



**Digital cellular telecommunications system (Phase 2+) (GSM);  
Universal Mobile Telecommunications System (UMTS);  
LTE;  
Use of Data Terminal Equipment - Data Circuit terminating  
Equipment (DTE - DCE) interface for Short Message Service  
(SMS) and Cell Broadcast Service (CBS)  
(3GPP TS 27.005 version 17.0.0 Release 17)**



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**Reference**RTS/TSGC-0127005vh00

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**Keywords**GSM,LTE,UMTS

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# Contents

Intellectual Property Rights .....	2
Legal Notice .....	2
Modal verbs terminology.....	2
Foreword.....	6
0 Scope .....	7
0.1 References .....	8
0.2 Abbreviations .....	8
1 Reference configuration .....	9
1.1 V.24 Interface Circuits .....	9
1.1.1 Circuit definitions for the SMS Block mode .....	9
1.1.2 Circuit definitions for the SMS Text and PDU modes .....	10
2 SMS Block Mode .....	10
2.1 Beginning and ending of SMS/CBS Block Mode .....	10
2.1.1 Beginning SMS/CBS Block Mode .....	10
2.1.2 Returning from SMS/CBS Block Mode To Default Mode.....	11
2.2 Protocol description.....	11
2.3 Requesting messages already held in the Mobile Termination .....	12
2.3.1 Requesting List Of Messages .....	13
2.3.2 Requesting Transfer Of Messages .....	13
2.3.2.1 Requesting Transfer Of A Specific Message .....	13
2.3.2.2 Requesting Transfer Of All Messages.....	13
2.3.3 Requesting Diversion Of Incoming Messages .....	14
2.3.3.1 Requesting SMS Messages .....	14
2.3.3.2 Requesting CBS Messages.....	14
2.3.3.3 Requesting indication of message arrival.....	14
2.3.4 Requesting Transfer Into Mobile Termination .....	15
2.3.5 Requesting Deletion Of Messages .....	15
2.4 Message functional definitions and contents .....	16
2.4.1 Commands Issued By The Terminal Equipment .....	16
2.4.1.1 List Request.....	17
2.4.1.2 Get Message .....	17
2.4.1.3 Get First Message.....	17
2.4.1.4 Get Next Message .....	17
2.4.1.5 Transfer Inc SMS .....	17
2.4.1.6 Indicate Inc SMS .....	17
2.4.1.7 Transfer Inc CBS .....	18
2.4.1.8 Insert SMS.....	18
2.4.1.9 Delete message.....	18
2.4.1.10 Unable to process .....	18
2.4.1.11 End SMS Mode .....	18
2.4.1.12 Acknowledge Message.....	19
2.4.2 Responses/Indications Issued By The MT .....	19
2.4.2.1 Message List .....	19
2.4.2.2 Message.....	19
2.4.2.3 Get Message Failure.....	20
2.4.2.4 Inc Message.....	20
2.4.2.5 Message Arrived .....	20
2.4.2.6 Insert SMS Complete .....	20
2.4.2.7 Insert SMS Failure .....	20
2.4.2.8 Delete Message Complete.....	21
2.4.2.9 Delete Message Failure .....	21
2.4.2.10 Unable To Process .....	21
2.4.2.11 End SMS Mode .....	21
2.4.2.12 Request Confirmed.....	21

2.5	General message format and information elements coding .....	21
2.5.1	Message Type .....	21
2.5.2	Other Information Elements .....	22
2.5.2.1	Short Message Reference .....	22
2.5.2.2	SMS Transfer Type .....	23
2.5.2.3	Indication Type .....	23
2.5.2.4	Insert Type .....	24
2.5.2.5	Short Message Index .....	25
2.5.2.6	Short Message Data .....	26
2.5.2.7	Cause .....	28
2.5.2.8	Index Count .....	29
2.5.2.9	CBS Transfer Type .....	29
2.5.2.10	Page Index .....	29
2.5.2.11	Last Short Message .....	30
2.5.2.12	Confirm Type .....	30
2.5.2.13	TP-Failure Cause .....	31
2.5.2.14	SM-Deliver-Ack .....	31
2.5.2.15	SM-Submit-Ack .....	32
3	Text Mode .....	32
3.1	Parameter Definitions .....	32
3.2	General Configuration Commands .....	35
3.2.1	Select Message Service +CSMS .....	35
3.2.2	Preferred Message Storage +CPMS .....	35
3.2.3	Message Format +CMGF .....	36
3.2.4	Enter SMS Block Mode Protocol +CESP .....	36
3.2.5	Message Service Failure Result Code +CMS ERROR .....	37
3.2.6	Informative Examples .....	37
3.3	Message Configuration Commands .....	38
3.3.1	Service Centre Address +CSCA .....	38
3.3.2	Set Text Mode Parameters +CSMP .....	38
3.3.3	Show Text Mode Parameters +CSDH .....	39
3.3.4	Select Cell Broadcast Message Types +CSCB .....	39
3.3.5	Save Settings +CSAS .....	40
3.3.6	Restore Settings +CRES .....	40
3.3.7	Informative Examples .....	41
3.4	Message Receiving and Reading Commands .....	41
3.4.1	New Message Indications to TE +CNMI .....	41
3.4.2	List Messages +CMGL .....	46
3.4.3	Read Message +CMGR .....	47
3.4.4	New Message Acknowledgement to ME/TA +CNMA .....	47
3.4.5	Informative Examples .....	48
3.5	Message Sending and Writing Commands .....	49
3.5.1	Send Message +CMGS .....	49
3.5.2	Send Message from Storage +CMSS .....	50
3.5.3	Write Message to Memory +CMGW .....	50
3.5.4	Delete Message +CMGD .....	51
3.5.5	Send Command +CMGC .....	52
3.5.6	More Messages to Send +CMMS .....	52
3.5.7	Informative Examples .....	53
4	PDU Mode .....	53
4.0	General .....	53
4.1	List Messages +CMGL .....	54
4.2	Read Message +CMGR .....	54
4.3	Send Message +CMGS .....	54
4.4	Write Message to Memory +CMGW .....	55
4.5	Send Command +CMGC .....	56
4.6	New Message Acknowledgement to ME/TA +CNMA .....	56
4.7	Send Message from Storage +CMSS .....	57

<b>Annex A (normative):</b>	<b>Character Set Conversions for SMS Text Mode .....</b>	<b>58</b>
-----------------------------	--	-----------

<b>Annex B (informative):</b>	<b>Example of processing a data block .....</b>	<b>61</b>
B.1	Example state diagrams for the block receiver.....	61
B.2	Example of coding and decoding a data block.....	61
<b>Annex C (informative):</b>	<b>Change History .....</b>	<b>68</b>
History .....		69

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# Foreword

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## 0 Scope

The present document defines three interface protocols for control of SMS functions within a GSM/UMTS mobile telephone from a remote terminal via an asynchronous interface.

Clause 2 defines a binary protocol ("Block Mode"). The protocol includes error protection and is suitable for use where the link may not be completely reliable. It will be of particular use where control of remote devices is required. Efficient transfer of binary encoded user data is possible.

Clause 3 defines a character-based interfaced based on "AT" commands ("Text Mode"). This mode is suitable for unintelligent terminals or terminal emulators, and for application software built on command structures like those defined in V.25ter. Some of the commands defined in clause 3 will also be useful for implementations of clause 2 and/or clause 4, for example enabling an indication of incoming SMS messages.

Clause 4 defines a character-based interface with hex-encoded binary transfer of message blocks ("PDU Mode"). This mode is suitable for software drivers based on AT command structures which do not understand the content of the message blocks and can only pass them between the MT and "upper level" software resident in the TE.

In all three modes, the terminal is considered to be in control for SMS/CBS transactions.

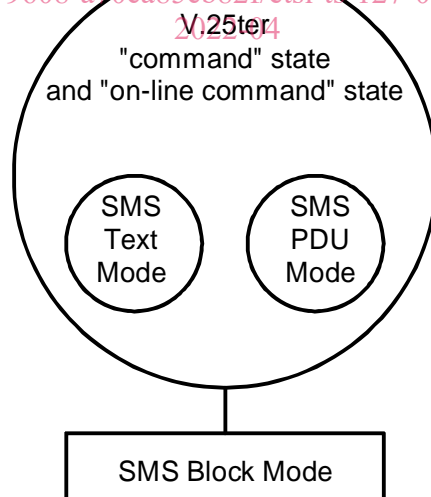
The present document considers the mobile termination to be a single entity. Other 3GPP/GSM Technical Specifications describe the split of functionality between the mobile equipment and (U)SIM.

The three "modes" referred to above, are represented in figure 0.1.

The "Block mode" is a self contained mode in its own right, and when entered, control will remain within that mode until the procedures to exit the mode are executed, after which control is returned to the V.25ter "command" state or "on-line command" state.

The "Text" and "PDU" modes are not in themselves V.25ter states but are simply sets of commands which will operate in either the V.25ter "command" state or "on-line command" state. The "Text" and "PDU" modes are transitory states and after each operation, control is automatically returned to the V.25ter "command" state or "on-line command" state. Whilst in the V.25ter command state, the MS is available to handle incoming and outgoing calls such as Data or Facsimile.

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**Figure 0.1: Block, Text and PDU modes**

In the "Block mode" and "PDU" mode a mobile is not permitted to modify any component of an SMS/CBS message received from the air interface or an SMS message received from a TE, before passing it on, except where 3GPP TS 23.040 [3] or 3GPP TS 23.041 [4] defines a "component modification facility" and where this "component modification facility" is supported by the mobile. In the Text Mode the mobile may be unable to display characters coded in particular coding schemes. In this case, the mobile shall behave as described in 3GPP TS 23.038 [2] and assume the coding scheme to be the GSM 7 bit default alphabet.



## 0.1 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] Void.
- [2] 3GPP TS 23.038: "Alphabets and language-specific information".
- [3] 3GPP TS 23.040: "Technical realization of the Short Message Service (SMS)".
- [4] 3GPP TS 23.041: "Technical realization of the Cell Broadcast Service (CBS)".
- [5] 3GPP TS 24.008: "Mobile Radio Interface Layer 3 specification; Core Network Protocols; Stage 3".
- [6] 3GPP TS 24.011: "Short Message Service (SMS) support on mobile radio interface".
- [7] 3GPP TS 24.012: "Cell Broadcast Service (CBS) support on the mobile radio interface".
- [8] 3GPP TS 27.001: "General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".
- [9] 3GPP TS 27.007: "AT command set for User Equipment (UE)".
- [10] 3GPP TS 51.011: "Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface".
- [11] ITU-T Recommendation V.25ter: "Serial asynchronous automatic dialling and control".
- [12] ITU-T Recommendation V.24: "List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE)".
- [13] ITU-T Recommendation E.164: "The international public telecommunication numbering plan".
- [14] ITU-T Recommendation E.163: "Numbering plan for the international telephone service".
- [15] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [16] 3GPP TS 31.102: "Characteristics of the USIM application".

## 0.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [15] and the following apply.

EVPF	Enhanced Validity Period Format
------	---------------------------------

# 1 Reference configuration

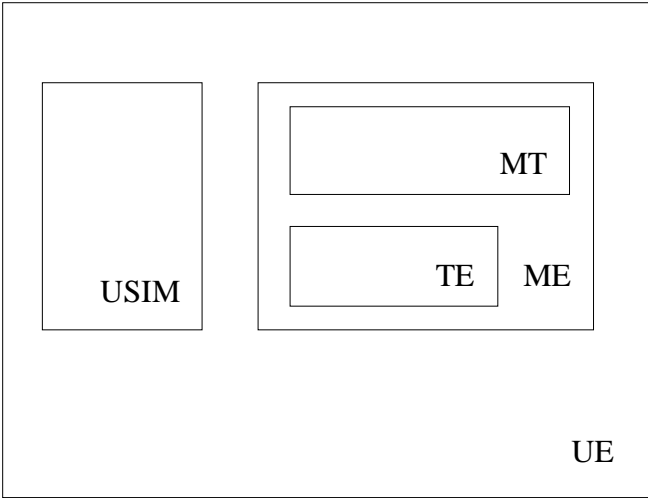


Figure 1: Reference configuration

The User Equipment (UE) consists of the mobile equipment (ME) and the (U)SIM. Messages may be stored in either, but the present document does not distinguish between messages stored in the (U)SIM or in the ME. The management of message storage in the two parts of the UE is a matter for the UE implementation.

## 1.1 V.24 Interface Circuits

The operation of the ITU-T Recommendation V.24 blue book interface circuits for SMS is shown in table 1.1.

Table 1-1: Use of V.24 interface circuits

V.24 CIRCUIT	DESCRIPTION	TE to MT	MT to TE
CT102	signal ground	x	x
CT103	TXD	x	
CT104	RXD		x
CT105	RTS	x	
CT106	CTS		x
CT107	DSR		x
CT108.2	DTR	x	
CT109	DCD		x

NOTE: CT105 at the TE is connected to CT133 at the MT.

### 1.1.1 Circuit definitions for the SMS Block mode

#### CT103

All commands from the TE to the MT are transferred across this circuit. Inband flow control is not permitted during Block Mode.

#### CT104

All responses/indications from the MT to the TE are transferred across this circuit. Inband flow control is not permitted during Block Mode.

**CT105**

This circuit allows the TE to flow control the MT when in the Block Mode and at other times if hardware flow control is enabled.

**CT106**

This circuit allows the MT to flow control the TE when in the Block Mode and at other times if hardware flow control is enabled.

**CT107**

This circuit shall be set to the ON condition before entry into the Block Mode, and shall remain in the ON condition during Block Mode. If the TE detects that this circuit returns to the OFF condition during the block mode then the TE shall return CT108.2 to the OFF condition and exit the Block Mode.

**CT108.2**

This circuit shall be set in the ON condition before the AT+CESP command is sent from the TE to begin the Block Mode, and shall be maintained in the ON condition during the Block Mode. It shall be returned to the OFF condition after the command 'END SMS MODE' has been accepted and acknowledged by the MT. If the MT detects that this circuit returns to the OFF condition during the Block Mode then the MT shall exit the Block Mode.

**CT109**

This circuit shall be set to the ON condition before entry into the Block Mode and remain in the ON condition during the Block Mode. If the TE detects that this circuit returns to the OFF condition during the Block Mode then the TE shall return CT108.2 to the OFF condition and shall exit the Block Mode.

### 1.1.2 Circuit definitions for the SMS Text and PDU modes

Only circuits CT102, CT103 and CT104 are mandatory for the Text and PDU modes. The functionality and operation of other circuits shall be in accordance with V.25ter.

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## 2 SMS Block Mode

### 2.1 Beginning and ending of SMS/CBS Block Mode

#### 2.1.1 Beginning SMS/CBS Block Mode

As described in 3GPP TS 27.001 [8], the DTE/DCE interface is normally associated with the terminal adaptation function (TAF), if such a function is available. When no data connection is in progress, and the terminal equipment wishes to enter SMS/CBS mode, the command 'AT+CESP' shall be issued by the TE through the DTE/DCE interface requesting that the Block mode protocol described in the present document is to be used. The syntax of this command is further described in clause 3.2.4 later. The syntax for these commands is derived from ITU-T Recommendation V.25ter, i.e. the command is encoded as an IA5 character string together with delimiters as described in ITU-T Recommendation V.25ter.

Upon receipt of this command, the mobile termination shall respond as follows:

- If the mobile termination supports SMS/CBS block mode commands, responses and indications as described in the present document, it shall respond with 'OK' (or 0) and enter the SMS/CBS mode.
- If the mobile termination does not support SMS/CBS block mode commands, responses and indications as described in the present document, it shall respond with 'ERROR' (or 4) and remain in the current mode.

- Terminal software shall wait a short time (e.g. 5 seconds) for the 'OK' (0) or 'ERROR' (4) response. If neither response is received before the timeout then the terminal software shall assume that the block mode has been entered. The terminal software may then submit its first block mode command. If no response is received to this command then the terminal software shall proceed as described below in clause 2.2 (i.e. repeat the command 3 times and then exit the block mode).

If the SMS/CBS block mode command is accepted by the mobile termination, then all further commands, responses and indications shall be as defined in clause 2 of the present document. These SMS/CBS mode commands, responses and indications use 8-bit encoded data and not IA5 characters.

## 2.1.2 Returning from SMS/CBS Block Mode To Default Mode

When the terminal equipment wishes to return to default mode from SMS/CBS mode, it shall issue the command 'END SMS MODE', described in clause 2.4.1.11. The mobile termination shall respond with 'OK' (or 0) to indicate that the DTE/DCE interface has returned to default mode. The TE shall change back to default mode whether or not such a response is received.

The TE may also indicate that it has exit from the SMS/CBS mode through the use of CT 108/2 (see clause 1.1)

If an incoming data call arrives while the DTE/DCE interface is set to SMS/CBS mode, then the mobile termination may autonomously issue the 'END SMS MODE' indication (clause 2.4.2.11) and revert to default mode in order to connect the data call through the TAF.

The MT may exit from SMS/CBS mode autonomously if the power to the MT is switched off and then on again. In addition, the MT manufacturer may provide MMI to change the mode back to the default mode. In the latter case, the MT shall issue the 'END SMS MODE' indication (clause 2.4.2.11) and exit the SMS/CBS mode immediately.

The MT may also indicate that it has exit from the SMS/CBS mode through the use of CT 107 and CT 109 (see clause 1.1).

A BREAK condition in either direction at the DTE/DCE interface shall cause the TE and the MT to exit from the SMS/CBS block mode and return to the default mode.

In the event where the TE or the MT find themselves unable to recover from a protocol error then either entity may exit the SMS/CBS mode using any of the mechanisms described above. Confirmation of default mode operation will be achieved through the use of AT commands and responses.

## 2.2 Protocol description

The communication path between the MT and the TE across the DTE/DCE interface should be quite reliable if it uses a short wire link. However, to ensure that the low error rate does not cause malfunction, the following error protection scheme is provided.

Each message sent from the MT to the TE or vice-versa consists of a data block (DATA) and block check sum (BCS, see figure 2.2.1). In the following description the notation DLE, STX, NUL and ETX refer to control characters having the values 10 02 00 and 03 hexadecimal respectively.

<-----DATA-----> <- BCS ->

DLE 10H	STX 02H	Message content	DLE 10H	ETX 03H	BCS MSB	BCS LSB
------------	------------	-----------------	------------	------------	------------	------------

**Figure 2.2.1: Format of DTE/DCE interface messages**

The data block consists of a start transmission sequence, set to 00010000 00000010 (10 02 hex), the message content as defined below and an end transmission sequence, set to 00010000 00000011 (10 03 hex). The least significant bit of each octet is always transmitted first.

The block check sum is calculated at the transmitter by adding all of the octets in the message content modulo 65536. Each bit of the 16-bit result is then inverted, and 1 is added to the answer.

During transmission of the message content and the BCS octets, any occurrence of the value 10 hex (DLE) shall result in an additional 'stuffing' octet of value 00 hex (NUL) being transmitted immediately following the octet containing 10

hex. This is to ensure that the start and end markers are unambiguous. The receiver shall remove stuffing octets by discarding any octet of value 00 hex (NUL) which immediately follows an octet of value 10 hex (DLE).

After removal of any stuffing octets, the receiver can check the BCS by adding all of the octets in the message content and the 16-bit BCS modulo 65536. The correct result is 0000 hex. If any message is received with an incorrect BCS, then the message is discarded. No response is sent over the DTE/DCE interface, but an indication may be provided to higher layers within the receiving entity.

The transmitter shall only send DLE when it is followed by STX, NUL or ETX. Therefore, if the receiver sees a DLE followed by anything else then the receiver shall assume that some data has been lost, and shall start to search for the start marker. An unexpected end marker at the receiver shall also result in a search for a start marker. A start marker shall always be treated as the start of a new block, regardless of which state the receiver is in.

Examples of state diagrams for a block receiver to implement this procedure are given in Annex B, together with an example of coding and decoding a message.

Only one Command/Response transaction shall be permitted at any one time from any sending or receiving entity. It shall however be possible for a Command/Response transaction from one entity to be initiated even if there is a Command/Response transaction in progress from the other entity.

If an immediate response is expected to a message sent over the DTE/DCE interface, then the sending entity shall wait 10 s. If no response is received within this time, the sending entity shall repeat the message. The message shall be repeated a maximum of 3 times, after which the sending entity shall exit from the SMS/CBS mode and provide an error indication to the user.

If a message cannot be understood by the receiving entity even though it has a correct BCS, then it shall return an UNABLE TO PROCESS message with cause value 'Command not understood'. The receipt of an UNABLE TO PROCESS message should not in itself initiate re-transmission although re-transmission may take place due to the timeout mechanism described earlier since an UNABLE TO PROCESS is deemed to be an invalid response. The 'Cause' may however be referred to a higher layer. An UNABLE TO PROCESS shall not be sent as the result of an incorrect BCS.

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## 2.3 Requesting messages already held in the Mobile Termination

The TE may request the MT to provide SMS or CBS messages already stored. The TE will either request all messages, or request a list of messages and subsequently ask for specific messages.

At the start of the SMS/CBS mode session, the MT shall number all messages contiguously, starting with message number 1. These "Short Message References" are only valid for a single SMS/CBS MODE session and should not be confused with the 3GPP TS 23.040 [3] TP-Message-Reference. Each message retains its Short Message Reference for the duration of the SMS/CBS mode session. New messages will normally be given the lowest previously-unused Short Message Reference. However, if all Short Message References have been used then the MT may reallocate Short Message References previously allocated to now-deleted messages.

Short Message Reference 0 signifies that there are no messages in the MT. The value of 0 is used under the following conditions:

- When an INSERT SMS command is used to transfer an SM over the air interface and not store it in the MT then the MT will return a Short Message Reference of 0 in the REQUEST CONFIRMED response and the ensuing INSERT SMS COMPLETE / INSERT SMS FAILURE indications.
- For Class 0 SM's which are not stored in the MT.
- For TE specific SM's which are not stored in the MT.

If Message number 0 is requested by the TE, the MT will always return an error cause, but will also include the highest valid Short Message Reference (see clause 2.3.2.1).

### 2.3.1 Requesting List Of Messages

The TE may request the MT to provide a list of SMS and CBS messages currently stored in the mobile termination. This is achieved by the LIST REQUEST command (clause 2.4.1.1). The MT divides the messages stored into groups of 5 (called pages) and transfers the first 5 in a MESSAGE LIST response (clause 2.4.2.1) containing message references allocated by the MT, plus the relevant header information described in 3GPP TS 23.040 [3] and 3GPP TS 24.011 [6] and 3GPP TS 23.041 [4] and 3GPP TS 24.012 [7].

If there are no messages stored in the MT, then the MESSAGE LIST response shall be empty.

The TE may then request further groups of up to 5 messages by repeating the LIST REQUEST command for pages 2, 3, and so on. The MT will indicate that there are no more pages by responding with an empty MESSAGE LIST response.

### 2.3.2 Requesting Transfer Of Messages

The TE may request the transfer of one or more messages by means of the commands described below. The MT does not delete messages which have been transferred. Messages can only be deleted by the DELETE MESSAGE command (clause 2.4.1.9).

#### 2.3.2.1 Requesting Transfer Of A Specific Message

The TE may request the MT to transfer a specific message by sending the GET MESSAGE command (clause 2.4.1.2), including the appropriate message reference. The MT will provide the full message including header in a MESSAGE response (clause 2.4.2.2). If the message reference is unallocated, then the GET MESSAGE FAILURE response is returned with cause 'No such message' and the highest valid Message Reference (clause 2.4.2.3).

#### 2.3.2.2 Requesting Transfer Of All Messages

The TE may request the MT to transfer all messages by sending the GET FIRST MESSAGE command (clause 2.4.1.3), followed by the appropriate number of GET NEXT MESSAGE commands (clause 2.4.1.4).

The MT shall be able to transfer all messages one-by-one, starting with the 'first' and continuing with the 'next'. The precise ordering of the messages is left to the MT implementation.

If the MT exits from SMS/CBS mode for any reason, then this information need not be retained.

On receipt of the GET FIRST MESSAGE command, the MT shall set a pointer to the first message, and transfer this message using the MESSAGE response as described in clause 2.3.2.1.

On receipt of the GET NEXT MESSAGE command, the MT shall move the pointer to the first available message after the last message transferred (using either GET FIRST MESSAGE, GET MESSAGE or GET NEXT MESSAGE), and transfer this message using the MESSAGE response as described in clause 2.3.2.1.

If the MT receives a GET NEXT MESSAGE command when all messages have been transferred to the TE, or there are no messages stored in the MT, then the GET MESSAGE FAILURE response shall be provided with the cause 'No such message' (see clause 2.4.2.3).

If the TE receives an out of sequence message then it shall attempt to transfer the missing message using the GET MESSAGE command before continuing with GET NEXT MESSAGE. If this attempt fails with the cause 'no such message', it means that the message has been deleted, or it has been lost due to a failure at the MT.

The MT includes a LAST SHORT MESSAGE REFERENCE in the GET MESSAGE FAILURE response. This is so that the TE can detect whether or not the last short message was received in error.

If the MT receives a GET NEXT MESSAGE command prior to receiving a GET FIRST MESSAGE or GET MESSAGE command, then it shall continue as if the command had been GET FIRST MESSAGE (i.e. provide the 'first' message and continue with the 'next' on receipt of the subsequent GET NEXT MESSAGE command).



### 2.3.3 Requesting Diversion Of Incoming Messages

The TE may request the MT to transfer SMS or CBS messages directly from the air interface to the DTE/DCE interface, by the following procedures. If messages are diverted then they are not stored in the MT. If messages are diverted and there is no communication path to the TE (e.g. because it has been disconnected), the diversion shall be cancelled.

#### 2.3.3.1 Requesting SMS Messages

The TE may request an indication of arrival of incoming SMS messages, or the direct transfer of incoming SMS messages.

The TE requests new SMS messages by the TRANSFER INC SMS command (clause 2.4.1.5). This command will be sent with parameters indicating whether all incoming SMS messages are to be transferred, or only those indicated as being for the TE.

The MT shall confirm receipt of this command with a REQUEST CONFIRMED message provided there is memory available to store SM's in the ME or the (U)SIM. If there is no memory available, the MT shall respond with 'unable to process' with a cause value No memory.

The MT shall transfer incoming messages by the INC MESSAGE indication (clause 2.4.2.4).

For an INC MESSAGE which contains a Short Message (SMS) info element id, the TE shall acknowledge receipt of the INC MESSAGE with an ACKNOWLEDGE MESSAGE (clause 2.4.1.12). The MT should not send another INC MESSAGE which contains a Short Message (SMS) info element id to the TE whilst it is waiting for an ACKNOWLEDGE MESSAGE.

In the event of the MT not receiving an ACKNOWLEDGE MESSAGE within a time specified by the MT manufacturer the MT shall exit the SMS mode automatically after 'n' attempts to send the INC MESSAGE (where n is a number specified by the MT manufacturer). The MT should attempt to store the unacknowledged SM or Status Report (contained in the INC MESSAGE) in the MT or on the (U)SIM as appropriate.

The ACKNOWLEDGE MESSAGE sent from the TE to the MT must not delay the MT sending the RP-ACK defined in 3GPP TS 23.040 [3] (to the SC) for longer than the RP-ACK timeout specified in 3GPP TS 24.011 [6].

The TE requests the cessation of incoming message transfer by the same command, indicating no incoming messages. The transfer of messages will automatically cease on exit of the SMS/CBS mode. Transfer shall not recommence until a new request is issued by the TE.

#### 2.3.3.2 Requesting CBS Messages

The TE may request the transfer of all cell broadcast messages directly from the air interface to the DTE/DCE interface. This is achieved by the use of the TRANSFER INC CBS message (clause 2.4.1.7).

The MT shall confirm receipt of this command with a REQUEST CONFIRMED message.

After receipt of this command, the MT shall transfer all CBS pages as they arrive on the air interface, using the INC MESSAGE indication (clause 2.4.2.4).

While the CBS pages are being transferred, any other indication or response required to be sent to the TE will take precedence over the CBS pages. However, the MT shall not interrupt the transfer of a page to send other information within the SMS/CBS mode (ie. the MT shall wait until a page boundary).

The transfer of messages will automatically cease on exit of the SMS/CBS mode. Transfer shall not recommence until a new request is issued by the TE.

#### 2.3.3.3 Requesting indication of message arrival

If the TE requires an indication of incoming message arrival, the INDICATE INC SMS command (clause 2.4.1.6) shall be used.

The MT shall confirm receipt of this command with a REQUEST CONFIRMED message.