3	2	1	0	
Oct. No.	1.	|	|	|	|	|	|	|	|	TP-MTI
	1.	|	|	|	|	|	|	|	|	TP-FCS

SMS-SUBMIT-REPORT is used as NACK in SMS-MO call and is carried as data in the DMS DT(N) frames.

2.2.3 Definitions of the TPDU parameters

2.2.3.1 TP-Message-Type-Indicator (TP-MTI)

The TP-Message-Type-Indicator is a 2-bit field, located within bits no 0 and 1 of the first octet of SMS-DELIVER, SMS-SUBMIT, SMS-STATUS-REPORT or SMS-COMMAND and to be given the following values:

Bit no 0,1:

bit1	bit0	Message type
0	0	SMS-DELIVER (in the direction SC to MS)
0	0	SMS-DELIVER REPORT (in the direction MS to SC)
1	0	SMS-STATUS-REPORT (in the direction SC to MS. Not used in this phase)
1	0	SMS-COMMAND (in the direction MS to SC. Not used in this phase)
0	1	SMS-SUBMIT (in the direction MS to SC)
0	1	SMS-SUBMIT-REPORT (in the direction SC to MS)
1	1	Reserved

2.2.3.2 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

2.2.3.3 TP-Validity-Period-Format (TP-VPF)

The TP-Validity-Period-Format is a 2-bit field, located within bit no 4 and 3 of the first octet of SMS-SUBMIT, and to be given the following values:

bit4 bit3:

0	0	TP-VP field not present
1	0	TP-VP field present and integer represented (relative)
0	1	Reserved
1	1	TP-VP field present and semi-octet represented (absolute)

Value ’01’ is used as default in MO SMS-call.

Any reserved values may be rejected by the SC.

2.2.3.4 TP-Status-Report-Indication (TP-SRI)

The TP-Status-Report-Indication is a 1-bit field, located within bit no. 5 of the first octet of SMS-DELIVER, and to be given the following values:

Bit no. 5:

0	A status report will not be returned to the SME
1	A status report will be returned to the SME

This is not used, and its value is always ignored by the MS.

2.2.3.5 TP-Status-Report-Request (TP-SRR)

The TP-Status-Report-Request is a 1-bit field, located within bit no. 5 of the first octet of SMS-SUBMIT, and to be given the following values:

Bit no. 5:

0	A status report is not requested
1	A status report is requested

This is not used, and its value is always set to 0.

2.2.3.6 TP-Message-Reference (TP-MR)

According to GSM Rec. 03.40, section 9.2.3.6.

2.2.3.7 TP-Originating-Address (TP-OA)

The TP-Originating-Address field is formatted according to the formatting rules of address fields. Originating-Address is number of A-subscriber.

2.2.3.8 TP-Destination-Address (TP-DA)

The TP-Destination-Address field is formatted according to the formatting rules of address fields. Destination-Address is the number of B-subscriber.

2.2.3.9 TP-Protocol-Identifier (TP-PID)

The TP-Protocol-Identifier parameter serves the purposes indicated in section 3.2.3 in GSM 03.40. It consists of one octet, and the bits in the octet are used as follows:

The SC may reject messages with a TP-Protocol-Identifier containing a reserved value or one which is not supported.

For the straightforward case of simple MS-to-SC short message transfer the Protocol Identifier is set to the value 0.

2.2.3.10 TP-Data-Coding-Scheme (TP-DCS)

The TP-Data-Coding-Scheme is defined in GSM 03.40 section 9.2.3.10

In addition to the default character set (GSM), other country specific character sets can be defined for NMT. All MSs with the SMS feature shall be capable of receiving and transmitting using the GSM Default Character Set (TP-DCS=0000 0000) and at least receiving according to the NMT 8-bit Character Sets (TP-DCS=0011 0000... 0011 1111, max length 160, optionally 255, characters) using characters 0...7Fh as defined in the GSM Default Alphabet.

2.2.3.11 TP-Service-Centre-Time-Stamp (TP-SCTS)

The TP-Service-Centre-Time-Stamp field is given in semi-octet representation, and it represents the local time in the following way:

Year:	**Month:**	**Day:**	**Hour:**	**Minute:**	**Second:**	**Time Zone**
2	**2**	**2**	**2**	**2**	**2**	**2**

digits (semi-octets)

The Time Zone indicates the difference, expressed in quarters of an hour, between the local time and GMT. In the first of the two semi-octets, the first bit (bit 3 of the seventh octet of the TP-Service-Centre-Time-Stamp field) represents the algebraic sign of this difference (0 = positive, 1 = negative).

The Service-Centre-Time-Stamp, and any other times coded in this format, represents the time local to the sending entity. The Time Zone code enables the receiver to calculate the equivalent time in GMT from the other semi-octets in the Service-Centre-Time-Stamp, or indicate the time zone (GMT, GMT+1h etc.), or perform other similar calculations as required by the implementation.

2.2.3.12 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.

2.2.3.13 TP-User-Data-Length (TP-UDL)

If the TP-User-Data is coded using the default GSM 7-bit alphabet, the TP-User-Data-Length field gives an integer representation of the number of 7-bit characters within the TP-User-Data field to follow.

If the TP-User-Data is coded using 8-bit data (NMT alphabets) , the TP-User-Data-Length field gives an integer representation of the number of octets within the TP-User-Data field to follow.

<The maximum number of characters is 160 both for 7-bit and 8-bit characters, corresponding to 140 and 160 octets respectively. Optionally, the MS may be capable of receiving 255 characters of 8 bits each when using NMT alphabets.>

2.2.3.14 TP-Reply-Path (TP-RP)

The TP-Reply-Path is a 1-bit field, located within bit no 7 of the first octet of both SMS-DELIVER and SMS-SUBMIT, and to be given the following values:

Bit no 7:

0	TS-Reply-Path parameter is not set in this SMS-SUBMIT/DELIVER
1	TS-Reply-Path parameter is set in this SMS-SUBMIT /DELIVER

Not used, and is ignored by the MS and default is 0 in SMS-SUBMIT.

2.2.3.15 TP-Failure-Cause (TP-FCS)

The TP-Failure-Cause field is used to report the reason for failure to transfer or process a short message. It consists of a single octet used as follows:

C0	SC busy
C1	No SC subscription
C2	SC system failure
C4	Destination SME barred
D2	Error in MS
D3	Memory Capacity Exceeded
FF	Unspecified error cause

2.3 Service Provided by the SM-RL

2.3.1 General

All SMS-data terminated or originated by MS or SC should be in Relay Layer Protocol format (Reference is made to GSM Rec. 04.11 and 03.40). Additionally, RP-SMRR is specified.

The SM-RL comprises the following 6 protocol elements. RP-MTI, bits 2,1,0 are indicated in brackets (MO: MS->SC, MT: SC->MS):

RP-MO-DATA (000) for transferring a TPDU from MS to SC

RP-MT-DATA (001) for transferring a TPDU from SC to MS

RP-ACK (MO/MT: 010/011) for acknowledging an RP-MO-DATA, an RP-MT-DATA or an RP-SM-MEMORY-AVAILABLE

RP-ERROR (MO/MT: 100/101) for informing of an unsuccessful RP-MO-DATA or an RP-MT-DATA transfer attempt

RP-SM-MEMORY-AVAILABLE (110) for notifying the network that the MS has memory available to accept one or more short messages

RP-SM-READY-TO-RECEIVE (111) for notifying the SC that MS is ready to receive messages after receiving message waiting alert.

RP-SM-NO-MESSAGE (111) for notifying the MS that there are no messages in the SMSC after e.g. a manual request (RP-SM-READY-TO RECEIVE)

2.3.2 RP-MO-DATA

Basic elements of the RP-MO-DATA type.

RP-OA	RP-Originating-Address	Address of the originating MS.
RP-UD	RP-User-Data	Parameter containing the TPDU

The address of the originating MS will be sent by the MS in international format (e.g. ‘+35849123456’ for a Finnish MS). The complete address (‘+35849123456’ in the example) should be programmed in conjunction with the identity programming of the MS (e.g. by the dealer) and it should not be easily changeable by the user. The ‘+’ sign corresponds to bit combination ‘1101’ in the Originator/Destination Number (semi-octet presentation).<Proposed option: The address may also be followed by the tel.number of the SMSC of the originating MS preceded by an asterix (e.g. ‘+35849123456*+3580987654321’). This is to assist SMS reply function.>.

2.3.3 RP-MT-DATA

Basic elements of the RP-MT-DATA type.

RP-UD	RP-User-Data	Parameter containing the TPDU

2.3.4 RP-ACK

The RP-ACK does not contain any specific information elements.

2.3.5 RP-ERROR

Basic elements of the RP-ERROR type.

RP-CS	RP-Cause	Parameter identifying the error type. The RP-Cause parameter gives the reason why a short message transfer attempt fails.
RP-UD	RP-User-Data	Parameter containing a TPDU

2.3.6 RP-SM-MEMORY-AVAILABLE

For notifying SC that MS has memory available.

RP-OA	RP-Originating-Address	Address of the originating MS.

See 2.3.2 for the RP-OA format.

2.3.7 RP-SM-READY-TO-RECEIVE

For notifying SC that MS is ready to receive messages after receiving message waiting alert.

RP-OA	RP-Originating-Address	Address of the originating MS.

See 2.3.2 for the RP-OA format.

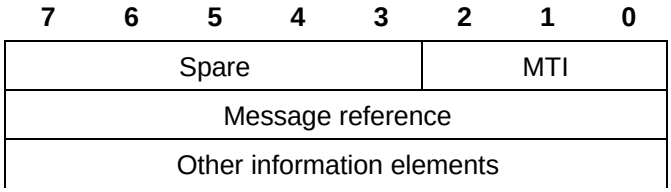
2.3.8 RP-SM-NO-MESSAGES

For notifying the MS that SMSC has no pending messages.

2.4 RP-messages

The message shall consist of the following parts:

a) Message type indicator
b) Message reference
c) Other required information elements



2.4.1 Message Type Indicator (MTI)

The message type indicator, MTI, is a 3-bit field, located in the first octet of all RP-messages. The coding of the MTI is shown in 2.3.1. (Table 8.3/GSM 04.11 - version 4.4.0, additionallyfor RP-SMRR, bits 111 are used)

2.4.2 Message Reference

The message reference field contains a sequence number in the range 0 through 255, and is used to link an RP-ACK message to the associated RP-DATA or RP-SMMA message.

2.4.3 Other Required Information Elements

The information element identifier for a given element is not sent when the element is mandatory in a message.

2.4.3.1 Originator Address Element

In the case of MO transfer, RP-SMMA or RP-SMRR, this element contains the originating entity address, the entity being the A-subscriber.
The element may be up to 12 octets long.

2.4.3.2 RP-User Data Element

The RP-User data field contains the TPDU and is mandatory in a RP-DATA message. In NMT SMS, the Length indicator value for possible TPDU lengths over 255 is 255. Though he SMSC will send messages with more than 160 characters only to MSs with the option of receiving longer messages, MSs in general should not malfunction if the TPDU length value does not match the real length of the TPDU when over 255 octets.

7	6	5	4	3	2	1	0
0	1	0	0	0	0	1	0
	RP-User data IEI						
Length indicator							
TPDU (max. length 238 octets in GSM)							

2.4.3.3 RP-cause Element

This element is a variable length element always included in the RP-ERROR message, conveying a negative result of a RP-DATA message transfer or a RP-SMMA notification. The element contains a cause value (given in Table 8.4 /GSM 04.11 version 4.4.0) and optionally a diagnostic field further details of the error causes. The Diagnostic field is not used in NMT-SMS environment.

7	6	5	4	3	2	1	0
0	1	0	0	0	0	1	0
Length indicator							
0	Cause value						
(Diagnostic field**)**							

2.5 Coding of SMS Header Additional Information

The spare bytes in the NMT SMS Header (‘any number of any characters’) can be used to eliminate the small possibility of receiving undue SMS transmissions during a voice or SMS call in case of a severe co-channel interference (when DMS scrambling is not used). The SMSC can send the Destination Address to the MS receiving the Message (DELIVER) within the spare characters of the SMS Header. The format is: (XXh)...01h 41h <Destination Address Length> <Destination Address Format> <Destination Address> (XXh)...02h. The format and coding of address parameters is similar to the corresponding parameters within the SM-TL (equal to the Originator Address in SUBMIT).

If the MS detects a wrong Identity, not corresponding to its own address, it shall not display or store the Message. When no identity, or a correct identity, is received within the SMS Header, the Message is stored and displayed normally.

Please note that other Additional Information may be specified later using similarly 01h, YYh to indicate start of the data. When required, the value of YYh will be set for different purposes.

Example, MS with number +358 400 654321 receives SMS DELIVERY:

```
SC->MS  SMS-DELIVER, RP+TP
        ++++++++++++++++++

BITS    7 6 5 4 3 2 1 0

Header  0 0 0 0 0 0 0 1   01h
        0 0 0 1 1 0 0 0   18h
        0 1 0 1 0 0 1 0   53h
        0 1 0 0 1 1 0 1   4Dh
        0 1 0 1 0 0 1 0   53h
        0 1 0 0 1 0 0 0   48h
        0 0 0 1 1 0 0 0   18h
        0 1 0 0 0 0 0 1   'A'  Any number of any characters...
        0 1 0 0 0 0 1 0   'B'  ...
        0 1 0 0 0 0 1 1   'C'  ...
        0 0 0 0 0 0 0 1   01h   Start of Information.
        0 1 0 0 0 0 0 1   41h   Destination Address will follow.
        0 0 0 0 1 1 0 1     Destination Address Length (13), semi-octets (BCD)
        1|0 0 0|0 0 0 1     Addr.Type 001='Internat.' Num.plan 0001='ISDN/Tel.'
        0 0 1 1 1 1 0 1     '3' '+'   '+358400654321' (international)
        1 0 0 0 0 1 0 1     '8' '5'
        1 0 1 0 0 1 0 0     '0' '4'
        0 1 1 0 1 0 1 0     '6' '0'
        0 1 0 0 0 1 0 1     '4' '5'
        0 0 1 0 0 0 1 1     '2' '3'
        1 1 1 1 0 0 0 1      F  '1'
        0 1 0 0 0 1 0 0   'D'  ...
        0 1 0 0 0 1 0 1   'E'  ...any number of any characters
        0 0 0 0 0 0 1 0   02h  End of SMS Header
...(RP-MTI etc. as specified)
```

3. NMT Short Message Service Examples

3.1 Message from SMSC to the MS

```
SC->MS  SMS-DELIVER, RP+TP
        ++++++++++++++++++

BITS    7 6 5 4 3 2 1 0

Header  0 0 0 0 0 0 0 1   01h
        0 0 0 1 1 0 0 0   18h
        0 1 0 1 0 0 1 0   53h
        0 1 0 0 1 1 0 1   4Dh
        0 1 0 1 0 0 1 0   53h
        0 1 0 0 1 0 0 0   48h
        0 0 0 1 1 0 0 0   18h
        0 1 0 0 0 0 0 1   'A'  Any number of any characters
        0 1 0 0 0 0 1 0   'B'  ...
        0 1 0 0 0 0 1 1   'C'  ...
        0 0 0 0 0 0 1 0   02h  End of SMS Header
RP      0 0 0 0 0 0 0 1   RP-MTI, Type 001 (bits 210)
        0 0 0 0 0 0 0 1   Reference Number
        0|1 0 0 0 0 0 1   User Data IEI
        0 0 0 1 1 0 0 0   TPDU Length (24 octets = 18h)  **** TPDU: *****
TP      0 0 0 0 0 1 0 0     TP-MTI/Type 00, MoreMsgs b2, VPF b43, Stat.Rep. b5,
        0 0 0 0 1 1 0 1     Originator Addr.Length (11), used semi-octets(BCD)
        1|0 0 1|0 0 0 1     Addr.Type, 81h unknown, 91h internat., A1h national
        0 0 1 1 1 1 0 1     '3' '+'  '+35849654321'
        1 0 0 0 0 1 0 1     '8' '5'
        1 0 0 1 0 1 1 0     '9' '4'
        0 1 0 1 0 1 1 0     '5' '6'
        0 0 1 1 0 1 0 0     '3' '4'
        0 0 0 1 0 0 1 0     '1' '2'
        0 0 0 0 0 0 0 0     Above Protocol Identifier (none)
        0 0 0 0 0 0 0 0     Data Coding Scheme of User Data
        0 1 1 0 1 0 0 1     '6' '9'  SC Time Stamp (7 octets)
        0 0 1 0 0 0 0 1     '2' '1'  -time when the SC had received the message
        0 1 0 0 0 0 1 0     '4' '2'   '24.12.96 13:35:04'
        0 0 1 1 0 0 0 1     '3' '1'
        0 1 1 0 0 0 1 1     '5' '3'
        0 1 0 0 1 0 1 0     '4' '0'
        0 0 0 0 1 0 0 0     Time Zone.
        0 0 0 0 0 1 0 1     User Data Length, 5 characters => 05h
        1|1 0 0 1 0 0 0     User Data: 'HELLO'  'H'= 1001000 (48h)
        0 0|1 0 0 0 1 0                         'E'= 1000101 (45h)
        1 0 0|1 0 0 1 1                         'L'= 1001100 (4Ch)
        1 1 1 1|1 0 0 1                         'L'= 1001100 (4Ch)
        0 0 0 0 0|1 0 0                         'O'= 1001111 (4Fh)

End

MS->SC  SMS-DELIVER-REPORT
        ++++++++++++++++++

Successful (ACK):

RP      0 0 0 0 0 0 1 0    RP-MTI, Type 010 (RP-ACK)(bits 210)
        0 0 0 0 0 0 0 1    Reference Number
End
```

```
        Unsuccessful (NAK):


RP      0 0 0 0 0 1 0 0    RP_MTI, Type 100 (RP-ERROR)
        0 0 0 0 0 0 0 1    Reference Number
        0|1 0 0 0 0 1 0    RP-Cause IEI
        0 0 0 0 0 0 0 1    Length
End     0|1 1 0 1 1 1 1    Cause Value (6Fh). Values:16h=mem.full,6Fh=gen.error


      TP layer is not used
```

3.2 Message from MS to the SMSC

```
MS->SC  SMS-SUBMIT, RP+TP
        ++++++++++++++++

BITS    7 6 5 4 3 2 1 0

RP      0 0 0 0 0 0 0 0   RP-MTI, Type 000 (bits 210)
        0 0 0 0 0 0 0 1   Reference Number
        0 0 0 0 1 1 0 0     Originator Address Length (12), semi-octets (BCD)
        1|0 0 1|0 0 0 1     Addr.Type 001='Internat.' Num.plan 0001='ISDN/Tel.'
        0 0 1 1 1 1 0 1     '3' '+'       '+35849123456'
        1 0 0 0 0 1 0 1     '8' '5'
        1 0 0 1 0 1 0 0     '9' '4'
        0 0 1 0 0 0 0 1     '2' '1'
        0 1 0 0 0 0 1 1     '4' '3'
        0 1 1 0 0 1 0 1     '6' '5'
        0|1 0 0 0 0 0 1   User Data IEI
        0 0 0 1 0 0 1 1   TPDU Length (19 oct)  (TP-MTI bits number 1,0:)
TP      0 0 0 1 0 0 0 1     TP-MTI/Type 01, b2, VPF b43, Stat.Rep. b5,
        0 0 0 0 0 0 0 1     Message Reference Number        ...Reply Path 0
        0 0 0 0 1 1 0 1     Destination Address Length (13), semi-octets (BCD)
        1|0 0 1|0 0 0 1     Addr.Type 001='Internat.' Num.plan 0001='ISDN/Tel.'
        0 0 1 1 1 1 0 1     '3' '+'   '+358400654321' (international)
        1 0 0 0 0 1 0 1     '8' '5'
        1 0 1 0 0 1 0 0     '0' '4'
        0 1 1 0 1 0 1 0     '6' '0'
        0 1 0 0 0 1 0 1     '4' '5'
        0 0 1 0 0 0 1 1     '2' '3'
        1 1 1 1 0 0 0 1      F  '1'
        0 0 0 0 0 0 0 0     Above Protocol Identifier (0h)
        0 0 0 0 0 0 0 0     Data Coding Scheme of User Data (0h)
        1 0 0 0 1 1 1 1     Validity Period 24 hours => 143 (8Fh)
        0 0 0 0 0 1 0 1     User Data Length, 5 characters => 05h
        1|1 0 0 1 0 0 0     User Data: 'HELLO'  'H'= 1001000 (48h)
        0 0|1 0 0 0 1 0                         'E'= 1000101 (45h)
        1 0 0|1 0 0 1 1                         'L'= 1001100 (4Ch)
        1 1 1 1|1 0 0 1                         'L'= 1001100 (4Ch)
        0 0 0 0 0|1 0 0                         'O'= 1001111 (4Fh)
End
```

```
SC->MS  SMS-SUBMIT-REPORT
        ++++++++++++++++++

        Successful (ACK):

Header  0 0 0 0 0 0 0 1    01h
        0 0 0 1 1 0 0 0    18h
        0 1 0 1 0 0 1 0    53h
        0 1 0 0 1 1 0 1    4Dh
        0 1 0 1 0 0 1 0    53h
        0 1 0 0 1 0 0 0    48h
        0 0 0 1 1 0 0 0    18h
        0 1 0 0 0 0 0 1   'A'  Any number of any characters
        0 1 0 0 0 0 1 0   'B'  ...
        0 1 0 0 0 0 1 1   'C'  ...
        0 0 0 0 0 0 1 0    02h  End of SMS Header
RP      0 0 0 0 0|0 1 1    RP-MTI/Type 011 (RP-ACK)
        0 0 0 0 0 0 0 1    Reference Number
End


        Unsuccessful (NAK):

Header  0 0 0 0 0 0 0 1    01h
        0 0 0 1 1 0 0 0    18h
        0 1 0 1 0 0 1 0    53h
        0 1 0 0 1 1 0 1    4Dh
        0 1 0 1 0 0 1 0    53h
        0 1 0 0 1 0 0 0    48h
        0 0 0 1 1 0 0 0    18h
        0 1 0 0 0 0 0 1   'A'  Any number of any characters
        0 1 0 0 0 0 1 0   'B'  ...
        0 1 0 0 0 0 1 1   'C'  ...
        0 0 0 0 0 0 1 0    02h  End of SMS Header
RP      0 0 0 0 0|1 0 1    RP-MTI/Type 101 (RP-ERROR)
        0 0 0 0 0 0 0 1    Reference Number
End

      MS does not have to care about the rest of fields (possible TP)
```

3.3. MS Calls the SMSC for Pending Messages (automatic or manual call)

```
MS->SC  SMS-REQUEST, RP
        ++++++++++++++

BITS    7 6 5 4 3 2 1 0

RP      0 0 0 0 0 1 1 1    RP-MTI, Type 111, (RP-SMRR)
        0 0 0 0 0 0 0 1    Reference Number
        0 0 0 0 1 1 0 0    Address Length (12), semi-octets (BCD)
        1|0 0 1|0 0 0 1    Address Type international,
        0 0 1 1 1 1 0 1    '3' '+'       '+35849123456'
        1 0 0 0 0 1 0 1    '8' '5'
        1 0 0 1 0 1 0 0    '9' '4'
        0 0 1 0 0 0 0 1    '2' '1'
        0 1 0 0 0 0 1 1    '4' '3'
        0 1 1 0 0 1 0 1    '6' '5'
End
```

```
SC->MS  SMS-NO-MESSAGES, RP (Response to SMS-REQUEST)
        ++++++++++++++++++++++++++++++++++++++++++++

Header  0 0 0 0 0 0 0 1    01h
        0 0 0 1 1 0 0 0    18h
        0 1 0 1 0 0 1 0    53h
        0 1 0 0 1 1 0 1    4Dh
        0 1 0 1 0 0 1 0    53h
        0 1 0 0 1 0 0 0    48h
        0 0 0 1 1 0 0 0    18h
        0 1 0 0 0 0 0 1    'A'  Any number of any characters
        0 1 0 0 0 0 1 0    'B'  ...
        0 1 0 0 0 0 1 1    'C'  ...
        0 0 0 0 0 0 1 0    02h  End of SMS Header
RP      0 0 0 0 0 1 1 1    RP-MTI/Type 111(RP-SMRR)
        0 0 0 0 0 0 0 1    Reference Number
End
       If There are messages for the MS, SMS-DELIVER is sent by the
       SC insted of the SMS-NO-MESSAGES.
```

3.4. MS Calls the SMSC to Indicate that Memory is Available for SMS

```
MS->SC  MEMORY AVAILABLE IN MS, SMS-SMMA,RP
        ++++++++++++++++++++++++++++++++++

RP      0 0 0 0 0 1 1 0    RP-MTI, Type 110 (RP-SMMA)
        0 0 0 0 0 0 0 1    Reference Number
        0 0 0 0 1 1 0 0    Originating Address Length (12), semi-octets (BCD)
        1|0 0 1|0 0 0 1    Address Type International, 91h
        0 0 1 1 1 1 0 1    '3' '+'  '+35849123456'
        1 0 0 0 0 1 0 1    '8' '5'
        1 0 0 1 0 1 0 0    '9' '4'
        0 0 1 0 0 0 0 1    '2' '1'
        0 1 0 0 0 0 1 1    '4' '3'
        0 1 1 0 0 1 0 1    '6' '5'
End
      Note: The Originating address is the address of the MS which has memory
      available and is now ready to receive messages.

SC->MS  Response to SMS-SMMA (ACK), no messages:

Header  0 0 0 0 0 0 0 1    01h
        0 0 0 1 1 0 0 0    18h
        0 1 0 1 0 0 1 0    53h
        0 1 0 0 1 1 0 1    4Dh
        0 1 0 1 0 0 1 0    53h
        0 1 0 0 1 0 0 0    48h
        0 0 0 1 1 0 0 0    18h
        0 1 0 0 0 0 0 1    'A'  Any number of any characters
        0 1 0 0 0 0 1 0    'B'  ...
        0 1 0 0 0 0 1 1    'C'  ...
        0 0 0 0 0 0 1 0    02h  End of SMS Header
RP      0 0 0 0 0|0 1 1    RP-MTI/Type 011 (RP-ACK)
        0 0 0 0 0 0 0 1    Reference Number
End
         If there are messages for the MS and the SC can deliver them
         immediately, SMS-DELIVER is sent by the SC instead of the ACK
         (Response to RP-SMMA).
```

4. Character Sets in NMT Short Message Service

4.1. Minimum Requirements for the MS to Support Character Sets

The NMT Short Message Service uses the GSM Default Character Set (7-bit characters) and special 8-bit sets defined for NMT. The TP-Data-Coding-Scheme (TP-DCS, GSM 03.40, paragraph 9.2.3.10) defines which coding is used. In NMT, Coding Group bit values (bits 7...4) 0011 are chosen for country/area-specific 8-bit NMT Character Sets which include both national/local letters and the GSM Default Character Set as far as possible. Initially only NMT Character Sets 0 to 3 are defined. Each set provides 255 different kind of charcters. All NMT MSs with SMS feature shall be capable of receiving and transmitting according to the GSM Default character set and at least receiving characters in the table locations 00...7F (hex) according to NMT Character Set 0 (= the GSM Default part of it) with all Set values (bits 3...0 = 0000...1111) if not further supporting the NMT Code Sets.

4.2. The GSM Alphabet

TP-DCS, bits 7...4: 0000, Coding Group: Alphabet Indication (GSM)

bits 3...0:	0000	Default GSM Alphabet
	0001	Reserved (GSM)
...	...	
	1111	Reserved (GSM)

4.3. NMT Alphabets

TP-DCS, bits 7...4: 0011, Coding Group: NMT Alphabets

The maximum message length in this this Coding Group is 255 characters.
The characters use 8 bits each, one character per octet..

bits 3...0:	0000	NMT Character Set 0 - Cyrillic
	0001	NMT Character Set 1 - Baltic
	0010	NMT Character Set 2 - Central
	0011	NMT Character Set 3 - Western
	0100	NMT Character Set 4 (spare)
	...	
	1111	NMT Character Set 15 (spare)

4.3.1. NMT Character Set 0 - CYRILLIC ALPHABET

Data Coding Scheme 0011 0000 - Languages: Ukrainian, Russian, Bulgarian

Hex values 00...7F represent characters according to the Default GSM Character Set.

HEX	UNICODE	UNICODE description
80	0x0404	CYRILLIC CAPITAL LETTER UKRAINIAN IE
81	0x0406	CYRILLIC CAPITAL LETTER BYELORUSSIAN-UKRAINIAN I
82	0x0407	CYRILLIC CAPITAL LETTER YI
83	0x0410	CYRILLIC CAPITAL LETTER A
84	0x0411	CYRILLIC CAPITAL LETTER BE
85	0x0412	CYRILLIC CAPITAL LETTER VE
86	0x0413	CYRILLIC CAPITAL LETTER GHE
87	0x0414	CYRILLIC CAPITAL LETTER DE
88	0x0415	CYRILLIC CAPITAL LETTER IE
89	0x0416	CYRILLIC CAPITAL LETTER ZHE
8A	0x0417	CYRILLIC CAPITAL LETTER ZE
8B	0x0418	CYRILLIC CAPITAL LETTER I
8C	0x0419	CYRILLIC CAPITAL LETTER SHORT I
8D	0x041A	CYRILLIC CAPITAL LETTER KA
8E	0x041B	CYRILLIC CAPITAL LETTER EL
8F	0x041C	CYRILLIC CAPITAL LETTER EM
90	0x041D	CYRILLIC CAPITAL LETTER EN
91	0x041E	CYRILLIC CAPITAL LETTER O
92	0x041F	CYRILLIC CAPITAL LETTER PE
93	0x0420	CYRILLIC CAPITAL LETTER ER
94	0x0421	CYRILLIC CAPITAL LETTER ES
95	0x0422	CYRILLIC CAPITAL LETTER TE
96	0x0423	CYRILLIC CAPITAL LETTER U
97	0x0424	CYRILLIC CAPITAL LETTER EF
98	0x0425	CYRILLIC CAPITAL LETTER HA
99	0x0426	CYRILLIC CAPITAL LETTER TSE
9A	0x0427	CYRILLIC CAPITAL LETTER CHE
9B	0x0428	CYRILLIC CAPITAL LETTER SHA
9C	0x0429	CYRILLIC CAPITAL LETTER SHCHA
9D	0x042A	CYRILLIC CAPITAL LETTER HARD SIGN
9E	0x042B	CYRILLIC CAPITAL LETTER YERU
9F	0x042C	CYRILLIC CAPITAL LETTER SOFT SIGN
A0	0x0454	CYRILLIC SMALL LETTER UKRAINIAN IE
A1	0x0456	CYRILLIC SMALL LETTER BYELORUSSIAN-UKRAINIAN I
A2	0x0457	CYRILLIC SMALL LETTER YI
A3	0x0430	CYRILLIC SMALL LETTER A
A4	0x0431	CYRILLIC SMALL LETTER BE
A5	0x0432	CYRILLIC SMALL LETTER VE
A6	0x0433	CYRILLIC SMALL LETTER GHE
A7	0x0434	CYRILLIC SMALL LETTER DE
A8	0x0435	CYRILLIC SMALL LETTER IE
A9	0x0436	CYRILLIC SMALL LETTER ZHE
AA	0x0437	CYRILLIC SMALL LETTER ZE
AB	0x0438	CYRILLIC SMALL LETTER I
AC	0x0439	CYRILLIC SMALL LETTER SHORT I
AD	0x043A	CYRILLIC SMALL LETTER KA
AE	0x043B	CYRILLIC SMALL LETTER EL
AF	0x043C	CYRILLIC SMALL LETTER EM
B0	0x043D	CYRILLIC SMALL LETTER EN
B1	0x043E	CYRILLIC SMALL LETTER O
B2	0x043F	CYRILLIC SMALL LETTER PE
B3	0x0440	CYRILLIC SMALL LETTER ER
B4	0x0441	CYRILLIC SMALL LETTER ES
B5	0x0442	CYRILLIC SMALL LETTER TE
B6	0x0443	CYRILLIC SMALL LETTER U
B7	0x0444	CYRILLIC SMALL LETTER EF
B8	0x0445	CYRILLIC SMALL LETTER HA
B9	0x0446	CYRILLIC SMALL LETTER TSE

BA	0x0447	CYRILLIC SMALL LETTER CHE
BB	0x0448	CYRILLIC SMALL LETTER SHA
BC	0x0449	CYRILLIC SMALL LETTER SHCHA
BD	0x044A	CYRILLIC SMALL LETTER HARD SIGN
BE	0x044B	CYRILLIC SMALL LETTER YERU
BF	0x044C	CYRILLIC SMALL LETTER SOFT SIGN
C0	0x042D	CYRILLIC CAPITAL LETTER E
C1	0x042E	CYRILLIC CAPITAL LETTER YU
C2	0x042F	CYRILLIC CAPITAL LETTER YA
C3	0x0490	CYRILLIC CAPITAL LETTER GHE WITH UPTURN
C4	0x0401	CYRILLIC CAPITAL LETTER IO
E0	0x044D	CYRILLIC SMALL LETTER E
E1	0x044E	CYRILLIC SMALL LETTER YU
E2	0x044F	CYRILLIC SMALL LETTER YA
E3	0x0491	CYRILLIC SMALL LETTER GHE WITH UPTURN
E4	0x0451	CYRILLIC SMALL LETTER IO

4.3.2. NMT Character Set 1 - BALTIC ALPHABET

Data Coding Scheme: 0011 0001

Languages: Lithuanian, Latvian, Estonian, Lappish

Hex values 00...7F represent characters according to the Default GSM Character Set.

HEX	UNICODE	UNICODE description
80	0x00C1	LATIN CAPITAL LETTER A WITH ACUTE
81	0x00D5	LATIN CAPITAL LETTER O WITH TILDE
82	0x0100	LATIN CAPITAL LETTER A WITH MACRON
83	0x0104	LATIN CAPITAL LETTER A WITH OGONEK
84	0x010C	LATIN CAPITAL LETTER C WITH CARON
85	0x0110	LATIN CAPITAL LETTER D WITH STROKE
86	0x0112	LATIN CAPITAL LETTER E WITH MACRON
87	0x0116	LATIN CAPITAL LETTER E WITH DOT ABOVE
88	0x0118	LATIN CAPITAL LETTER E WITH OGONEK
89	0x0122	LATIN CAPITAL LETTER G WITH CEDILLA
8A	0x012A	LATIN CAPITAL LETTER I WITH MACRON
8B	0x012E	LATIN CAPITAL LETTER I WITH OGONEK
8C	0x0136	LATIN CAPITAL LETTER K WITH CEDILLA
8D	0x013B	LATIN CAPITAL LETTER L WITH CEDILLA
8E	0x0145	LATIN CAPITAL LETTER N WITH CEDILLA
8F	0x014A	LATIN CAPITAL LETTER ENG
90	0x0156	LATIN CAPITAL LETTER R WITH CEDILLA
91	0x0160	LATIN CAPITAL LETTER S WITH CARON
92	0x0166	LATIN CAPITAL LETTER T WITH STROKE
93	0x016A	LATIN CAPITAL LETTER U WITH MACRON
94	0x0172	LATIN CAPITAL LETTER U WITH OGONEK
95	0x017D	LATIN CAPITAL LETTER Z WITH CARON
A0	0x00E1	LATIN SMALL LETTER A WITH ACUTE
A1	0x00F5	LATIN SMALL LETTER O WITH TILDE
A2	0x0101	LATIN SMALL LETTER A WITH MACRON
A3	0x0105	LATIN SMALL LETTER A WITH OGONEK
A4	0x010D	LATIN SMALL LETTER C WITH CARON
A5	0x0111	LATIN SMALL LETTER D WITH STROKE
A6	0x0113	LATIN SMALL LETTER E WITH MACRON
A7	0x0117	LATIN SMALL LETTER E WITH DOT ABOVE
A8	0x0119	LATIN SMALL LETTER E WITH OGONEK
A9	0x0123	LATIN SMALL LETTER G WITH CEDILLA
AA	0x012B	LATIN SMALL LETTER I WITH MACRON
AB	0x012F	LATIN SMALL LETTER I WITH OGONEK
AC	0x0137	LATIN SMALL LETTER K WITH CEDILLA
AD	0x013C	LATIN SMALL LETTER L WITH CEDILLA
AE	0x0146	LATIN SMALL LETTER N WITH CEDILLA
AF	0x014B	LATIN SMALL LETTER ENG

B0	0x0157	LATIN SMALL LETTER R WITH CEDILLA
B1	0x0161	LATIN SMALL LETTER S WITH CARON
B2	0x0167	LATIN SMALL LETTER T WITH STROKE
B3	0x016B	LATIN SMALL LETTER U WITH MACRON
B4	0x0173	LATIN SMALL LETTER U WITH OGONEK
B5	0x017E	LATIN SMALL LETTER Z WITH CARON

4.3.3. NMT Character Set 2 - CENTRAL ALPHABET

Data Coding Scheme: 0011 0010

Languages: Czech, Croatian, Hungarian, Polish, Romanian, Slovak, Slovene, Turkish

Hex values 00...7F represent characters according to the Default GSM Character Set.

HEX	UNICODE	UNICODE description
80	0x00C1	LATIN CAPITAL LETTER A WITH ACUTE
81	0x00C2	LATIN CAPITAL LETTER A WITH CIRCUMFLEX
82	<capital c cedilla is also included in GSM Set>	
83	0x00CD	LATIN CAPITAL LETTER I WITH ACUTE
84	0x00CE	LATIN CAPITAL LETTER I WITH CIRCUMFLEX
85	0x00D3	LATIN CAPITAL LETTER O WITH ACUTE
86	0x00D4	LATIN CAPITAL LETTER O WITH CIRCUMFLEX
87	0x00DA	LATIN CAPITAL LETTER U WITH ACUTE
88	0x0102	LATIN CAPITAL LETTER A WITH BREVE
89	0x0104	LATIN CAPITAL LETTER A WITH OGONEK
8A	0x0106	LATIN CAPITAL LETTER C WITH ACUTE
8B	0x010C	LATIN CAPITAL LETTER C WITH CARON
8C	0x010E	LATIN CAPITAL LETTER D WITH CARON
8D	0x0110	LATIN CAPITAL LETTER D WITH STROKE
8E	0x0118	LATIN CAPITAL LETTER E WITH OGONEK
8F	0x011A	LATIN CAPITAL LETTER E WITH CARON
90	0x011E	LATIN CAPITAL LETTER G WITH BREVE
91	0x0130	LATIN CAPITAL LETTER I WITH DOT ABOVE
92	0x0139	LATIN CAPITAL LETTER L WITH ACUTE
93	0x013D	LATIN CAPITAL LETTER L WITH CARON
94	0x0141	LATIN CAPITAL LETTER L WITH STROKE
95	0x0143	LATIN CAPITAL LETTER N WITH ACUTE
96	0x0147	LATIN CAPITAL LETTER N WITH CARON
97	0x0150	LATIN CAPITAL LETTER O WITH DOUBLE ACUTE
98	0x0154	LATIN CAPITAL LETTER R WITH ACUTE
99	0x0158	LATIN CAPITAL LETTER R WITH CARON
9A	0x015A	LATIN CAPITAL LETTER S WITH ACUTE
9B	0x015E	LATIN CAPITAL LETTER S WITH CEDILLA
9C	0x0160	LATIN CAPITAL LETTER S WITH CARON
9D	0x0162	LATIN CAPITAL LETTER T WITH CEDILLA
9E	0x0164	LATIN CAPITAL LETTER T WITH CARON
9F	0x0170	LATIN CAPITAL LETTER U WITH DOUBLE ACUTE
A0	0x00E1	LATIN SMALL LETTER A WITH ACUTE
A1	0x00E2	LATIN SMALL LETTER A WITH CIRCUMFLEX
A2	0x00E7	LATIN SMALL LETTER C WITH CEDILLA
A3	0x00ED	LATIN SMALL LETTER I WITH ACUTE
A4	0x00EE	LATIN SMALL LETTER I WITH CIRCUMFLEX
A5	0x00F3	LATIN SMALL LETTER O WITH ACUTE
A6	0x00F4	LATIN SMALL LETTER O WITH CIRCUMFLEX
A7	0x00FA	LATIN SMALL LETTER U WITH ACUTE
A8	0x0103	LATIN SMALL LETTER A WITH BREVE
A9	0x0105	LATIN SMALL LETTER A WITH OGONEK
AA	0x0107	LATIN SMALL LETTER C WITH ACUTE
AB	0x010D	LATIN SMALL LETTER C WITH CARON
AC	0x010F	LATIN SMALL LETTER D WITH CARON

AD	0x0111	LATIN SMALL LETTER D WITH STROKE
AE	0x0119	LATIN SMALL LETTER E WITH OGONEK
AF	0x011B	LATIN SMALL LETTER E WITH CARON
B0	0x011F	LATIN SMALL LETTER G WITH BREVE
B1	0x0131	LATIN SMALL LETTER DOTLESS I
B2	0x013A	LATIN SMALL LETTER L WITH ACUTE
B3	0x013E	LATIN SMALL LETTER L WITH CARON
B4	0x0142	LATIN SMALL LETTER L WITH STROKE
B5	0x0144	LATIN SMALL LETTER N WITH ACUTE
B6	0x0148	LATIN SMALL LETTER N WITH CARON
B7	0x0151	LATIN SMALL LETTER O WITH DOUBLE ACUTE
B8	0x0155	LATIN SMALL LETTER R WITH ACUTE
B9	0x0159	LATIN SMALL LETTER R WITH CARON
BA	0x015B	LATIN SMALL LETTER S WITH ACUTE
BB	0x015F	LATIN SMALL LETTER S WITH CEDILLA
BC	0x0161	LATIN SMALL LETTER S WITH CARON
BD	0x0163	LATIN SMALL LETTER T WITH CEDILLA
BE	0x0165	LATIN SMALL LETTER T WITH CARON
BF	0x0171	LATIN SMALL LETTER U WITH DOUBLE ACUTE
C0	0x016E	LATIN CAPITAL LETTER U WITH RING ABOVE
C1	0x00DD	LATIN CAPITAL LETTER Y WITH ACUTE
C2	0x0179	LATIN CAPITAL LETTER Z WITH ACUTE
C3	0x017B	LATIN CAPITAL LETTER Z WITH DOT ABOVE
C4	0x017D	LATIN CAPITAL LETTER Z WITH CARON
E0	0x016F	LATIN SMALL LETTER U WITH RING ABOVE
E1	0x00FD	LATIN SMALL LETTER Y WITH ACUTE
E2	0x017A	LATIN SMALL LETTER Z WITH ACUTE
E3	0x017C	LATIN SMALL LETTER Z WITH DOT ABOVE
E4	0x017E	LATIN SMALL LETTER Z WITH CARON

4.3.4. NMT Character Set 3 - WESTERN APLHABET

Data Coding Scheme: 0011 0011

Languages: Danish (*), Dutch, English (*), Finnish (*), French, German (*), Icelandic, Norwegian (*), Swedish (*)

(*)-marked languages are completely included in the GSM Default Character Set.

Hex values 00...7F represent characters according to the Default GSM Character Set.

HEX	UNICODE	UNICODE description
80	0x00C0	LATIN CAPITAL LETTER A WITH GRAVE
81	0x00C1	LATIN CAPITAL LETTER A WITH ACUTE
82	0x00C2	LATIN CAPITAL LETTER A WITH CIRCUMFLEX
83		<capital c cedilla is also included in GSM Set>
84	0x00C8	LATIN CAPITAL LETTER E WITH GRAVE
85	0x00CA	LATIN CAPITAL LETTER E WITH CIRCUMFLEX
86	0x00CB	LATIN CAPITAL LETTER E WITH DIAERESIS
87	0x00CD	LATIN CAPITAL LETTER I WITH ACUTE
88	0x00CE	LATIN CAPITAL LETTER I WITH CIRCUMFLEX
89	0x00CF	LATIN CAPITAL LETTER I WITH DIAERESIS
8A	0x00D0	LATIN CAPITAL LETTER ETH
8B	0x00D3	LATIN CAPITAL LETTER O WITH ACUTE
8C	0x00D4	LATIN CAPITAL LETTER O WITH CIRCUMFLEX
8D	0x00D9	LATIN CAPITAL LETTER U WITH GRAVE
8E	0x00DA	LATIN CAPITAL LETTER U WITH ACUTE
8F	0x00DB	LATIN CAPITAL LETTER U WITH CIRCUMFLEX
90	0x00DD	LATIN CAPITAL LETTER Y WITH ACUTE
91	0x00DE	LATIN CAPITAL LETTER THORN
A0		<small a grave is also included in GSM Set>
A1	0x00E1	LATIN SMALL LETTER A WITH ACUTE
A2	0x00E2	LATIN SMALL LETTER A WITH CIRCUMFLEX
A3	0x00E7	LATIN SMALL LETTER C WITH CEDILLA
A4		<small e grave is also included in GSM Set>
A5	0x00EA	LATIN SMALL LETTER E WITH CIRCUMFLEX
A6	0x00EB	LATIN SMALL LETTER E WITH DIAERESIS
A7	0x00ED	LATIN SMALL LETTER I WITH ACUTE
A8	0x00EE	LATIN SMALL LETTER I WITH CIRCUMFLEX
A9	0x00EF	LATIN SMALL LETTER I WITH DIAERESIS
AA	0x00F0	LATIN SMALL LETTER ETH
AB	0x00F3	LATIN SMALL LETTER O WITH ACUTE
AC	0x00F4	LATIN SMALL LETTER O WITH CIRCUMFLEX
AD		<small u grave is also included in GSM Set>
AE	0x00FA	LATIN SMALL LETTER U WITH ACUTE
AF	0x00FB	LATIN SMALL LETTER U WITH CIRCUMFLEX
B0	0x00FD	LATIN SMALL LETTER Y WITH ACUTE
B1	0x00FE	LATIN SMALL LETTER THORN

4.3.5. NMT Character Set 4 - THAI APLHABET

Data Coding Scheme: 0011 0100

Languages: Thai

Hex values 00...7F represent characters according to the Default GSM Character Set.

HEX	UNICODE	UNICODE description
80		
81	U+0E01	THAI CHARACTER KO KAI
82	U+0E02	THAI CHARACTER KHO KHAI
83	U+0E03	THAI CHARACTER KHO KHUAT
84	U+0E04	THAI CHARACTER KHO KHWAI
85	U+0E05	THAI CHARACTER KHO KHON
86	U+0E06	THAI CHARACTER KHO RAKHANG
87	U+0E07	THAI CHARACTER NGO NGU
88	U+0E08	THAI CHARACTER CHO CHAN
89	U+0E09	THAI CHARACTER CHO CHING
8A	U+0E0A	THAI CHARACTER CHO CHANG
8B	U+0E0B	THAI CHARACTER SO SO
8C	U+0E0C	THAI CHARACTER CHO CHOE
8D	U+0E0D	THAI CHARACTER YO YING
8E	U+0E0E	THAI CHARACTER DO CHADA
8F	U+0E0F	THAI CHARACTER TO PATAK
90	U+0E10	THAI CHARACTER THO THAN
91	U+0E11	THAI CHARACTER THO NANGMONTHO
92	U+0E12	THAI CHARACTER THO PHUTHAO
93	U+0E13	THAI CHARACTER NO NEN
94	U+0E14	THAI CHARACTER DO DEK
95	U+0E15	THAI CHARACTER TO TAO
96	U+0E16	THAI CHARACTER THO THUNG
97	U+0E17	THAI CHARACTER THO THAHAN
98	U+0E18	THAI CHARACTER THO THONG
99	U+0E19	THAI CHARACTER NO NU
9A	U+0E1A	THAI CHARACTER BO BAIMAI
9B	U+0E1B	THAI CHARACTER PO PLA
9C	U+0E1C	THAI CHARACTER PHO PHUNG
9D	U+0E1D	THAI CHARACTER FO FA
9E	U+0E1E	THAI CHARACTER PHO PHAN
9F	U+0E1F	THAI CHARACTER FO FAN
A0	U+0E20	THAI CHARACTER PHO SAMPHAO
A1	U+0E21	THAI CHARACTER MO MA
A2	U+0E22	THAI CHARACTER YO YAK
A3	U+0E23	THAI CHARACTER RO RUA
A4	U+0E24	THAI CHARACTER RU
A5	U+0E25	THAI CHARACTER LO LING
A6	U+0E26	THAI CHARACTER LU
A7	U+0E27	THAI CHARACTER WO WAEN
A8	U+0E28	THAI CHARACTER SO SALA
A9	U+0E29	THAI CHARACTER SO RUSI
AA	U+0E2A	THAI CHARACTER SO SUA
AB	U+0E2B	THAI CHARACTER HO HIP
AC	U+0E2C	THAI CHARACTER LO CHULA
AD	U+0E2D	THAI CHARACTER O ANG
AE	U+0E2E	THAI CHARACTER HO NOKHUK
AF	U+0E2F	THAI CHARACTER PAIYANNOI
B0	U+0E30	THAI CHARACTER SARA A
B1	U+0E31	THAI CHARACTER MAI HAN-AKAT
B2	U+0E32	THAI CHARACTER SARA AA
B3	U+0E33	THAI CHARACTER SARA AM
B4	U+0E34	THAI CHARACTER SARA I

B5	U+0E35	THAI CHARACTER SARA II
B6	U+0E36	THAI CHARACTER SARA UE
B7	U+0E37	THAI CHARACTER SARA UEE
B8	U+0E38	THAI CHARACTER SARA U
B9	U+0E39	THAI CHARACTER SARA UU
BA	U+0E3A	THAI CHARACTER PHINTHU
BF	U+0E3F	THAI CURRENCY SYMBOL BAHT
C0	U+0E40	THAI CHARACTER SARA E
C1	U+0E41	THAI CHARACTER SARA AE
C2	U+0E42	THAI CHARACTER SARA O
C3	U+0E43	THAI CHARACTER SARA AI MAIMUAN
C4	U+0E44	THAI CHARACTER SARA AI MAIMALAI
C5	U+0E45	THAI CHARACTER LAKKHANGYAO
C6	U+0E46	THAI CHARACTER MAIYAMOK
C7	U+0E47	THAI CHARACTER MAITAIKHU
C8	U+0E48	THAI CHARACTER MAI EK
C9	U+0E49	THAI CHARACTER MAI THO
CA	U+0E4A	THAI CHARACTER MAI TRI
CB	U+0E4B	THAI CHARACTER MAI CHATTAWA
CC	U+0E4C	THAI CHARACTER THANTHAKHAT
CD	U+0E4D	THAI CHARACTER NIKHAHIT
CE	U+0E4E	THAI CHARACTER YAMAKKAN
CF	U+0E4F	THAI CHARACTER FONGMAN
D0	U+0E50	THAI DIGIT ZERO
D1	U+0E51	THAI DIGIT ONE
D2	U+0E52	THAI DIGIT TWO
D3	U+0E53	THAI DIGIT THREE
D4	U+0E54	THAI DIGIT FOUR
D5	U+0E55	THAI DIGIT FIVE
D6	U+0E56	THAI DIGIT SIX
D7	U+0E57	THAI DIGIT SEVEN
D8	U+0E58	THAI DIGIT EIGHT
D9	U+0E59	THAI DIGIT NINE
DA	U+0E5A	THAI CHARACTER ANGKHANKHU
DB	U+0E5B	THAI CHARACTER KHOMUT

Note: UNICODE refers to Unicode Standard and is indicated above as a global reference. The Unicode Worldwide Character Standard is a character coding system designed to support the interchange, processing, and display of written texts of the diverse languages of the world.