SMS with the SMS PDU-mode

for the mobile phone

Siemens S25

1. Introduction

To use the SMS you have to declare the number of the SMSC[1] (Short Message Service Center) in the MS (Mobile Station), provided that the MS support SMS-MO (Short Message Service-Mobile Orginated).
The SIEMENS **S25, SL10, S10**, **S10 active, E10, M1 Module** for example are providing SMS-MO.

card	SMSC-number (Germany)
D1	491710760000
D2	491722270000

At the MOBILE you enter the SMSC-number with the AT+Celular command:

at+csca = "<SMSC-number>"

If the receiver of the SMS possesses a D2 card, the AT command has to be entered in the following way:
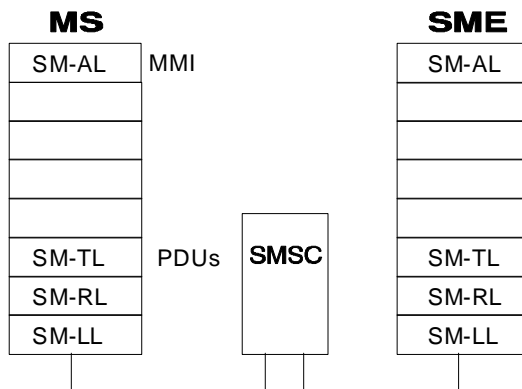
at+csca = "+491722270000"

With the command

at+csca?

you can question the actual adjusted SMSC-number

Ask your network operator for the right SMSC-number !!

! notice: In addition to the AT+CSCA command it is possible to enter The SMSC-number in front of the Protocol Data Unit (PDU) see chapter 3.1!

2. Overview:

MS: Mobile Station
SME: Short Message Entity
SMSC: Short Message Service Center
MMI: Man Machine Interface
PDUs: Protocol Data Units
SM-AL: Short Message Aplication Layer
SM-TL: Short Message Transport Layer
SM-RL: Short Message Relay Layer
SM-LL: Short Message Link Layer
The MMI is based on the command set of AT+Cellular, and could be realized by means of a terminal (for example Triodata, Telix, WIN-Terminal) or the display of a handy.

The SM-TL provides a service to the Short Message Application Layer. This service enables the 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.
The SM-TL communicates with its peer entity with six several PDUs (Protocol Data Units):

- **SMS-DELIVER, conveying a short message from the SMSC to the MS**
- SMS-DELIVER-REPORT, conveying a failure cause (if necessary)
- **SMS-SUBMIT, conveying a short message from the MS to the SMSC**
- SMS-SUBMIT-REPORT, conveying a failure cause (if necessary)
- SMS-STATUS-REPORT, conveying a status report from the SMSC to the MS
- SMS-COMMAND, conveying a command from the MS to the SMSC

The SMS-DELIVER and SMS-SUBMIT PDUs are described in the following sections.

2.1 SMS-DELIVER (Mobile Terminated)

1-12 octets		2-12 octets	1 octet	1 octet	7 octets	1 octet	0-140 octets
SCA	PDU-type	OA	PID	DCS	SCTS	UDL	UD

RP	UDHI	SRI			MMS	MTI

bits: 7   6   5   4   3   2   1   0
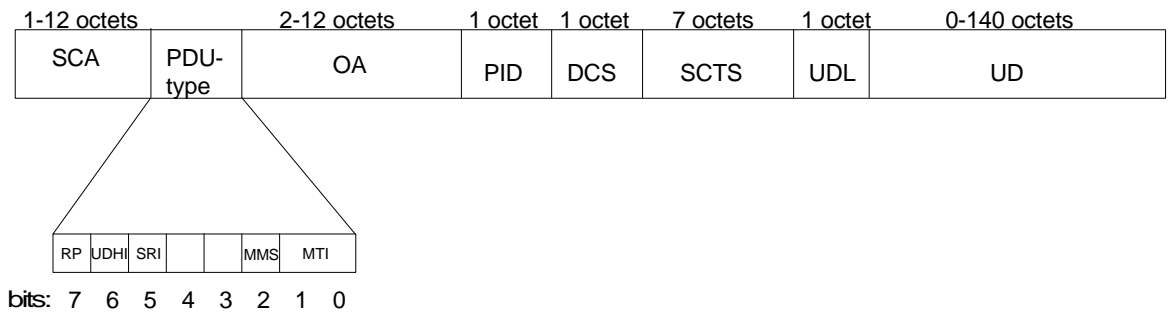
MTI   bit 1 = 0
            bit 0 = 0

2.2 SMS-SUBMIT (Mobile Originated)

1-12 octets		1 octet	2-12 octets	1 octet	1 octet	0,1 or 7 octets	1 octet	0-140 octets
SCA	PDU-type	MR	DA	PID	DCS	VP	UDL	UD

RP	UDHI	SRR	VPF	RD	MTI

bits: 7   6   5   4   3   2   1   0
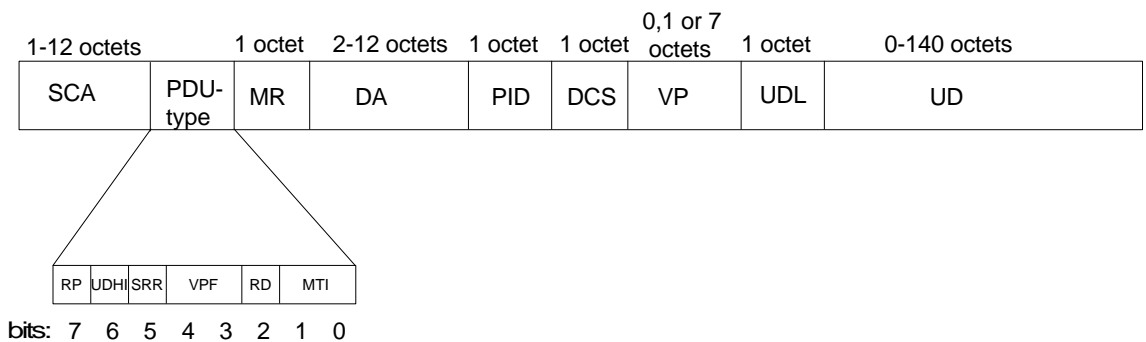
MTI   bit 1 = 0
            bit 0 = 1

**❗ notice: Any unused bits will be set to zero by the sending entity and
will be ignored by   the receiving entity ❗**

SCA	Service Center Adress - information element	Telephone number of the Service Center
PDU Type	Protocol Data Unit Type	
MR	Message Reference	sucessive number (0..255) of all SMS-SUBMIT Frames set by the MOBILE
OA	Originator Adress	Adress of the originating SME
DA	Destination Adress	Adress of the destination SME
PID	Protocol Identifier	Parameter showing the SMSC how to process the SM (as FAX, Voice etc)
DCS	Data Coding Scheme	Parameter identifying the coding scheme within the User Data (UD)
SCTS	Service Center Time Stamp	Parameter identifying time when the SMSC received the message
VP	Validity Period	Parameter identifying the time from where the message is no longer valid in the SMSC
UDL	User Data Length	Parameter indicating the length of the UD-field
UD	User Data	Data of the SM
RP	Reply Path	Parameter indicating that Reply Path exists

UDHI	User Data Header Indicator	Parameter indicating that the UD field contains a header
SRI	Status Report Indication	Parameter indicating if the SME has requested a status report
SRR	Status Report Request	Parameter indicating if the MS has requested a status report
VPF	Validity Period Format	Parameter indicating whether or not the VP field is present
MMS	More Messages to Send	Parameter indicating whether or not there are more messages to send
RD	Reject Duplicate	
MTI	Message Type Indicator	Parameter describing the message type 00 means SMS-DELIVER 01 means SMS-SUBMIT

3. Parameter description

3.1 Service Center adress information element (SCA info element)
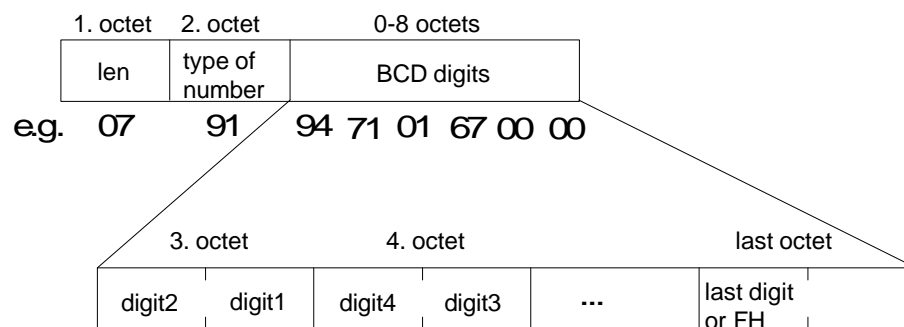
len:
The octet "len" contains the number of octets reqiured for the number of
the Service Center plus the 1 byte „type of number"

type of number:
81H: the following number is national
91H: the following number international
   (for further information see GSM 04.08 chapter 10.5.4.6)

octet:
One octet includes two BCD-digit Fields
If the called party BCD number contains an odd number of digits, the last
digit shall be filled with an end mark coded as "FH"

Example:
if you have the SC-number +49 171 0760000 you have to type:

0791947101670000

! notice: If the „len" field is set to Zero the MOBILE takes the default value of the Service Center adress set by the AT+CSCA command!

3.2 Protocol Data Unit Type (PDU Type)

SMS-SUBMIT: SMS-DELIVER:

bits:	7	6	5	4	3	2	1	0
	RP	UDHI	SRR	VPF		RD	MTI	
	0	0	0	X	X	0	0	1

bits:	7	6	5	4	3	2	1	0
	RP	UDHI	SRI			MMS	MTI	
							0	0

! notice: you have to write the PDU-type in Hex-Format, a possible example is "11H" !

RP: **0   Reply Path parameter is not set in this PDU**
        1   Reply Path parameter is set in this PDU

UDHI: **0   The UD field contains only the short message**
        1   The beginning of the UD field contains a header in addition of the short   message

SRI: (is only set by the SMSC)
        0   A status report will not be returned to the SME
        1   A status report will be returned to the SME

SRR: **0   A status report is not requested**
        1   A status report is requested

VPF: bit4   bit3
        0   0   VP field is not present
        0   1   Reserved
        1   0   VP field present an integer represented (relative)
        1   1   VP field present an semi-octet represented (absolute)
any reserved values may be rejected by the SMSC

MMS: (is only set by the SMSC)
        0   More messages are waiting for the MS in the SMSC
        1   No more messages are waiting for the MS in the SMSC

RD: **0   Instruct the SMSC to accept an SMS-SUBMIT for an short message still   held in the SMSC which has the same MR and DA as a previosly   submitted short message from the same OA.**

1   Instruct the SMSC to reject an SMS-SUBMIT for an short message still
held in the SMSC which has the same MR and DA as a previosly submitted short message from the same OA.

MTI: bit1   bit0   Message type
              0   0   SMS-DELIVER (SMSC ==> MS)
              0   0   SMS-DELIVER REPORT (MS ==>
SMSC, is generated
automatically by the MOBILE, after receiving a SMS-DELIVER)
              0   1   SMS-SUBMIT (MS ==> SMSC)
              0   1   SMS-SUBMIT REPORT (SMSC ==> MS)
              1   0   SMS-STATUS REPORT (SMSC ==> MS)
              1   0   SMS-COMMAND (MS ==> SMSC)
              1   1   Reserved

(the fat-marked lines represent the features supported by the MOBILE)
❗ notice: not every PDU Type is supported by the Service Center ❗

3.3 Message Reference MR

```
MR:            1 octet
    ┌─────────────────────────────┐
    │    e.g    0 0 H             │
    └─────────────────────────────┘
```
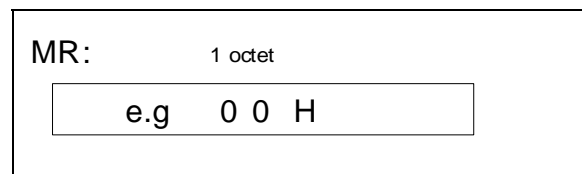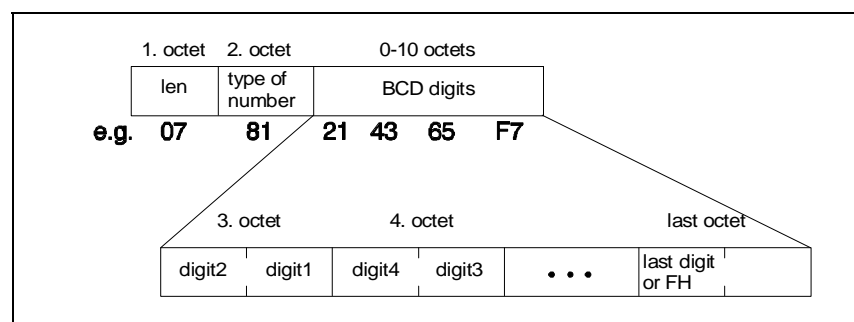
The MR field gives an integer (0..255) representation of a reference
number of the SMS-SUBMIT submitted to the SMSC by the MS.

❗ notice: at the MOBILE the MR is generated automatically, -anyway you have to generate it-
** a possible entry is for example "00H" ❗**

3.4 Originator Adress OA Destination Adress DA

OA and DA have the same format explained in the following lines:

len:
The octet "len" contains the number of BCD digits

type of number:
81H: the following number is national
91H: the following number international
  (for further information see GSM 04.08 chapter 10.5.4.6)
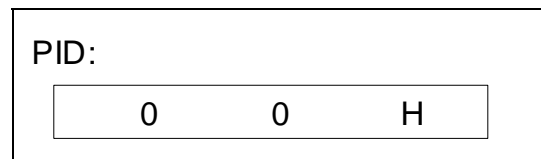
BCD-digits:
The BCD-digit Field contains the BCD-number of the Destination e.g. of
the Originator
If the called party BCD number contains an odd number of digits, the last
digit shall be filled with an end mark coded as "FH"

Example:
if you have the national number 1234567 you have to type:

0781214365F7

3.5 Protocol Identifier PID

```
PID:
      ┌──────────────────────────────┐
      │    0        0        H        │
      └──────────────────────────────┘
```

The PID is the information element by which the Transport Layer either
refers to the higher layer protocol being used, or indicates interworking
with a certain type of telematic device.
here are some examples of PID codings:

> **00H: The PDU has to be treat as a short message**
> **41H: Replace Short Message Type1**
> **42H: Replace Short Message Type2**
> **43H: Replace Short Message Type3**

......
> **47H: Replace Short Message Type7**

If „Replace Short Message Type x" is present, then the MS will check the
associated SC address and originating address and replace any existing
stored message having the same Protocol Identifier code, SC address and
originating address with the new short message and other parameter values.
If there is no message to be replaced, the MS shall store the message in the
normal way.

(for further information see GSM 03.40 chapter 9.2.3.9)

**! notice: it is not guaranteed that the SMSC supports every PID
codings!**

3.6 Data Coding Scheme DCS

```
bits:   7   6   5   4   3   2   1   0
        ┌───────────────┬───┬───┬───┬───┐
        │ Coding Group  │ 0 │ X │ X │ X │
        └───────────────┴───┴───┴───┴───┘

e.g. 0  0  0  0  0   0  0  0   = 00 H
     means: 7- bit data coding default alphabet

e.g. 1  1  1  1  0   1  1  0   = F6 H
     means: 8-bit data coding Class 2
```

The DCS field indicates the data coding scheme of the UD (User Data) field, and may indicate a message class. the octet is used according to a coding group which is indicated in bits 7..4. The octet is then coded as follows:

Coding group: bits 7..4	bits 3..0
0000	**Alphabet indication** Unspecified message handling at the MS 0000　　　Default alphabet (7 bit data coding in the User Data) 0001-1111　reserved
0001-1110	Reserved coding groups
1111	**Data Coding/message class** **bit 3** is reserved, set 0 　　**bit 2**　　　(message coding) 　　**0**　　　　**Default alphabet (7 bit data coding in the User Data)** 　　**1**　　　　**8-bit data coding in the User Data** 　　　**bit 1　bit 0**　(message class) 　　　0　　0　　Class0 immediate display 　　　**0　　1　　Class1 ME (Mobile Equipment)- specific** 　　　**1　　0　　Class2 SIM specific message** 　　　**1　　1　　Class3 TE (Terminate Equipment)- specific**

Default alphabet indicates that the UD (User Data) is coded from the 7-bit alphabet given in the appendix. When this alphabet is used, eight characters of the message are packed in seven octets, and the message can consist of up to 160 characters (instead of 140 characters in 8-bit data coding)
In 8-bit data coding, you can relate to the INTEL ASCII-HEX table.
In Class 0 (immediate display) the short message is written directly in the display, as the M1 has no display the Class 0 message can be realised only in a roundabout way.
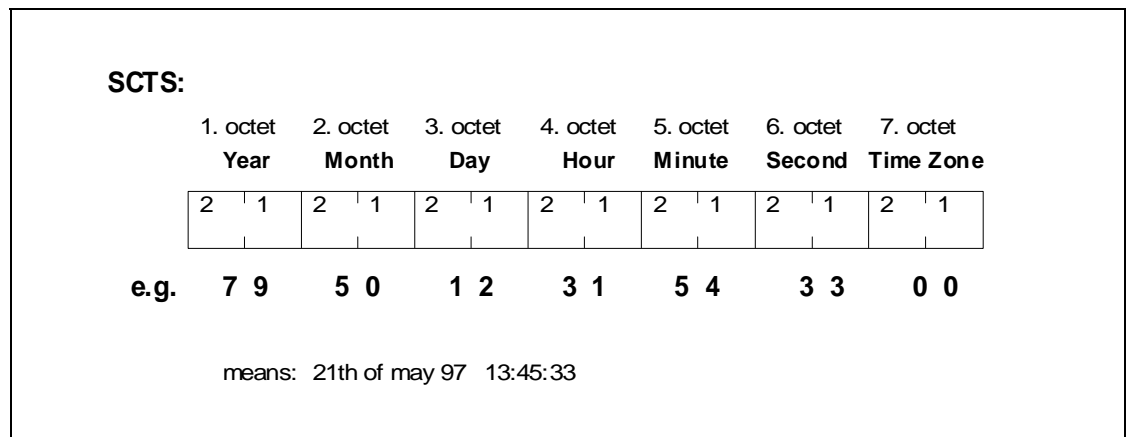In Class 1 to Class 3 the short message is stored in the several equipments ME, SIM-card and TE.
In time the Class 2 is supported, if you choose Class 1 or Class 3 the short message is treated the same way as a Class 2 message.

! note: It is recommended to use the Class2 message, or the coding group "0000 bin" !

3.7 Service Center Time Stamp SCTS

The SCTS is the information element by which the SMSC informs the recipient MS about the time of arrival of the short message at the Transport Layer entity of the SMSC. The time value is included in every SMS-DELIVER being delivered to the SMSC, and represents the local time in the following way:

SCTS:

	1. octet	2. octet	3. octet	4. octet	5. octet	6. octet	7. octet
	Year	**Month**	**Day**	**Hour**	**Minute**	**Second**	**Time Zone**
	2 1	2 1	2 1	2 1	2 1	2 1	2 1
e.g.	7 9	5 0	1 2	3 1	5 4	3 3	0 0

means: 21th of may 97   13:45:33

The Time Zone indicates the difference, expressed in quarters of an hour, between the local time and GMT (Greenwich Main Time).

3.8 Validity Period VP

The Validity-Period is the information element which gives an MS submitting an SMS-SUBMIT to the SMSC the possibility to include a specific time period value in the short message. The Validity Period parameter value indicates the time period for which the short message is valid, i.e. for how long the SMSC shall guarantee its existence in the SMSC memory before delivery to the recipient has been carried out.

first case (relative):

e.g. A A H	**VPF = 10**

(four days)

second case (absolute):

Year	Month	Day	Hour	Minute	Second	Time Zone	**VPF = 11**

e.g.   7 9   5 0   1 2   3 1   5 4   3 3   0 0

The VP field is given in either integer or semi-octet representation. In the first case, the VP comprises 1 octet, giving the length of the validity period, counted from when the SMS-SUBMIT is received by the SMSC. In the second case, the VP comprises 7 octets, giving the absolute time of the vality period termination.
In the first case, the representation of time is as follows:

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

in the second case, the representation of time is identical to the representation or the SCTS (Service Center Time Stamp)
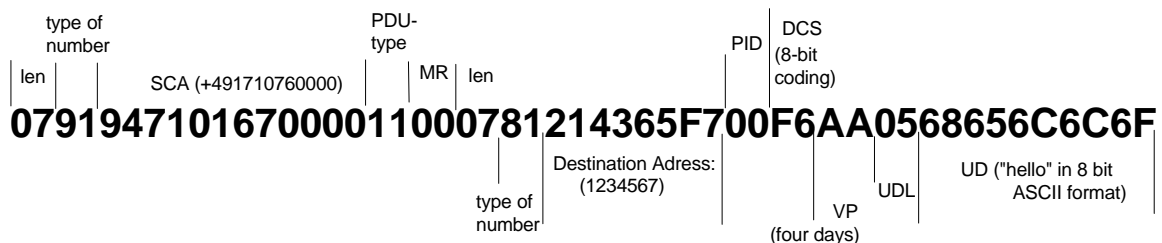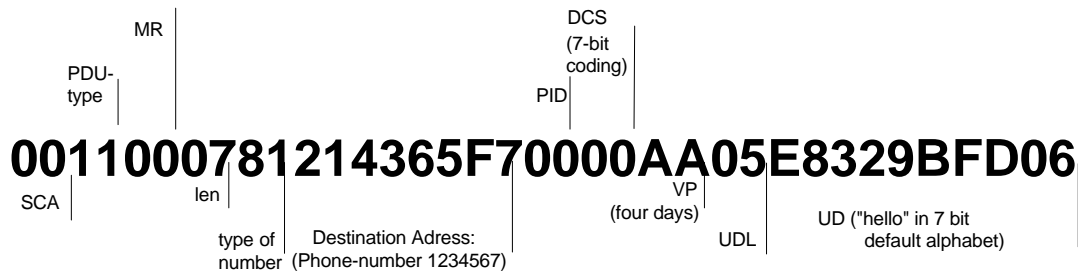
The case of representation is set in the VPF (Validity Period Format) in the PDU-type.

3.9 User Data Length UDL and User Data UD

1 octet   0..140 octets

UDL	UD

e.g.   0 5   E8   32   9B   FD   06

means: "hello" with the default alphabet (see Appendix)

The UDL field gives an integer representation of the number of characters within the User Data field to follow.

4. PDU Examples

here are two examples how to send a short message with AT+Cellular:

first enter PIN-number and the Service Center Adress:

at+cpin="XXXX"   *enter the PIN-number*
OK
at+csca="+491722270000"   *enter the Service-Center-Adress (here D2)*
OK

<u>**1st example:**</u>

at+cmgs=140   *enter "send message", 140 is the maximum length (in   byte) of the following PDU*
> 0011000781214365F70000AA05E8329BFD06   type the PDU (SMS-SUBMIT) and finish with "ctrl Z"the thin-typed characters are the Destination Adress e.g. the own tel.-number the Service Center adress is the same as set via at+csca command
+CMGS: 0
OK

at+cpms?   *are messages stored on the SIM-Card?*
+CPMS: "SM" , 1 , 7 , "SM" , 1 , 7   on this SIM-Card is 1 message stored

OK   you can store at most 7 messages

at+cmgr=1   *read stored message in location 1*
+CMGR: 0 ,, 24
00040C9194718215219200006930824161840005E8329BFD06   This is a PDU (SMS-
DELIVER) sent by the Service Center
OK

2nd example:

at+cmgw=140   *write message in the memory of the SIM-card*

> ***079194710167000011000781***214365F7***00F6AA0568656C6C6F*** *type the PDU (SMS-
SUBMIT) and finish with "ctrl Z" the thin-typed characters are the Destination Adress e.g. the
own tel.-number. The Service Center Adress is „+491710760000"*
+CMGW: 2
OK

at+cmgr=2   *read stored message in location 2*
+CMGR: 2 ,, 17
0011000781214365F700F6AA0568656C6C6F   this is the PDU stored in location 2
OK

at+cmss=2   *send the message stored in location 2*
+CMSS: 3
OK

at+cmss=2,"7654321",129   *send the message stored in location 2 to the
national (129 = 81H) destination address „7654321"*

at+cmss=2,"+491717654321",145   *send the message stored in location 2 to the
international (145 = 91H) destination address „+491717654321"*

at+cpms?   *are messages stored on the SIM-Card?*
+CPMS: "SM" , 3 , 7 , "SM" , 3 , 7   on this SIM-Card are 3 message stored
OK   you can store at most 7 messages

at+cmgr=3   *read stored message in location 3*
+CMGR: 0 ,, 24
00040C9194718215219200F66930825194720000568656C6C6F   This is a PDU (SMS-
DELIVER) sent by the Service Center
OK

5. Appendix

Default alphabet:

b4	b3	b2	b1	b7 0	0	0	0	1	1	1	1
				b6 0	0	1	1	0	0	1	1
				b5 0	1	0	2	0	1	0	1
					0	1	2	3	4	5	6	7
0	0	0	0	0	@	Δ	SP	0	-	P	¨	p
0	0	0	1	1			!	1	A	Q	a	q
0	0	1	0	2	$	Φ	″	2	B	R	b	r
0	0	1	1	3		Γ	#	3	C	S	c	s
0	1	0	0	4		Λ		4	D	T	d	t
0	1	0	1	5		Ω	%	5	E	U	e	u
0	1	1	0	6		Π	&	6	F	V	f	v
0	1	1	1	7		Ψ	'	7	G	W	g	w
1	0	0	0	8		Σ	(	8	H	X	h	x
1	0	0	1	9		Θ	)	9	I	Y	i	y
1	0	1	0	10	LF	Ξ	*	:	J	Z	j	z
1	0	1	1	11			+	;	K	Ä	k	ä
1	1	0	0	12			,	<	L	Ö	l	ö
1	1	0	1	13	CR		-	=	M		m	
1	1	1	0	14		ß	.	>	N	Ü	n	ü
1	1	1	1	15			/	?	O		o	

abbreviations:

MS   Mobile Station
SME   Short Message Entity
SMSC   Short Message Service Center
MMI   Man Machine Interface
PDUs   Protocol Data Units
SM-AL   Short Message Aplication   Layer
SM-TL   Short Message Transport   Layer
SM-RL   Short Message Relay Layer
SM-LL   Short Message Link Layer
PDU Type   Protocol Data Unit Type
MR   Message Reference
OA   Originator Adress
DA   Destination Adress
PID   Protocol Identifier
DCS   Data Coding Scheme
SCTS   Service Center Time Stamp
VP   Validity Period
UDL   User Data Length
UD   User Data
RP   Reply Path

UDHI User Data Header Indicator
SRI   Status Report Indication
SRR   Status Report Request
VPF   Validity Period Format
MMS   More Messages to Send
RD   Reject Duplicate
MTI   Message Type Indicator
ME   Mobile Equipment
TE   Terminal Equipment
SIM   Subscriber Identity Modul

error codes:

0	phone failure
1	no connection to phone
2	Phone-adaptor link reserved
3	operation not allowed
4	operation not supported
5	PH-SIM PIN necessary
10	SIM not inserted
11	SIM PIN required
12	SIM PUK required
13	SIM failure
14	SIM busy
15	SIM wrong
16	incorrect password
20	memory full
21	invalid index
22	not found
23	memory failure
24	text string too long (+CPBW)
25	invalid characters in text string
26	dial string to long
27	invalid characters in dial string
30	no network service
31	network timeout
100	unknown
265	PUK for theft protection necessary
266	PUK2 for SIM necessary
267	PIN2 for SIM necessary