3GPP TSG-T#7
Madrid, SPAIN, 13-15 March 2000

TSGT#7(00)0024

Agenda Item: 5.2.3

Source: T2

Title: R99 Change Requests

Document for: Approval

T2 Tdocs	Spec	CR	Rev	Ph	Subject	Cat	Version-Current	Version -New	Workitem
T2-000100	23.040	009		R99	Enhancement of the Message Content in SMS	B	3.3.0	3.4.0	MMS
T2-000136	23.040	010		R99	SMS multiple information elements	B	3.3.0	3.4.0	TEI
T2-000129	23.040	011		R99	SMS E-MAIL PARAMETERS	B	3.3.0	3.4.0	TEI
T2-000134	23.041	003		R99	Addition of LCS message identifier to support GPS Navigation message	A	3.1.0	3.2.0	LCS
T2-000130	23.041	004		R99	Adaptation of the scope of TS 23.041 from “GSM only” to “GSM and UMTS” part II	F	3.1.0	3.2.0	CBS
T2-000047	23.057	001		R99	Corrections to WAP chapters	F	3.0.0	3.1.0	MExE
T2-000049	23.057	002		R99	QoS	F	3.0.0	3.1.0	MExE
T2-000058	27.007	023		R99	Deletion of the +CPROT? read command	F	3.3.0	3.4.0	TEI
T2-000072	27.007	025		R99	Adaptations for UMTS	F	3.3.0	3.4.0	TEI
T2-000059	27.007	026		R99	References to ASCI Specifications	D	3.3.0	3.4.0	ASCI
T2-000060	27.007	027		R99	Abbreviations related to ASCI	D	3.3.0	3.4.0	ASCI
T2-000061	27.007	028		R99	Priority indication in +CLCC, List Current Calls	B	3.3.0	3.4.0	ASCI
T2-000062	27.007	029		R99	Indication of priority, sub-address, sub-address type and TS 91/TS92 in +CRC, Cellular Result Codes	B	3.3.0	3.4.0	ASCI
T2-000063	27.007	030		R99	Commands for ASCI	B	3.3.0	3.4.0	ASCI
T2-000064	27.007	031		R99	Commands for eMLPP	B	3.3.0	3.4.0	ASCI
T2-000065	27.007	032		R99	Example for usage of priority	B	3.3.0	3.4.0	ASCI
T2-000071	27.007	024		R99	Additional format(4 digits) for +CCLK	B	3.3.0	3.4.0	TEI
T2-000057	27.010	005		R99	Adaptations for UMTS	F	3.2.0	3.3.0	TEI

3GPP TSG-T2 #8 / ETSI SMG4
Puerto Vallarta, MEXICO, 1 - 4 Feb 2000

Document ***TSGT2#8(00)100***

e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

23.040 **CR** **009** Current Version: 3.3.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	T#7	for approval	X	strategic		*(for SMG use only)*
list expected approval meeting # here ↑		for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)*	(U)SIM		ME	X	UTRAN / Radio		Core Network	

Source:	T2	**Date:**	28 Jan 2000
Subject:	Enhancement of the Message Content in SMS		
Work item:	Messaging (Short Message Service (SMS))		

Category:	F	Correction		**Release:**	Phase 2	
	A	Corresponds to a correction in an earlier release			Release 96	
(only one category	B	Addition of feature	X		Release 97	
shall be marked	C	Functional modification of feature			Release 98	
with an X)	D	Editorial modification			Release 99	X
					Release 00	

Reason for change:

This CR proposes an enhancement of the message-contents in SMS. At the moment SMS users are not able to send more than plain text to each other. This proposal provides the users to make more exciting messages with features like formatting the text, sounds, small pictures and simple animations.

This enhancement is based on standard mechanisms in GSM and is therefore backward compatible with older terminals. Terminals that do not have these extra features will still be able to present the text but not the extra information (e.g. formatting, pictures).

Clauses affected: 2, 3.10, 9.2.3.24, 9.2.3.24.10

Other specs affected:	Other 3G core specifications		→ List of CRs:	
	Other GSM core specifications		→ List of CRs:	
	MS test specifications		→ List of CRs:	
	BSS test specifications		→ List of CRs:	
	O&M specifications		→ List of CRs:	

Other comments:

help.doc

<--------- double-click here for help and instructions on how to create a CR.

2 Normative 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.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] GSM 01.04: "Digital cellular telecommunication system (Phase 2+); Abbreviations and acronyms".

[2] GSM 02.03: "Digital cellular telecommunication system (Phase 2+); Teleservices supported by a GSM Public Land Mobile Network (PLMN)".

[3] 3G TS 22.004: "General on supplementary services".

[4] 3G TS 22.041: " Operator determined barring".

[5] GSM 03.02: "Digital cellular telecommunication system (Phase 2+); Network architecture".

[6] 3G TS 23.008: "Organization of subscriber data".

[7] 3G TS 23.011: "Technical realization of supplementary services - General Aspects".

[8] 3G TS 23.015: "Technical realisation of Operator Determined Barring (ODB)".

[9] 3G TS 23.038: "Alphabets and language-specific information".

[10] 3G TS 23.041: "Technical realization of Cell Broadcast Service (CBS)".

[11] GSM 03.47 (ETR 354): "Digital cellular telecommunication system; Example protocol stacks for interconnecting Service Centre(s) (SC) and Mobile-services Switching Centre(s) (MSC)".

[12] GSM 04.08: "Digital cellular telecommunication system (Phase 2+); Mobile radio interface layer 3 specification".

[13] 3G TS 24.011: "Short Message Service (SMS) support on mobile radio interface".

[14] 3G TS 27.005: "Use of Data Terminal Equipment - Data Circuit terminating Equipment (DTE - DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)".

[15] 3G TS 29.002: "Mobile Application Part (MAP) specification".

[16] GSM 11.11: "Digital cellular telecommunication system (Phase 2+); Specification of the Subscriber Identity Module - Mobile Equipment (SIM- ME) interface".

[17] CCITT Recommendation E.164 (Blue Book): "Numbering plan for the ISDN era".

[18] CCITT Recommendation E.163 (Blue Book): "Numbering plan for the international telephone service".

[19] CCITT Recommendation Q.771: "Specifications of Signalling System No.7; Functional description of transaction capabilities".

[20] CCITT Recommendation T.100 (Blue Book): "International information exchange for interactive videotex".

[21] CCITT Recommendation T.101 (Blue Book): "International interworking for videotex services".

[22] CCITT Recommendation X.121 (Blue Book): "International numbering plan for public data networks".

[23] CCITT Recommendation X.400 (Blue Book): "Message handling system and service overview".

[24] ISO/IEC10646, "Universal Multiple-Octet Coded Character Set (USC); UCS2, 16 bit coding".

[25] 3G TS 22.022: "Personalisation of GSM ME Mobile functionality specification - Stage 1".

[26] 3G TS 23.042: "Compression Algorithm for Text Messaging Services”

[27] 3G TS 23.060: "General Packet Radio Service (GPRS); Service description; Stage 2".

[28] GSM 03.48: "Digital cellular telecommunications system (Phase 2+); Security Mechanisms for the SIM application toolkit; Stage 2"

[29] 3G TR 21.905: "3G Vocabulary".

[30] 3G TS 31.102: "Characteristics of the USIM application"

[31] 3G TS 31.101: "UICC – Terminal interface; Physical and logical characteristics"

[32] 3G TS 22.105: "Services and Service Capabilites"

[33] Infrared Data Association. Specifications for Ir Mobile Communications (IrMC). iMelody.

3.10 Enhanced Messaging Service

The Enhanced Messaging Service (EMS) is based upon the standard SMS, but with formatting added to the text. The formatting permits the message to contain simple animations, small pictures, small melodies and formatting of the text, everything mixed together into one message. This section lists the supported features. The coding mechanisms and formats are specified in section 9.2.3.24.10

3.10.1 Text formatting

The following text formatting features are supported:

Alignment

- Left (default)
- Centre
- Right

Font size

- Normal (default)
- Large
- Small

Style

- Normal (default)
- **Bold**
- *Italic*
- Underlined
- ~~Strikethrough~~

3.10.2 Pictures

It is possible to include either a small (16*16 pixels), large (32*32 pixels) or pictures of variable size. These pictures have neither animation nor grey scales, it is plain black and white. All pictures are user defined.

If multiple pictures are received side by side, then they will be stitched together with no inter-character spacing. If a <CR> is inserted in the middle of multiple pictures, then the left margin of the pictures are vertically aligned. If two pictures that are of the same size are logically separate, they should be separated by a space or other characters. Maximum recommended pictures size usage of this technique : 96x64 (6 large pictures, with a CR in the middle). This unified picture is then formatted as one.

3.10.3 Animations

Predefined

There are number of predefined animations. These animations are not sent as animation over the air interface, only the identification of them. As soon as the position of the animation in the SM data is reached, the animation corresponding to the received number shall be displayed in a manner which is manufacturer specific..

User Defined

The user-defined animations consist of 4 pictures and there are two different sizes of these animations. The picture size of the small animations are 8*8 pixels and the large 16*16 pixels. These animations are sent over the air interface.

3.10.4 Sound

Predefined

There are a number of predefined sounds. These sounds are not transferred over the air interface, only the identification of them. There are 10 different sounds that can be added in the message, and as soon as the sound mark is in focus (on the display), the sound will be played.

User Defined

The sender can define own melodies according to the iMelody format [33]. These melodies are transferred in the SM and can take up to 128 bytes.

9.2.3.9 TP-Protocol-Identifier (TP-PID)

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

The MS shall interpret reserved or unsupported values as the value 00000000 but shall store them exactly as received.

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

bits	usage
7 6	
0 0	Assigns bits 0..5 as defined below
0 1	Assigns bits 0..5 as defined below
1 0	reserved
1 1	Assigns bits 0-5 for SC specific use

In the case where bit 7 = 0 and bit 6 = 0,

bit 5 indicates telematic interworking:
value = 0 : no interworking, but SME-to-SME protocol
value = 1 : telematic interworking

In the case of telematic interworking, the following five bit patterns in bits 4..0 are used to indicate different types of telematic devices:

4.. .0	
00000	implicit - device type is specific to this SC, or can be concluded on the basis of the address
00001	telex (or teletex reduced to telex format)
00010	group 3 telefax
00011	group 4 telefax
00100	voice telephone (i.e. conversion to speech)
00101	ERMES (European Radio Messaging System)
00110	National Paging system (known to the SC)
00111	Videotex (T.100 [20] /T.101 [21])
01000	teletex, carrier unspecified
01001	teletex, in PSPDN
01010	teletex, in CSPDN
01011	teletex, in analog PSTN
01100	teletex, in digital ISDN
01101	UCI (Universal Computer Interface, ETSI DE/PS 3 01-3)
01110..01111	(reserved, 2 combinations)
10000	a message handling facility (known to the SC)
10001	any public X.400-based message handling system
10010	Internet Electronic Mail
10011..10111	(reserved, 5 combinations)
11000..11110	values specific to each SC, usage based on mutual agreement between the SME and the SC (7 combinations available for each SC)
11111	A GSM/UMTS mobile station. The SC converts the SM from the received TP-Data-Coding-Scheme to any data coding scheme supported by that MS (e.g. the default).

If bit 5 has value 1 in an SMS-SUBMIT PDU, it indicates that the SME is a telematic device of a type which is indicated in bits 4..0, and requests the SC to convert the SM into a form suited for that device type. If the destination network is ISDN, the SC must also select the proper service indicators for connecting to a device of that type.

If bit 5 has value 1 in an SMS-DELIVER PDU, it indicates that the SME is a telematic device of a type which is indicated in bits 4..0.

If bit 5 has value 0 in an SMS-DELIVER PDU, the value in bits 4..0 identifies the SM-AL protocol being used between the SME and the MS.

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

In the case where bit 7 = 0, bit 6 = 1, bits 5..0 are used as defined below

5 0	
000000	Short Message Type 0
000001	Replace Short Message Type 1
000010	Replace Short Message Type 2
000011	Replace Short Message Type 3
000100	Replace Short Message Type 4
000101	Replace Short Message Type 5
000110	Replace Short Message Type 6
000111	Replace Short Message Type 7
001000..011101	Reserved
011110	Enhanced Message Service (EMS. Refer section 3.10)
011111	Return Call Message
100000..111011	Reserved
111100	ANSI-136 R-DATA
111101	ME Data download
111110	ME De-personalization Short Message
111111	(U)SIM Data download

A short message type 0 indicates that the ME must acknowledge receipt of the short message but may discard its contents.

The Replace Short Message feature is optional for the ME and the (U)SIM but if implemented it shall be performed as described here.

For MT short messages, on receipt of a short message from the SC, the MS shall check to see if the associated Protocol Identifier contains a Replace Short Message Type code.

If such a code is present, then the MS shall check the originating address and replace any existing stored message having the same Protocol Identifier code 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. The MS may also check the SC address as well as the Originating Address. However, in a network which has multiple SCs, it is possible for a Replace Message type for a SM to be sent via different SCs and so it is recommended that the SC address should not be checked by the MS unless the application specifically requires such a check.

If a Replace Short Message Type code is not present then the MS shall store the message in the normal way.

In MO short messages the SC reacts similarly but only the address of the originating MS or any other source is checked

The Enhanced Message Service PID value shall be set in a MO enhanced short message unless there is a need to set the PID to any other value (e.g for telematic interworking). In the event where the message contains one or more IE that could not be understood by the receiving SME, this PID value may be used to assist the receiving SME and/or the SMSC to identify such a message (e.g for diagnostic purposes). It is not a mandatory requirement for the SMSC or receiving SME to process this PID value or for the SMSC to pass the value to the receiving SME.

A Return Call Message indicates to the MS to inform the user that a call (e.g. a telephone call) can be established to the address specified within the TP-OA. The RP-OA contains the address of the SC as usual. The message content (if present) gives displayable information (e.g. the number of waiting voice messages). The message is handled in the same way as all other messages of the Replace Short Message Types.

The ME De-personalization Short Message is a ME-specific message which instructs the ME to de-personalities the ME (see 3G TS 22.022 [25]). The TP-DCS shall be set to Uncompressed, Default Alphabet, and Message Class 1 (ME-specific), which corresponds to a bit coding of 00010001. The TP-UD field contains de-personalization information coded according to 3G TS 22.022 [25]. This information shall not be displayed by an ME which supports the scheme. The acknowledgement to this message is a SMS-DELIVER-REPORT for RP-ACK in which the TP-User-Data shall be coded according to 3G TS 22.022 [25].

(U)SIM Data download is a facility whereby the ME must pass the short message in its entirety including all SMS elements contained in the SMS deliver to the (U)SIM using the mechanism described in GSM TS 11.11 [16] and 3G TS

31.102 [30]. The DCS shall be set to 8 bit message class 2 (either bit coding 1111 0110 or 00010110). The entire user data field is available for (U)SIM Data download. If the DCS is not set to 8-bit message class 2 then the message shall be handled in the normal way by the ME.

ME Data download is a facility whereby the ME shall process the short message in its entirety including all SMS elements contained in the SMS deliver to the ME. The DCS shall be set to message class 1. The entire user data field is available for ME data download.

ANSI-136 R-DATA is a facility whereby the ME must pass the short message in its entirety, including all elements contained in the SMS DELIVER, to the (U)SIM using the mechanism described in GSM TS 11.14 [16] and 3G TS 31.102 [30]. The DCS shall be set to 8-bit message class 2 (either bit coding 11110110 or 00010110). If the DCS is not set to 8-bit message class 2 then the message shall be handled in the normal way by the ME.

9.2.3.24 TP-User Data (TP-UD)

The length of the TP-User-Data field is defined in the PDU's of the SM-TL (see subclause 9.2.2).

The TP-User-Data field may comprise just the short message itself or a Header in addition to the short message depending upon the setting of TP-UDHI.

Where the TP-UDHI value is set to 0 the TP-User-Data field comprises the short message only, where the user data can be 7 bit (default alphabet) data, 8 bit data, or 16 bit (UCS2 [24]) data.

Where the TP-UDHI value is set to 1 the first octets of the TP-User-Data field contains a Header in the following order starting at the first octet of the TP-User-Data field.

Irrespective of whether any part of the User Data Header is ignored or discarded, the MS shall always store the entire TPDU exactly as received.

FIELD	LENGTH
Length of User Data Header	1 octet
Information-Element-Identifier "A"	1 octet
Length of Information-Element "A"	1 octet
Information-Element "A" Data	1 to "n" octets
Information-Element-Identifier "B"	1 octet
Length of Information-Element "B"	1 octet
Information-Element "B" Data	1 to "n" octets
Information-Element-Identifier "n"	1 octet
Length of Information-Element "n"	1 octet
Information-Element "n" Data	1 to "n" octets

The diagram below shows the layout of the TP-User-Data-Length and the TP-User-Data for uncompressed GSM 7 bit default alphabet data. The UDHL field is the first octet of the TP-User-Data content of the Short Message.

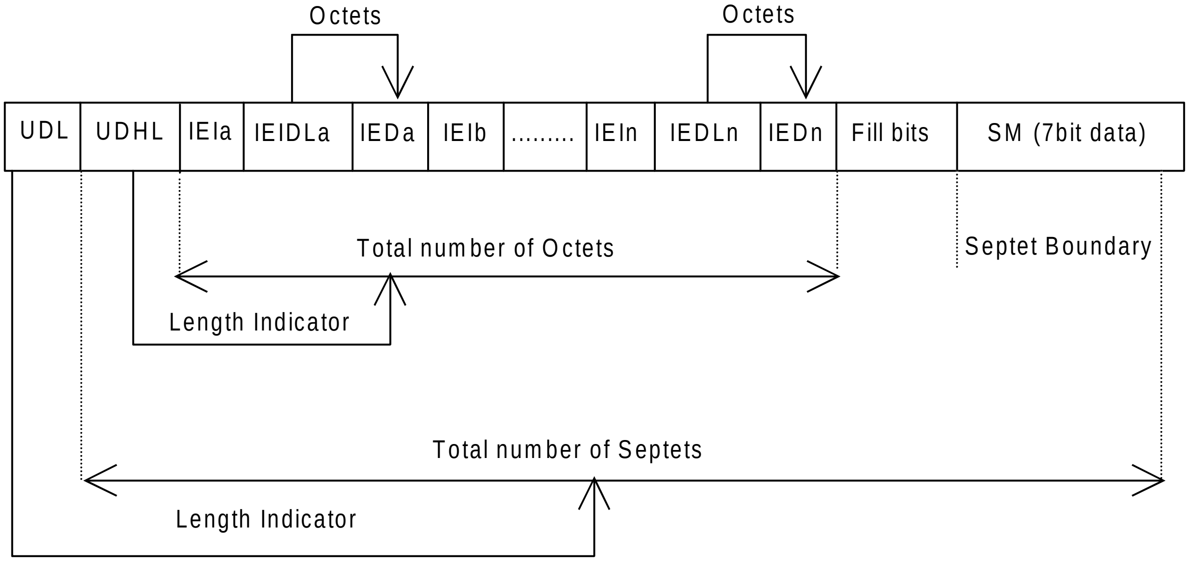

Figure 9.2.3.24 (a)

The diagram below shows the layout of the TP-User-Data-Length and the TP-User-Data for uncompressed 8 bit data or uncompressed UCS2 data. The UDHL field is the first octet of the TP-User-Data content of the Short Message.

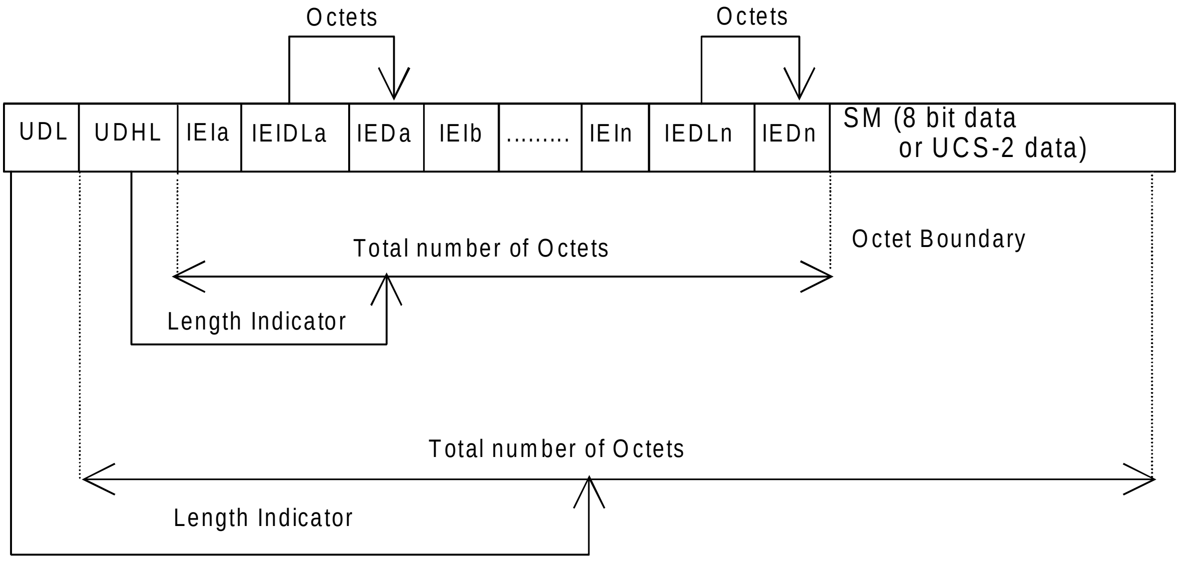

Figure 9.2.3.24 (b)

The diagram below shows the layout of the TP-User-Data-Length and the TP-User-Data for compressed GSM 7 bit default alphabet data, compressed 8 bit data or compressed UCS2 data. The UDHL field is the first octet of the TP-User-Data content of the Short Message.

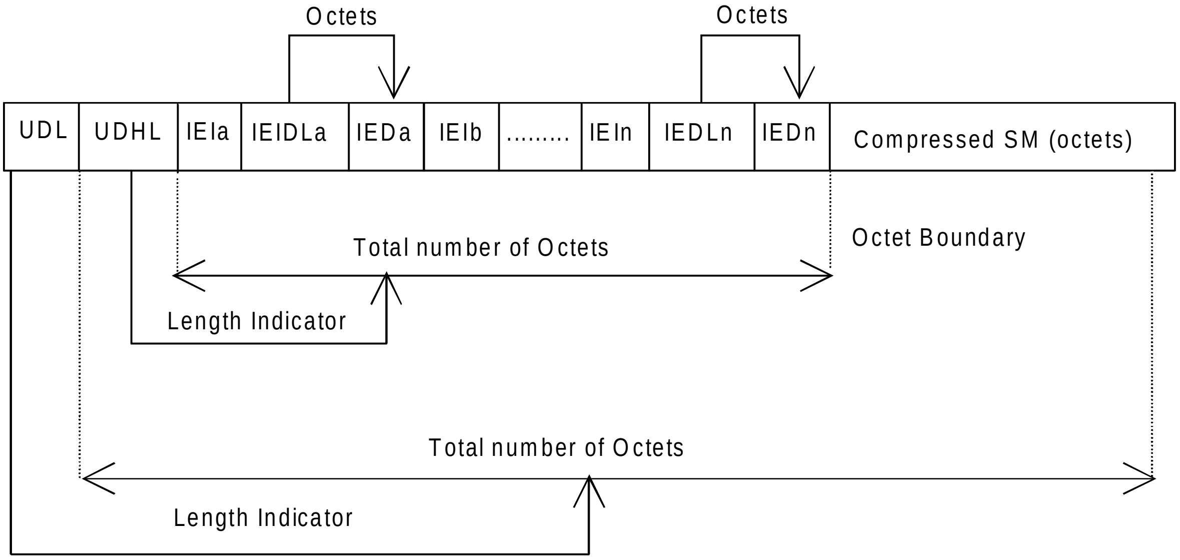

Figure 9.2.3.24 (c)

The definition of the TP-User-Data-Length field which immediately precedes the "Length of User Data Header" is unchanged and shall therefore be the total length of the TP-User-Data field including the Header, if present. (see 9.2.3.16)

The "Length-of-Information-Element" fields shall be the integer representation of the number of octets within its associated "Information-Element-Data" field which follows and shall not include itself in its count value.

The "Length-of-User-Data-Header" field shall be the integer representation of the number of octets within the "User-Data-Header" information fields which follow and shall not include itself in its count or any fill bits which may be present (see text below).

Information Elements may appear in any order and need not necessarily follow the order used in this specification. If Information Elements are duplicated (either with the same or different content) then the contents of the last occurrence of the Information Element shall be used. If the length of the User Data Header overall is such that there appear to be too few or too many octets in the final Information Element then the whole User Data Header shall be ignored.

If any reserved values are received within the content of any Information Element then that part of the Information Element shall be ignored.

The Information Element Identifier octet shall be coded as follows:

VALUE (hex)	MEANING
00	Concatenated short messages, 8-bit reference number
01	Special SMS Message Indication
02	Reserved
03	Value not used to avoid misinterpretation as <LF> character
04	Application port addressing scheme, 8 bit address
05	Application port addressing scheme, 16 bit address
06	SMSC Control Parameters
07	UDH Source Indicator
08	Concatenated short message, 16-bit reference number
09	Wireless Control Message Protocol
0A	Text Formatting
0B	Predefined Sound
0C	User Defined Sound (iMelody max 128 bytes)
0D	Predefined Animation
0E	Large Animation (16*16 times 4 = 32*4 =128 bytes)
0F	Small Animation (8*8 times 4 = 8*4 =32 bytes)
10	Large Picture (32*32 = 128 bytes)
11	Small Picture (16*16 = 32 bytes)
12	Variable Picture
13-1F	Reserved for future EMS features (see section 3.10)
20~~0A~~-6F	Reserved for future use
70-7F	(U)SIM Toolkit Security Headers
80 - 9F	SME to SME specific use
A0 - BF	Reserved for future use
C0 - DF	SC specific use
E0 - FF	Reserved for future use

A receiving entity shall ignore (i.e. skip over and commence processing at the next information element) any information element where the IEI is Reserved or not supported. The receiving entity calculates the start of the next information element by looking at the length of the current information element and skipping that number of octets.

The SM itself may be coded as 7, 8 or 16 bit data.

If 7 bit data is used and the TP-UD-Header does not finish on a septet boundary then fill bits are inserted after the last Information Element Data octet up to the next septet boundary so that there is an integral number of septets for the entire TP-UD header. This is to ensure that the SM itself starts on an septet boundary so that an earlier Phase mobile shall be capable of displaying the SM itself although the TP-UD Header in the TP-UD field may not be understood.

It is optional to make the first character of the SM itself a Carriage Return character encoded according to the default 7 bit alphabet so that earlier Phase mobiles, which do not understand the TP-UD-Header, shall over-write the displayed TP-UD-Header with the SM itself.

If 16 bit (USC2) data is used then padding octets are not necessary. The SM itself shall start on an octet boundary.

If 8 bit data is used then padding is not necessary. An earlier Phase mobile shall be able to display the SM itself although the TP-UD header may not be understood.

It is also possible for mobiles not wishing to support the TP-UD header to check the value of the TP-UDHI bit in the SMS-Deliver PDU and the first octet of the TP-UD field and skip to the start of the SM and ignore the TP-UD header.

9.2.3.24.10 Enhanced Messaging Service

9.2.3.24.10.1 EMS Coding

Enhanced Messaging is based on standard mechanism in GSM SMS messaging. The first mechanism is called **user data header** (TP-UDH), which makes it possible to include binary data in a normal SM prior the text message itself (chapter 9.2.3.24). The binary data is in the TP-UD field (message), which means that it steels a part of the 140 bytes.
Each object within the SM shall be identified by a IE in the TP-UD Header. The IE will contain a **octet** (refer to section 9.2.3.24.10.1) that identifies the absolute position of the object within and from the beginning of the SM data. In case of formatting text, an additional octet will give the number of characters for which the formatting applies.

Next mechanism that is used is **concatenation,** see chapter 9.2.3.24.1. This mechanism permits longer messages than 140 bytes, in fact 255 messages a 140 bytes each can be concatenated to one message up to about 38k bytes.

EMS IEs of the same type may occur more than once in a single message or one segment of a concatenated SM.

9.2.3.24.10.1.1 Text Formatting

The Information-Element-Data octet(s) shall be coded as follows.

Octet 1 Start position of the text formatting. Set to the number of characters after the formatting shall be applied from the beginning of the SM data.

This octet shall be coded as an integer value in the range 0 (beginning of the SM data) to the maximum number of characters included in the SM data of one single SM or one segment of a concatenated SM

Octet 2 Text formatting length. Gives the number of formatted characters

This octet shall be coded as an integer value in the range 1 to the maximum number of characters for which the formatting applies in one single SM or one segment of a concatenated SM.

Octet 3 formatting mode value coded as following :

Octet 3 :	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit 1	Bit 0	*Alignment
0	0	Left (default)
0	1	Center
1	0	Right
1	1	*reserved*

*in case formatting text is inserted on the same line as previous non formatting text or with a different mode value, the alignment value shall be set to the same value as the previous formatted predefined object.

Bit 3	Bit 2	Font Size
0	0	Normal (default)
0	1	Large
1	0	Small
1	1	*reserved*

Bit 4	Style **bold**
1	Bold on
0	Bold off

Bit 5	Style *Italic*
1	Italic on
0	Italic off

Bit 6 Style Underlined
1 Underlined on
0 Underlined off

Bit 7 Style ~~Strikethrough~~
1 Strikethrough on
0 Strikethrough off

If bit 4,5,6 and 7 are set to 0, it will mean normal style (default).

9.2.3.24.10.1.2 Predefined Sound

The Information-Element-Data octet(s) shall be coded as follows.

Octet 1 position indicating in the SM data the instant after which the sound shall be played. It will be set to the number of characters from the beginning of the SM data after which the sound shall be played.

This octet shall be coded as an integer value in the range 0 (beginning of the SM data) to the maximum number of characters included in the SM data of one single SM or one segment of a concatenated SM

Octet 2 sound number. Shall be encoded as a integer value.

9.2.3.24.10.1.3 User Defined Sound

The Information-Element-Data octet(s) shall be coded as follows.

Octet 1 position indicating in the SM data the instant the after which the sound shall be played (refer to section 9.2.3.24.10.1.2).

Octet 2-n Protocol Data Unit as described in section 9.2.3.24.10.3.1

This octet(s) shall contain a User Defined Sound.

9.2.3.24.10.1.4 Predefined Animation

The Information-Element-Data octet(s) shall be coded as follows.

Octet 1 position indicating in the SM data the instant the animation shall be displayed. Set to the number of characters from the beginning of the SM data after which the animation shall be displayed.

This octet shall be coded as an integer value in the range 0 (beginning of the SM data) to the maximum number of characters included in the SM data of one single SM or one segment of a concatenated SM

Octet 2 animation number. Shall be encoded as an integer value.

9.2.3.24.10.1.5 Large Animation

The Information-Element-Data octet(s) shall be coded as follows.

Octet 1 position indicating the instant the animation shall be displayed in the SM data (refer section 9.2.3.24.10.1.4).

Octet 2-n Protocol Data Unit as described in section 9.2.3.24.10.3.3

This octet(s) shall contain a Large Animation.

9.2.3.24.10.1.6 Small Animation

The Information-Element-Data octet(s) shall be coded as follows.

Octet 1 position indicating the instant the animation shall be displayed in the SM data (refer section 9.2.3.24.10.1.4).

Octet 2-n Protocol Data Unit as described in section 9.2.3.24.10.3.3

This octet(s) shall contain a Small Animation.

9.2.3.24.10.1.7 Large Picture

The Information-Element-Data octet(s) shall be coded as follows.

Octet 1 position indicating in the SM data the instant the picture shall be displayed. Set to the number of characters from the beginning of the SM data after which the picture shall be displayed.

This octet shall be coded as an integer value in the range 0 (beginning of the SM data) to the maximum number of characters included in the SM data of one single SM or one segment of a concatenated SM

Octet 2-n Protocol Data Unit as described in 9.2.3.24.10.3.2

This octet(s) shall contain a Large Picture.

9.2.3.24.10.1.8 Small Picture

The Information-Element-Data octet(s) shall be coded as follows.

Octet 1 position indicating in the SM data the instant the picture shall be displayed in the SM data (refer section 9.2.3.24.10.1.7)

Octet 2-n Protocol Data Unit as described in section 9.2.3.24.10.3.2

This octet(s) shall contain a Small Picture.

9.2.3.24.10.1.9 Variable Picture

The Information-Element-Data octet(s) shall be coded as follows.

Octet 1 position indicating in the SM data the instant the picture shall be displayed in the SM data (refer section 9.2.3.24.10.1.7)

Octet 2 Horizontal dimension of the picture.

This octet shall contain the horizontal number of 8 pixels i.e. this value shall be multiplied by 8 to get the whole number of horizontal pixels.

Octet 3 Vertical dimension of the picture.

This octet shall contain the vertical number of pixels.

Octet 4-n Protocol Data Unit as described in section 9.2.3.24.10.3.2

This octet(s) shall contain a Variable Picture line by line from top left to bottom right.

The values of the horizontal and vertical dimensions must be chosen properly by the sending entity. If the calculated size of this IE exceeds the limits of a single SM or segment it shall be discarded by the receiving entity.

9.2.3.24.10.2 Examples of EMS coding

All IE values in the TP-UD are hexadecimal values.

9.2.3.24.10.2.1 Example of Basic text formatting and predefined EMS coding

An example of the basic concept of coding is given as follows:

TP-UDHI=1

SMS User Data Header: UDHL=05, IEI=0A, IEDL=03, IED_1=0F, IED_2=12, IED_3=10

SMS User Data: This is a text with bold option on following with normal text.

Should be displayed as:

This is a text **with bold option on** following with normal text.

It is also possible to add predefined sounds in the message.

Example:

TP-UDHI=1

SMS User Data Header: UDHL=08, IEI=0B, IEDL=02, IED$_1$=09,<sound5>, IEI=0B, IEDL=2, IED$_1$=1C, <sound7>

SMS User Data: This is a message with two different sounds

The sound nr5 shall be played after the 9^{th} received character (“a”) and sound nr7 shall be played after the 28^{th} received character (“e”).

9.2.3.24.10.2.2 Example of User defined Objects EMS coding

Example of a message including one small picture is coded as follows:

TP UDHI=1

SMS User Data Header: UDHL=24, IEI=11, IEIDL=22, IED$_1$=08, <  (small picture 32bytes)>

SMS User Data: Hello!<CR><LF><CR><LF>One small picture in here

Should be displayed as :

Hello!

One small picture in here

If the message starts with <CR>, then the “unreadable” data in an old terminal will be overwritten by the text, and the user will not see any strange characters. It is possible to insert the same picture several times in the same message. In that case, the TP-UD header shall contain as many IE as the number of occurrences contained in the SM or one segment of a concatenated message. Using defined elements will normally imply that more than one SM is required and therefore concatenation is required.

9.2.3.24.10.2.3 Concatenation of SMS messages

Concatenated messages are required in most cases required when using several types of EMS elements, since it is only possible to send one large picture/large animation/melody in one single SM. After including either of these elements, there are only 4 (or 9 if no concatenation is used) characters left to the text part, and this is usually too little.

If one or more objects are embedded in one segment of a concatenated message, the IE octet indicating its/their position within the SM data cannot be set to a value that would refer to a position in the next segment(s) so that received segments should be processed before all of them have been received. It means that a formatting text that could not be conveyed in one segment shall be split in as many segments as necessary . In that case, the IE relating to the formatting shall be repeated in all the segments in which it will apply.

Example of a message including 2 Large Pictures, 4 Small animations and 2 User defined Melodies together with some text.

The EMS message: <Large Picture1> <User Defined Melody 1> Hello All, This is a real Enhanced Message <Small Animation 1>. I can send <Small Animation 2> and receive <Small Animation 3> really advanced EMS messages <Animation 4> Isn’t it impressive? /Lars <User Defined Melody2> <Large Picture 2>

This EMS message has to use concatenated messages and the SM will ty~~i~~pically contain the following data:

SM	User Data Header	User Data
1	IEI=10 (Large Picture) IED$_1$=00 (beginning of the SM) <Large Picture 1 (128 bytes)>	[<CR><LF>]
2	IEI=0C (User Defined Sound) IED$_1$=00 (beginning of the SM) <User Melody 1 (129bytes max)>	Hello
3	IEI=0F (Small Animation) IED$_1$=24 (36th position) <Small Animation 1 (32 bytes)> IEI=0F (Small Animation) IED$_1$=2F (47th position) <Small Animation 2 (32 bytes)>	All, This is a real Enhanced Message.I can send and
4	IEI=0F (Small Animation) IED$_1$=07 (7th position) <Small Animation 3 (32 bytes)> IEI=0F (Small Animation) IED$_1$=25 (37th position) <Small Animation 4 (32 bytes)>	receive really advanced EMS messages. Isn't it impressive? /Lars.
5	IEI=0C (User Defined Sound) IED$_1$=00 (beginning of the SM) <User Melody 1 (128 bytes max)>	[<CR><LF>]
6	IEI=10 (Large Picture) IED$_1$=00 (beginning of the SM) <Large Picture 2 (128 bytes)>	

9.2.3.24.10.3 EMS Formats

9.2.3.24.10.3.1 Sounds

Predefined Sounds

There are a number of fixed predefined sounds. Each sound nr corresponds to a specific sound according to the table below. The presentations of these sounds are manufacturer specific.

Sound nr	**Description**
0	Chimes high
1	Chimes low
2	Ding
3	TaDa
4	Notify
5	Drum
6	Claps

7	FanFar
8	Chord high
9	Chord low

User defined sounds

The user defined sounds are coded according to the iMelody format[33]. The maximum length of a sound is 128 bytes.

9.2.3.24.10.3.2 Pictures

Pictures are coded from upper left to lower right and in each byte the most significant bit represent the pixel at the left. The pictures are plain black and white, no colours or grey scales are supported. The bitvalue “0” represents a white pixel and the bitvalue “1” represents a black pixel.

Example 16*16 picture

Byte 1	Byte 2
Byte 3	Byte 4
…	…
…	…
Byte 31	Byte 32

9.2.3.24.10.3.3 Animation

Predefined

There are a number of predefined animations. Each animation nr corresponds to a specific animation according to the table below. The way of displaying the animation is manufacturer specific.

Animation nr	**Description**
0	I am ironic, flirty
1	I am glad
2	I am sceptic
3	I am sad
4	WOW!
5	I am crying

User Defined

Animations are coded as 4 sequential pictures, with the first picture sent first.

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Puerto Vallarta, Mexico, 1-4 Feb 2000

Document ***T2-000136***
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

23.040 CR 010 Current Version: 3.3.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	T#7	for approval	X	strategic		*(for SMG*
list expected approval meeting # here ↑		for information		non-strategic		*use only)*

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: (U)SIM [ ] ME [X] UTRAN / Radio [ ] Core Network [ ]
(at least one should be marked with an X)

Source: T2 **Date:** 02.02.2000

Subject: Multiple Information Elements

Work item: SMS ENHANCEMENTS AND IMPROVEMENTS

Category:				**Release:**	
	F Correction			Phase 2	
	A Corresponds to a correction in an earlier release			Release 96	
(only one category	B Addition of feature	X		Release 97	
shall be marked	C Functional modification of feature			Release 98	
with an X)	D Editorial modification			Release 99	X
				Release 00	

Reason for change: The existing specification does not permit multiple instances of any Information Element type to be used within a User-Data-Header. SMS enhancements that benefit from the possibility of multiple use of new Information Elements are now being introduced, and consequently this overall restriction should be relaxed.

Clauses affected: 9.2.3.24

Other specs affected:			
	Other 3G core specifications		→ List of CRs:
	Other GSM core specifications		→ List of CRs:
	MS test specifications		→ List of CRs:
	BSS test specifications		→ List of CRs:
	O&M specifications		→ List of CRs:

Other comments: The handling of Information Elements defined in the existing specification is unchanged by this CR. Therefore the CR is proposed as Category B.

Note: Although change bars appear at the diagrams in this CR the diagrams are unchanged.

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<--------- double-click here for help and instructions on how to create a CR.

9.2.3.24 TP-User Data (TP-UD)

The length of the TP-User-Data field is defined in the PDU's of the SM-TL (see subclause 9.2.2).
The TP-User-Data field may comprise just the short message itself or a Header in addition to the short message depending upon the setting of TP-UDHI.
Where the TP-UDHI value is set to 0 the TP-User-Data field comprises the short message only, where the user data can be 7 bit (default alphabet) data, 8 bit data, or 16 bit (UCS2) data.
Where the TP-UDHI value is set to 1 the first octets of the TP-User-Data field contains a Header in the following order starting at the first octet of the TP-User-Data field.
Irrespective of whether any part of the User Data Header is ignored or discarded, the MS shall always store the entire TPDU exactly as received.

FIELD	LENGTH
Length of User Data Header	1 octet
Information-Element-Identifier "A"	1 octet
Length of Information-Element "A"	1 octet
Information-Element "A" Data	1 to "n" octets
Information-Element-Identifier "B"	1 octet
Length of Information-Element "B"	1 octet
Information-Element "B" Data	1 to "n" octets
Information-Element-Identifier "n"	1 octet
Length of Information-Element "n"	1 octet
Information-Element "n" Data	1 to "n" octets

The diagram below shows the layout of the TP-User-Data-Length and the TP-User-Data for uncompressed GSM 7 bit default alphabet data. The UDHL field is the first octet of the TP-User-Data content of the Short Message.

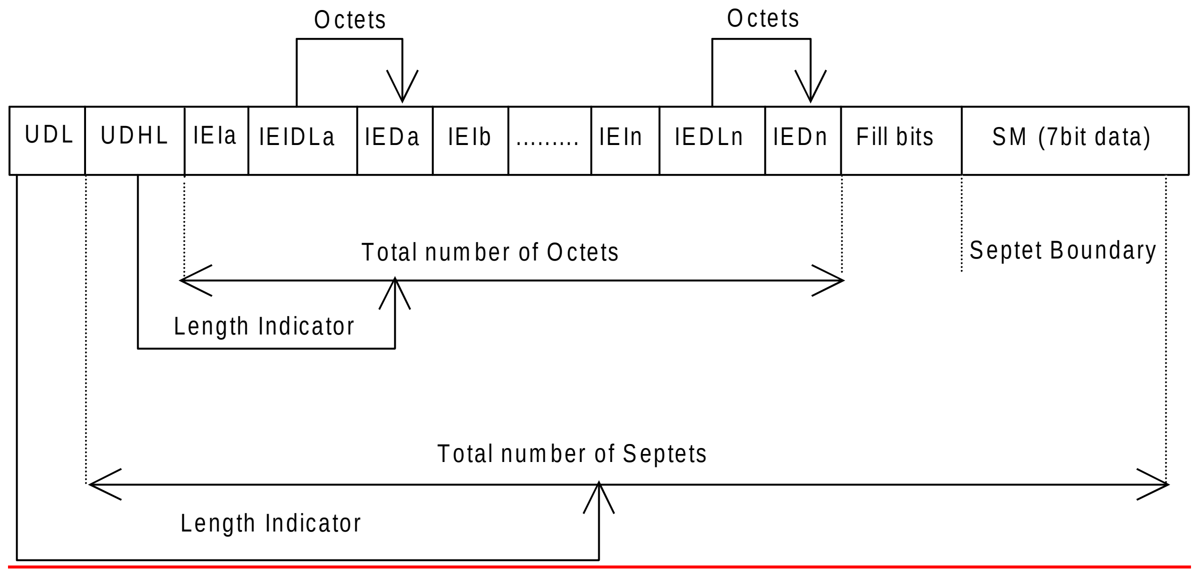

Figure 9.2.3.24 (a)

The diagram below shows the layout of the TP-User-Data-Length and the TP-User-Data for uncompressed 8 bit data or uncompressed UCS2 data. The UDHL field is the first octet of the TP-User-Data content of the Short Message.

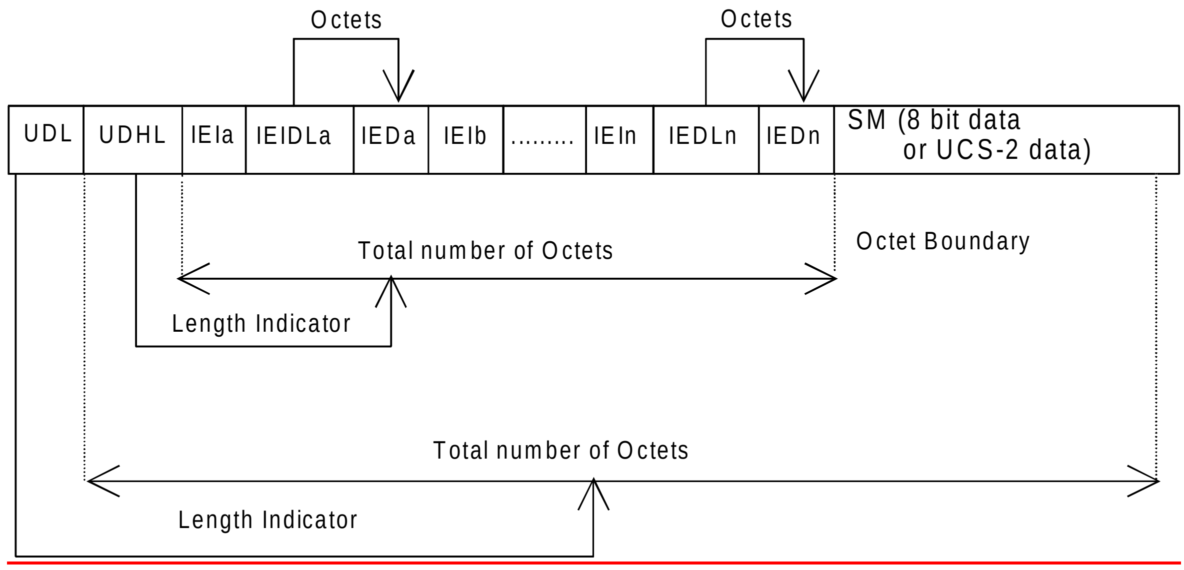

Figure 9.2.3.24 (b)

The diagram below shows the layout of the TP-User-Data-Length and the TP-User-Data for compressed GSM 7 bit default alphabet data, compressed 8 bit data or compressed UCS2 data. The UDHL field is the first octet of the TP-User-Data content of the Short Message.

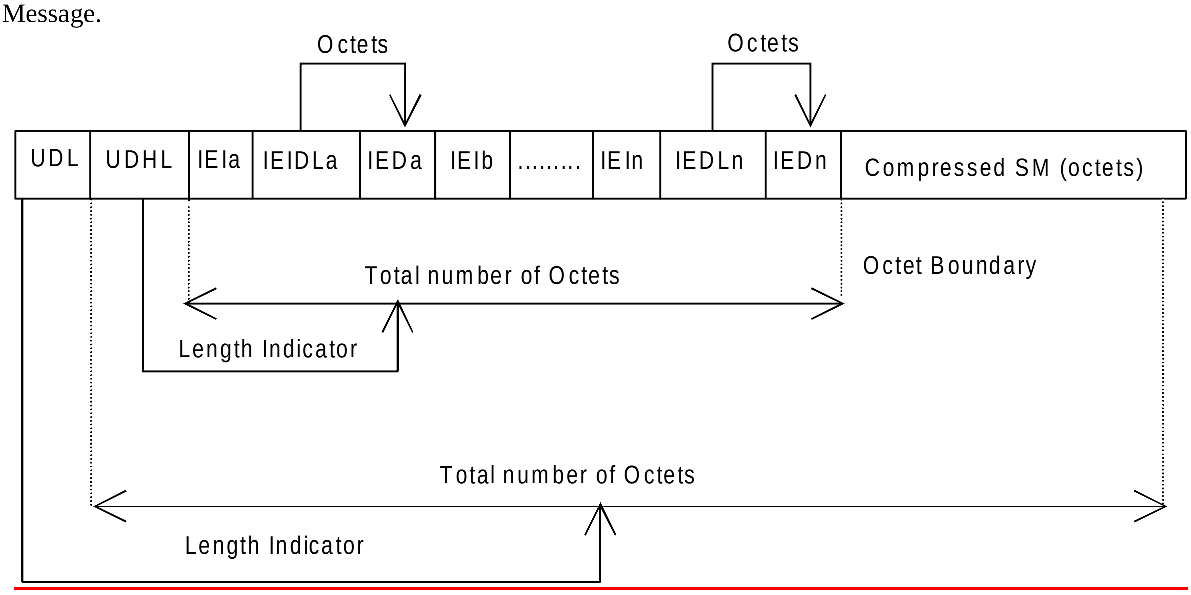

Figure 9.2.3.24 (c)

The definition of the TP-User-Data-Length field which immediately precedes the "Length of User Data Header" is unchanged and will therefore be the total length of the TP-User-Data field including the Header, if present. (see 9.2.3.16)
The "Length-of-Information-Element" fields shall be the integer representation of the number of octets within its associated "Information-Element-Data" field which follows and shall not include itself in its count value.
The "Length-of-User-Data-Header" field shall be the integer representation of the number of octets within the "User-Data-Header" information fields which follow and shall not include itself in its count or any fill bits which may be present (see text below).

Information Elements may appear in any order and need not necessarily follow the order used in this specification.

In the case where there are no multiple instances of any Information Element type: If Information Elements are duplicated (either with the same or different content), within one single SM or within one segment of a concatenated message then the contents of the last occurrence of the Information Element shall be used.

In the case where there are multiple instances of any Information Element type: If certain types of Information Elements are duplicated (either with the same or different content) within one single SM or within one segment of a concatenated message and there is a contradiction in meaning (e.g. more than one Special Message Indication for voice) or there is a contradiction of Information Element types (e.g. an 8bit port address and a 16bit port address), then the contents of the last occurrence of the Information Element shall be used. Other types of Information Elements may occur more than once when there is additional information of the same type to be conveyed. The individual specifications for each Information Element will state if multiple use is permitted and in such a case will also indicate the maximum number of occurrences within one User Data Header.

If the length of the User Data Header overall is such that there appear to be too few or too many octets in the final Information Element then the whole User Data Header shall be ignored.
If any reserved values are received within the content of any Information Element then that part of the Information Element shall be ignored.

The Information Element Identifier octet shall be coded as follows:

VALUE (hex)	MEANING
00	Concatenated short messages, 8-bit reference number
01	Special SMS Message Indication
02	Reserved
03	Value not used to avoid misinterpretation as <LF> character
04	Application port addressing scheme, 8 bit address
05	Application port addressing scheme, 16 bit address
06	SMSC Control Parameters
07	UDH Source Indicator
08	Concatenated short message, 16-bit reference number
09	Wireless Control Message Protocol
0A-6F	Reserved for future use
70-7F	SIM Toolkit Security Headers
80 - 9F	SME to SME specific use
A0 - BF	Reserved for future use
C0 - DF	SC specific use
E0 - FF	Reserved for future use

A receiving entity shall ignore (i.e. skip over and commence processing at the next information element) any information element where the IEI is Reserved or not supported. The receiving entity calculates the start of the next information element by looking at the length of the current information element and skipping that number of octets.

The SM itself may be coded as 7, 8 or 16 bit data.

If 7 bit data is used and the TP-UD-Header does not finish on a septet boundary then fill bits are inserted after the last Information Element Data octet up to the next septet boundary so that there is an integral number of septets for the entire TP-UD header. This is to ensure that the SM itself starts on an septet boundary so that an earlier Phase mobile will be capable of displaying the SM itself although the TP-UD Header in the TP-UD field may not be understood.

It is optional to make the first character of the SM itself a Carriage Return character encoded according to the default 7 bit alphabet so that earlier Phase mobiles, which do not understand the TP-UD-Header, will over-write the displayed TP-UD-Header with the SM itself.

If 16 bit (USC2) data is used then padding octets are not necessary. The SM itself will start on an octet boundary.

If 8 bit data is used then padding is not necessary. An earlier Phase mobile will be able to display the SM itself although the TP-UD header may not be understood.

It is also possible for mobiles not wishing to support the TP-UD header to check the value of the TP-UDHI bit in the SMS-Deliver PDU and the first octet of the TP-UD field and skip to the start of the SM and ignore the TP-UD header.

3GPP/SMG Meeting T2 #8 / ETSI SMG4
Puerto Vallarta, Mexico, 1 - 4 Feb 2000

Document T2(00)0129
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

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23.040 CR 011 Current Version: 3.3.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSG-T#7 — for approval: X; for information: (blank)
list expected approval meeting # here ↑

Strategic: (blank); non-strategic: (blank) *(for SMG use only)*

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: (U)SIM: (blank); ME: X; UTRAN / Radio: (blank); Core Network: (blank)
(at least one should be marked with an X)

Source: T2 **Date:** 30.1.2000

Subject: SMS E-MAIL PARAMETERS

Work item: SMS ENHANCEMENTS AND IMPROVEMENTS

Category:
(only one category shall be marked with an X)

F	Correction	
A	Corresponds to a correction in an earlier release	
B	Addition of feature	X
C	Functional modification of feature	
D	Editorial modification	

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change:

The existing 23.040 defines how certain e-mail parameters, such as an e-mail address and an e-mail subject, may be conveyed within the user-data of a short message. However, this mechanism is really only suitable for mobiles with simple text messaging facilities where the input/output is directly controlled by the human user.
In the case of more advanced mobile equipment which supports concatenated short messages and has a higher layer application process for e-mail, it is very desirable to support the full RFC 822 e-mail header parameters within User-Data-Header mechanism. The improved structure should guarantee unambiguous processing as well as smooth and simple interworking between the internet and the mobile environment.

Clauses affected: 2. / 3.8 / 9.2.3.24

Other specs affected:

Other 3G core specifications		→ List of CRs:
Other GSM core specifications		→ List of CRs:
MS test specifications		→ List of CRs:
BSS test specifications		→ List of CRs:
O&M specifications		→ List of CRs:

Other comments:

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<--------- double-click here for help and instructions on how to create a CR.

2 Normative 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.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] GSM 01.04: "Digital cellular telecommunication system (Phase 2+); Abbreviations and acronyms".

[2] GSM 02.03: "Digital cellular telecommunication system (Phase 2+); Teleservices supported by a GSM Public Land Mobile Network (PLMN)".

[3] 3G TS 22.004: "General on supplementary services".

[4] 3G TS 22.041: " Operator determined barring".

[5] GSM 03.02: "Digital cellular telecommunication system (Phase 2+); Network architecture".

[6] 3G TS 23.008: "Organization of subscriber data".

[7] 3G TS 23.011: "Technical realization of supplementary services - General Aspects".

[8] 3G TS 23.015: "Technical realisation of Operator Determined Barring (ODB)".

[9] 3G TS 23.038: "Alphabets and language-specific information".

[10] 3G TS 23.041: "Technical realization of Cell Broadcast Service (CBS)".

[11] GSM 03.47 (ETR 354): "Digital cellular telecommunication system; Example protocol stacks for interconnecting Service Centre(s) (SC) and Mobile-services Switching Centre(s) (MSC)".

[12] GSM 04.08: "Digital cellular telecommunication system (Phase 2+); Mobile radio interface layer 3 specification".

[13] 3G TS 24.011: "Short Message Service (SMS) support on mobile radio interface".

[14] 3G TS 27.005: "Use of Data Terminal Equipment - Data Circuit terminating Equipment (DTE - DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)".

[15] 3G TS 29.002: "Mobile Application Part (MAP) specification".

[16] GSM 11.11: "Digital cellular telecommunication system (Phase 2+); Specification of the Subscriber Identity Module - Mobile Equipment (SIM- ME) interface".

[17] CCITT Recommendation E.164 (Blue Book): "Numbering plan for the ISDN era".

[18] CCITT Recommendation E.163 (Blue Book): "Numbering plan for the international telephone service".

[19] CCITT Recommendation Q.771: "Specifications of Signalling System No.7; Functional description of transaction capabilities".

[20] CCITT Recommendation T.100 (Blue Book): "International information exchange for interactive videotex".

[21] CCITT Recommendation T.101 (Blue Book): "International interworking for videotex services".

[22] CCITT Recommendation X.121 (Blue Book): "International numbering plan for public data networks".

[23] CCITT Recommendation X.400 (Blue Book): "Message handling system and service overview".

[24] ISO/IEC10646, "Universal Multiple-Octet Coded Character Set (USC); UCS2, 16 bit coding".

[25] 3G TS 22.022: "Personalisation of GSM ME Mobile functionality specification - Stage 1".

[26] 3G TS 23.042: "Compression Algorithm for Text Messaging Services”

[27] 3G TS 23.060: "General Packet Radio Service (GPRS); Service description; Stage 2".

[28] GSM 03.48: "Digital cellular telecommunications system (Phase 2+); Security Mechanisms for the SIM application toolkit; Stage 2"

[29] 3G TR 21.905: "3G Vocabulary".

[30] 3G TS 31.102: "Characteristics of the USIM application"

[31] 3G TS 31.101: "UICC – Terminal interface; Physical and logical characteristics"

[32] 3G TS 22.105: "Services and Service Capabilites"

[33] IETF RFC 822: "Standard for the format of ARPA Internet text messages"

3.8 SMS and Internet Electronic Mail interworking

The interworking between Internet electronic mail and SMS is offered in both directions which enables new and old mobiles to send/receive Internet electronic mails via SMS. The interworking is according to the following procedures:

- An SMS message which is required to interwork with Internet email may have its TP-PID value set for Internet electronic mail;

NOTE: There is an alternative mechanism described in 9.2.3.24 providing full RFC 822[33] internet electronic mail interworking.

- Either single or concatenated SMS can be used to transport the email;
- Concatenation may be achieved by the TPUDH mechanism or text-based means described below;
- Email cc fields are not supported;
- Where multiple fields are present, additional spaces may be inserted by the sender to improve presentation of the message. Spaces may not be inserted into the actual email address (e.g. user@domain1.domain2).

9.2.3.24 TP-User Data (TP-UD)

The length of the TP-User-Data field is defined in the PDU's of the SM-TL (see subclause 9.2.2).
The TP-User-Data field may comprise just the short message itself or a Header in addition to the short message depending upon the setting of TP-UDHI.
Where the TP-UDHI value is set to 0 the TP-User-Data field comprises the short message only, where the user data can be 7 bit (default alphabet) data, 8 bit data, or 16 bit (UCS2 [24]) data.
Where the TP-UDHI value is set to 1 the first octets of the TP-User-Data field contains a Header in the following order starting at the first octet of the TP-User-Data field.
Irrespective of whether any part of the User Data Header is ignored or discarded, the MS shall always store the entire TPDU exactly as received.

FIELD	LENGTH
Length of User Data Header	1 octet
Information-Element-Identifier "A"	1 octet
Length of Information-Element "A"	1 octet
Information-Element "A" Data	1 to "n" octets
Information-Element-Identifier "B"	1 octet
Length of Information-Element "B"	1 octet
Information-Element "B" Data	1 to "n" octets

Information-Element-Identifier "n"	1 octet
Length of Information-Element "n"	1 octet
Information-Element "n" Data	1 to "n" octets

The diagram below shows the layout of the TP-User-Data-Length and the TP-User-Data for uncompressed GSM 7 bit default alphabet data. The UDHL field is the first octet of the TP-User-Data content of the Short Message.

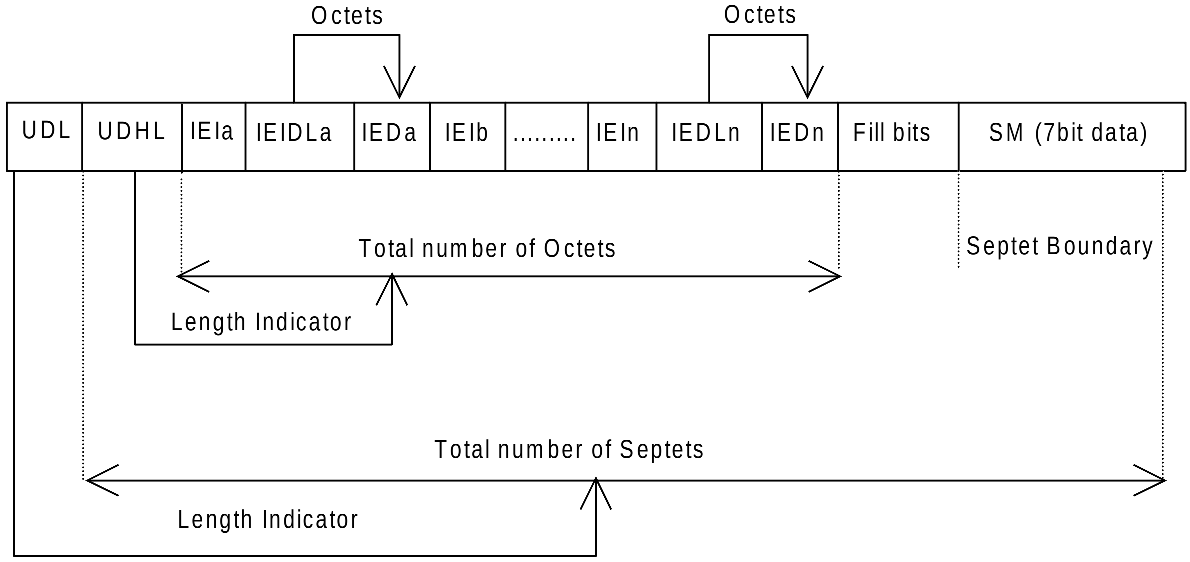

Figure 9.2.3.24 (a)

The diagram below shows the layout of the TP-User-Data-Length and the TP-User-Data for uncompressed 8 bit data or uncompressed UCS2 data. The UDHL field is the first octet of the TP-User-Data content of the Short Message.

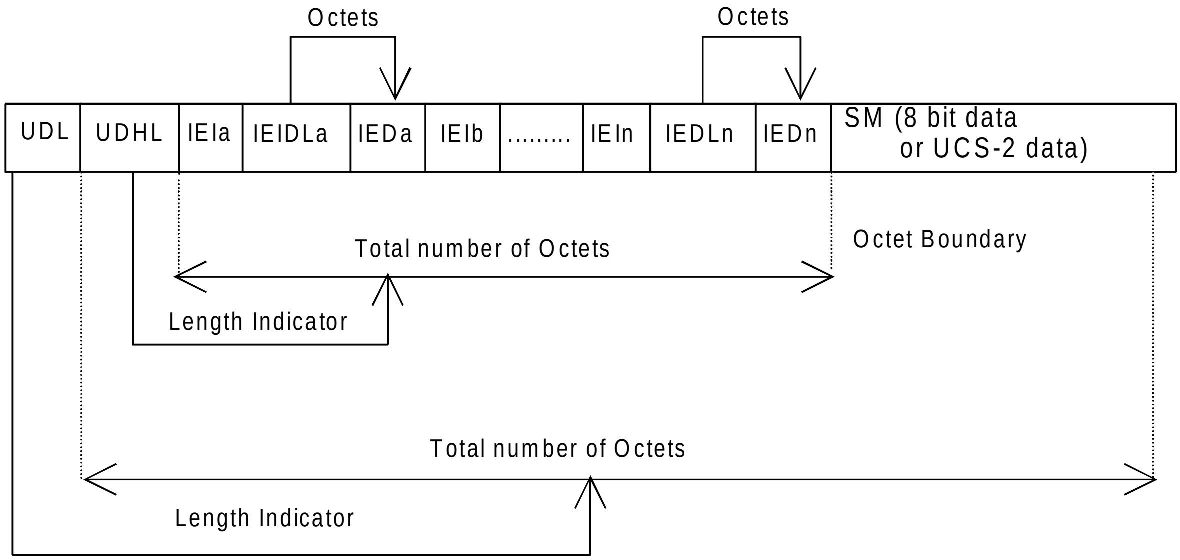

Figure 9.2.3.24 (b)

The diagram below shows the layout of the TP-User-Data-Length and the TP-User-Data for compressed GSM 7 bit default alphabet data, compressed 8 bit data or compressed UCS2 data. The UDHL field is the first octet of the TP-User-Data content of the Short Message.

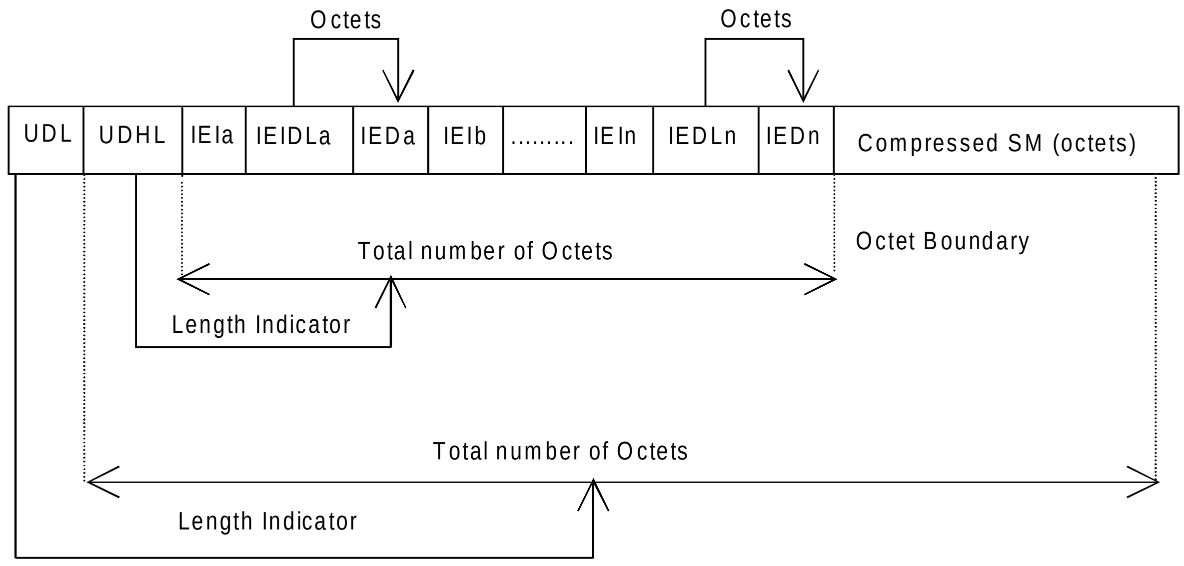

Figure 9.2.3.24 (c)

The definition of the TP-User-Data-Length field which immediately precedes the "Length of User Data Header" is unchanged and shall therefore be the total length of the TP-User-Data field including the Header, if present. (see 9.2.3.16)

The "Length-of-Information-Element" fields shall be the integer representation of the number of octets within its associated "Information-Element-Data" field which follows and shall not include itself in its count value.

The "Length-of-User-Data-Header" field shall be the integer representation of the number of octets within the "User-Data-Header" information fields which follow and shall not include itself in its count or any fill bits which may be present (see text below).

Information Elements may appear in any order and need not necessarily follow the order used in this specification. If Information Elements are duplicated (either with the same or different content) then the contents of the last occurrence of the Information Element shall be used. If the length of the User Data Header overall is such that there appear to be too few or too many octets in the final Information Element then the whole User Data Header shall be ignored.

If any reserved values are received within the content of any Information Element then that part of the Information Element shall be ignored.

The Information Element Identifier octet shall be coded as follows:

VALUE (hex)	MEANING
00	Concatenated short messages, 8-bit reference number
01	Special SMS Message Indication
02	Reserved
03	Value not used to avoid misinterpretation as <LF> character
04	Application port addressing scheme, 8 bit address
05	Application port addressing scheme, 16 bit address
06	SMSC Control Parameters
07	UDH Source Indicator
08	Concatenated short message, 16-bit reference number
09	Wireless Control Message Protocol
0A-1F~~6F~~	Reserved for future use
20	RFC 822 E-Mail Header
21-6F	Reserved for future use
70-7F	(U)SIM Toolkit Security Headers
80 ~~–~~- 9F	SME to SME specific use
A0 ~~–~~- BF	Reserved for future use
C0 ~~–~~- DF	SC specific use
E0 ~~–~~- FF	Reserved for future use

A receiving entity shall ignore (i.e. skip over and commence processing at the next information element) any information element where the IEI is Reserved or not supported. The receiving entity calculates the start of the next information element by looking at the length of the current information element and skipping that number of octets.
The SM itself may be coded as 7, 8 or 16 bit data.
If 7 bit data is used and the TP-UD-Header does not finish on a septet boundary then fill bits are inserted after the last Information Element Data octet up to the next septet boundary so that there is an integral number of septets for the entire TP-UD header. This is to ensure that the SM itself starts on an septet boundary so that an earlier Phase mobile shall be capable of displaying the SM itself although the TP-UD Header in the TP-UD field may not be understood.
It is optional to make the first character of the SM itself a Carriage Return character encoded according to the default 7 bit alphabet so that earlier Phase mobiles, which do not understand the TP-UD-Header, shall over-write the displayed TP-UD-Header with the SM itself.
If 16 bit (USC2) data is used then padding octets are not necessary. The SM itself shall start on an octet boundary.
If 8 bit data is used then padding is not necessary. An earlier Phase mobile shall be able to display the SM itself although the TP-UD header may not be understood.
It is also possible for mobiles not wishing to support the TP-UD header to check the value of the TP-UDHI bit in the SMS-Deliver PDU and the first octet of the TP-UD field and skip to the start of the SM and ignore the TP-UD header.

9.2.3.24.10 RFC 822 E-Mail Header

This information element ~~could be~~ is used to indicate the existence of an RFC 822 Internet electronic mail in the data part of the short message. Both, E-Mail Header and (optional) E-Mail Body shall be parts of the SM's data and shall be compliant with the syntax specified in RFC 822 [33]. The character set used for encoding of E-Mail Header and E-Mail body, however, shall be according to 3G TS 23.038 [9]. Encoding of E-Mail Header and E-Mail Body shall be done using the same character set.

In compliance with RFC 822 [33] the E-Mail Header shall always be located at the very beginning of the SM's data part. It shall always be present in the "unfolded" format as it is specified in RFC 822 [33]. Not the <CRLF> character defined in RFC 822 [33] but the <LF> character according to 3G TS 23.038 [9] shall be used for the separation of different E-Mail Header fields.

If an RFC 822 E-Mail Body exists, it shall immediately follow the E-Mail Header in the SM's data part.

NOTE: The null line defined in RFC 822 for the separation of E-Mail Header and E-Mail Body may be discarded.

NOTE: The sending of extended SMTP headers is allowed and the MS should not reject the message if there are header fields in the email header part that are not specified in RFC.822.

In case of an RFC 822 E-Mail Header exceeding the data part of a single SM, concatenation shall be used. In this case the E-Mail Header starts in the first segment of a concatenated SM and continues in one or several subsequent segments. The RFC 822 E-Mail Body shall immediately follow the final fraction of the RFC 822 E-Mail Header and may also be spread over several segments of the concatenated SM.

In case where this IEI is to be used in a concatenated SM then the IEI, its associated IEDL, and IED fields shall be contained in the first segment of the concatenated SM and shall also be contained in every subsequent segment of the concatenated SM.

The Information-Element-Data octet shall be coded as follows:

Octet 1 RFC 822 E-Mail Header length indicator

This octet shall indicate the length of the RFC 822 E-Mail Header that is located at the beginning of the data part of the SM. In case of an E-Mail Header exceeding the data part of a single SM, this octet shall indicate the length of that fraction of the RFC 822 E-Mail Header that is located at the beginning of the data part of the current segment of the concatenated SM.

If the user data is coded using the GSM 7 bit default alphabet, this IED octet shall give an integer representation of the number of septets within (that fraction of) the RFC 822 E-Mail Header that is located at the beginning of the data part of the current (segment of the concatenated) SM. See figure 9.2.3.24.10 (a).

If the user data is coded using 8-bit data, this IED octet shall give an integer representation of the number of octets within (that fraction of) the RFC 822 E-Mail Header that is located at the beginning of the data part of the current (segment of the concatenated) SM. See figure 9.2.3.24.10 (b).

If the user data is coded using UCS2 [24] data, this IED octet shall give an integer representation of the number of UCS2 characters (consisting of 2 octets) within (that fraction of) the RFC 822 E-Mail Header that is located at the beginning of the data part of the current (segment of the concatenated) SM. See figure 9.2.3.24.10 (c).

NOTE: If the user data is coded using compressed GSM 7 bit default alphabet or compressed 8 bit data or compressed UCS2 [24] data the RFC 822 E-Mail Header length indicator's value shall be based on the amount of uncompressed data, i.e. before compression is performed.

The diagram below shows the layout of the IED for GSM 7 bit default alphabet data.

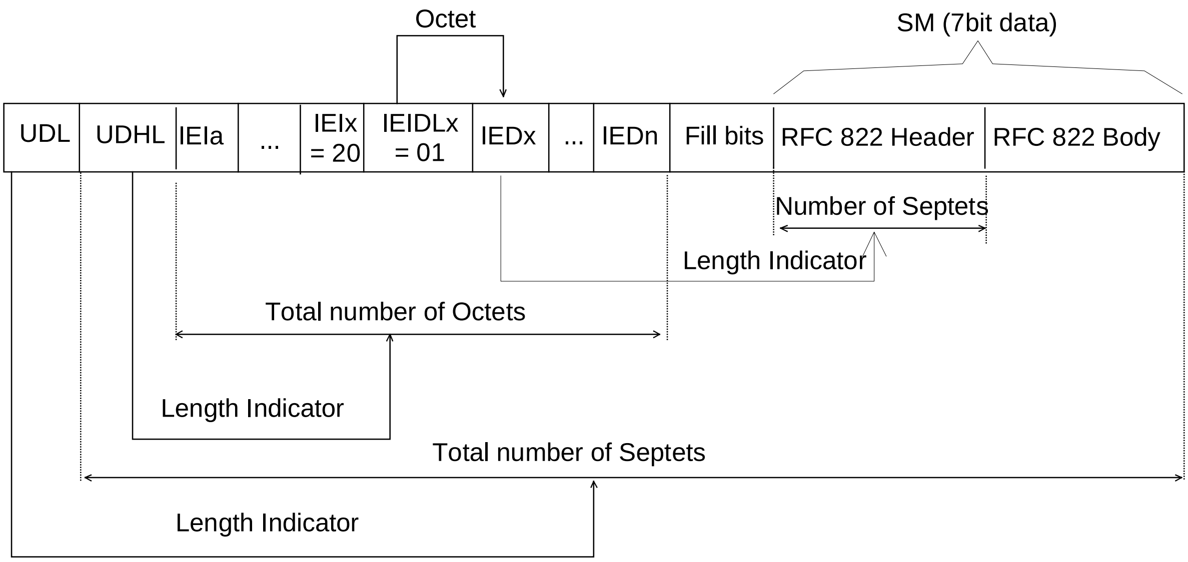

Figure 9.2.3.24.10 (a)

The diagram below shows the layout of the IED for 8 bit data.

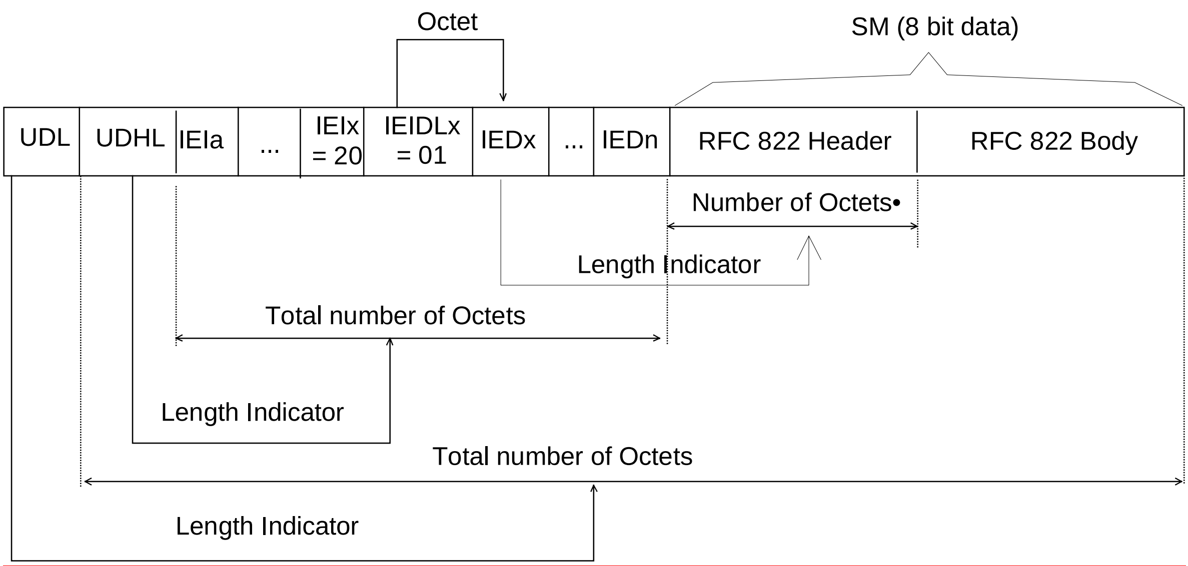

Figure 9.2.3.24.10 (b)

The diagram below shows the layout of the IED for UCS2 data.

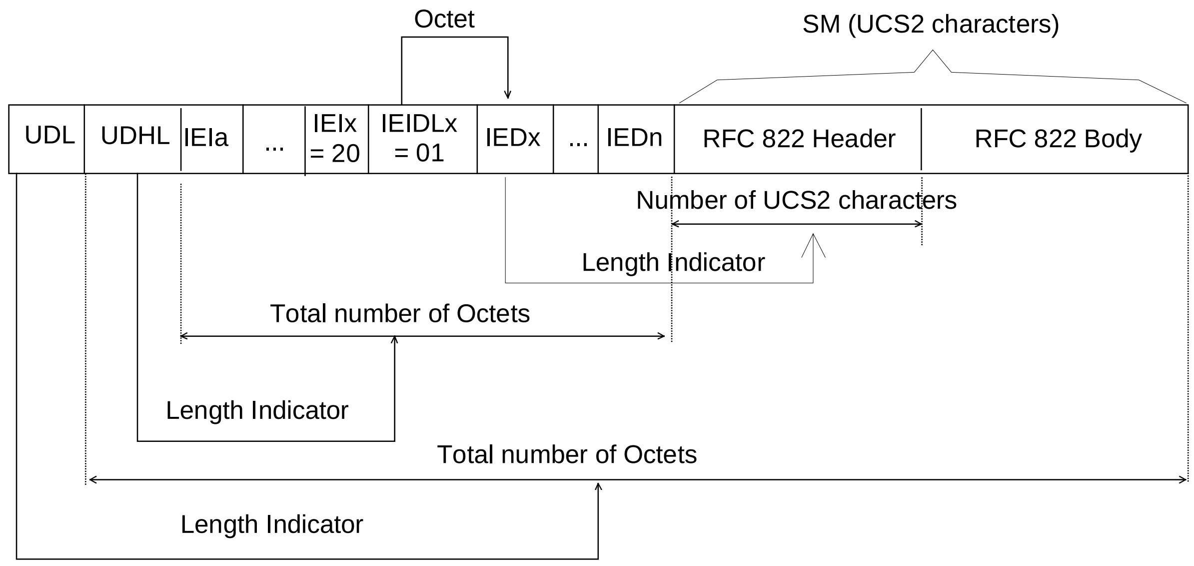

Figure 9.2.3.24.10 (c)

Document T2-000134

e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

23.041 CR 003 Current Version: 3.1.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSG-T#7
list expected approval meeting # here ↑

for approval	X	strategic		(for SMG use only)
For information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: (U)SIM [ ] ME [X] UTRAN / Radio [X] Core Network [ ]
(at least one should be marked with an X)

Source: T2 **Date:** 28 Jan 2000

Subject: Addition of LCS message identifier to support GPS Navigation message

Work item: Location Services (LCS)

Category:
(only one category shall be marked with an X)

Correction		**Release:**	Phase 2	
Corresponds to a correction in an earlier release	X		Release 96	
Addition of feature			Release 97	
Functional modification of feature			Release 98	
Editorial modification			Release 99	X
			Release 00	

Reason for change: Mirror R'99 CR to GSM 03.41. Assigns a value to LCS Message Identifier to support GPS Navigation Message Bits broadcast messaging.

Clauses affected: 4

Other specs affected:

her 3G core specifications		→ List of CRs:	
her GSM core specifications		→ List of CRs:	
test specifications		→ List of CRs:	
S test specifications		→ List of CRs:	
M specifications		→ List of CRs:	

Other comments:

9.4.1.2.2 Message Identifier

This parameter identifies the source and type of the CBS message. For example, "Automotive Association" (= source), " Traffic Reports" (= type) could correspond to one value. A number of CBS messages may originate from the same source and/or be of the same type. These will be distinguished by the Serial Number. The Message Identifier is coded in binary.

The ME shall attempt to receive the CBS messages whose Message Identifiers are in the "search list". This "search list" shall contain the Message Identifiers stored in the EF_{CBMI}, EF_{CBMID} and EF_{CBMIR} files on the SIM (see GSM 11.11) and any Message Identifiers stored in the ME in a "list of CBS messages to be received". If the ME has restricted capabilities with respect to the number of Message Identifiers it can search for, the Message Identifiers stored in the SIM shall take priority over any stored in the ME.

The use/application of the Message Identifier is shown in the following list, with octet 3 of the Message Identifier shown first, followed by octet 4. Thus "1234" (hex) represents octet 3 = 0001 0010 and octet 4 = 0011 0100.

0000 - 03E7 (hex): To be allocated by PLMN operator associations. If a Message Identifier from this range is in the "search list", the ME shall attempt to receive such CBS message.

This version of GSM 03.41 does not prohibit networks from using Message Identifiers in the range 0000 - 03E7 (hex) for Cell Broadcast Data Download to the SIM.

03E8 (hex): LCS CBS Message Identifier for E-OTD Assistance Data message

03E9 (hex): LCS CBS Message Identifier for GPS Assistance Data message

03EA (hex): LCS CBS Message Identifier for GPS Navigation Message Bits Data message

03EB~~A~~ - 0FFF (hex): Intended for standardization in future versions of GSM 03.41. These values shall not be transmitted by networks that are compliant to this version of GSM 03.41. If a Message Identifier from this range is in the "search list", the ME shall attempt to receive this CBS message.

1000 - 107F (hex): Networks shall only use Message Identifiers from this range for Cell Broadcast Data Download in "clear" (i.e. unsecured) to the SIM (see GSM 11.14). If a message Identifier from this range is in the "search list", the ME shall attempt to receive this CBS message.

1080 – 10FF (hex): Networks shall only use Message Identifiers from this range for Cell Broadcast Data Download secured according to GSM 03.48 [15] to the SIM (see GSM 11.14). If a message Identifier from this range is in the "search list", the ME shall attempt to receive this CBS message.

1100 - 9FFF (hex): intended for standardization in future versions of GSM 03.41. These values shall not be transmitted by networks that are compliant to this version of GSM 03.41. If a Message Identifier from this range is in the "search list", the ME shall attempt to receive this CBS message.

A000 - AFFF (hex): PLMN operator specific range. The type of information provided by PLMN operators using these Message Identifiers is not guaranteed to be the same across different PLMNs. If a Message Identifier from this range is in the "search list", the ME shall attempt to receive this CBS message.

B000 - FFFE (hex): intended as PLMN operator specific range in future versions of GSM 03.41. These values shall not be transmitted by networks that are compliant to this version of GSM 03.41. If a Message Identifier from this range is in the "search list", then the ME shall attempt to receive this CBS message.

FFFF (hex): Reserved, and should not be used for new services, as this value is used on the SIM to indicate that no Message Identifier is stored in those two octets of the SIM. If this Message Identifier is in the "search list", the ME shall attempt to receive this CBS message.

Generally, the MMI for entering these codes in the ME is left to the manufacturers' discretion. However, the 1000 lowest codes shall be capable of being specified via their decimal representation i.e.:

Octet 3	Octet 4		
0000 0000	0000 0000	(decimal '000')	
0000 0000	0000 0001	(decimal '001')	
0000 0000	0000 0010	(decimal '002')	
0000 0000	0000 0011	(decimal '003')	
	:	:	:
	:	:	:
0000 0011	1110 0111	(decimal '999')	

3GPP/SMG Meeting T2#8
Puerto Vallarta, MEXICO
1 - 4 Feb 2000

Document T2-000130
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

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3G TS 23.041	**CR**	**004**	Current Version:	3.1.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	T#7	for approval	X	Strategic		*(for SMG use only)*
list expected approval meeting # here ↑		for information		Non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: (U)SIM [ ] ME [X] UTRAN / Radio [X] Core Network [X]
(at least one should be marked with an X)

Source: T2 **Date:** 25.01.2000

Subject: Adaptation of the scope from "GSM only" to "GSM and UMTS" - Part II

Work item: Cell Broadcast Service CBS

Category: *(only one category shall be marked with an X)*

F	Correction	X	Phase 2	
A	Corresponds to a correction in an earlier release		Release 96	
B	Addition of feature		Release 97	
C	Functional modification of feature		Release 98	
D	Editorial modification		Release 99	X
			Release 00	

Release: Release 99

Reason for change: Cell Broadcast Service CBS is part of UMTS Release 99. The 3G TS 23.041 covers both the CBS in GSM and UMTS. Beyond some editorial changes this CR fills the gaps in the current version V.3.1.0 of 3G TS 23.041 concerning the technical realisation in UMTS.

Clauses affected:

Other specs affected:

Other 3G core specifications		→ List of CRs:
Other GSM core specifications		→ List of CRs:
MS test specifications		→ List of CRs:
BSS test specifications		→ List of CRs:
O&M specifications		→ List of CRs:

Other comments:

1 Scope

This Technical Specification describes the Cell Broadcast short message service (CBS) for GSM and UMTS.

For GSM it defines the primitives over the Cell Broadcast Centre - Base Station System (CBC-BSS) interface and the message formats over the Base Station System - Mobile Station (BSS-MS) interface for Teleservice 23 as specified in 3G TS 22.003 [2].

For UMTS it defines the interface requirements for the Cell Broadcast Center – UMTS Radio Network System (RNS) interface and the radio interface requirements for UMTS Radio Acces Networks to support CBS as specified in 3GPP 22.003 [2].

1.1 Normative 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.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] GSM 01.04: "Digital cellular telecommunication system (Phase 2+); Abbreviations and acronyms".

[2] 3G TS 22.003: "Digital cellular telecommunication system (Phase 2+); Teleservices supported by a GSM Public Land Mobile Network (PLMN)".

[3] 3G TS 23.038: "Digital cellular telecommunication system (Phase 2+);"Alphabets and language-specific information".

[4] 3G TS23.040: "Digital cellular telecommunication system (Phase 2+); Technical realization of the Short Message Service (SMS) Point to Point (PP)".

[5] GSM 03.47: "Digital cellular telecommunication system (Phase 2+); Example protocol stacks for interconnecting Service Centre(s) (SC) and Mobile-services Switching Centre(s) (MSC)".

[6] GSM 03.49: "Digital cellular telecommunication system (Phase 2+); Example protocol stacks for interconnecting Cell Broadcast Centre (CBC) and Mobile-services Switching Centre (MSC)".

[7] GSM 04.12: "Digital cellular telecommunication system (Phase 2+); Short Message Service Cell Broadcast (SMSCB) support on the mobile radio interface".

[8] GSM 05.02: "Digital cellular telecommunication system (Phase 2+); Multiplexing and multiple access on the radio path".

[9] 3G TS 27.005: "Digital cellular telecommunication system (Phase 2+); Use of Data Terminal Equipment - Data Circuit terminating Equipment (DTE - DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)".

[10] GSM 08.52: "Digital cellular telecommunication system (Phase 2+); Base Station Controller - Base Transceiver Station (BSC - BTS) interface Interface principles".

[11] GSM 08.58: "Digital cellular telecommunication system (Phase 2+); Base Station Controller - Base Transceiver Station (BSC - BTS) interface Layer 3 specification".

[12] CCITT Recommendation X.210: "Open systems interconnection layer service definition conventions".

[13] GSM 08.08 MSC-BSS Interface Layer 3 specification

[14] 3G TS 23.042: " Compression algorithm for text messaging services".

[15] GSM 03.48: "Digital cellular telecommunications system (Phase 2+); Security Mechanisms for the SIM application toolkit; Stage 2"

[16] 3G TS 25.331: "RRC Protocol Specification"

[17] 3G TS 25.401: "UTRAN Overall Description"

[18] 3G TS 31.102: "Characteristics of the USIM Application"

[19] 3G TS 25.324: "Radio Interface for Broadcast/Multicast Services"

[20] 3G TR 21.905: "3G Vocabulary"

1.2 Abbreviations

Abbreviations used in this TS are listed in GSM 01.04 [1] and 3G TR 21.905 [20].

2 General description

The CBS service is analogous to the Teletex service offered on television, in that like Teletex, it permits a number of unacknowledged general CBS messages to be broadcast to all receivers within a particular region. CBS messages are broadcast to defined geographical areas known as cell broadcast areas. These areas may comprise of one or more cells, or may comprise the entire PLMN. Individual CBS messages will be assigned their own geographical coverage areas by mutual agreement between the information provider and the PLMN operator. CBS messages may originate from a number of Cell Broadcast Entities (CBEs), which are connected to the Cell Broadcast Centre. CBS messages are then sent from the CBC to the cells, in accordance with the CBS's coverage requirements.

A CBS page comprises of 82 octets, which, using the default character set, equates to 93 characters. Other Data Coding Schemes may also be used, as described in 3G TS 23.038 [3]. Up to 15 of these pages may be concatenated to form a CBS messagee. Each page of such CBS message will have the same message identifier (indicating the source of the message), and the same serial number. Using this information, the MS/UE is able to identify and ignore re-broadcasts of already received messages.

CBS messages are broadcast cyclically by the cell at a frequency and for a duration agreed with the information provider. The frequency at which CBS messages are repeatedly transmitted will be dependent on the information that they contain; for example, it is likely that dynamic information such as road traffic information, will require more frequent transmission than weather information. The repetition period will also be affected by the desire for CBS messages to be received by high speed mobiles which rapidly traverse cells. ~~All suitably equipped mobiles within the catchment area of the transmitting cell will be able to receive the CBS messages, provided that they are switched on and in the idle state.~~Reception of CBS messages for a MS/UE is not a requirement if it is connected in the CS domain. It should be possible for a UE to receive messages if it is connected in the PS domain and no data is currently transmitted.

CS-Domain	CS-Connected	CS-Idle	CS-Idle
PS-Domain	-	PS-Idle	PS-Connected
Reception of CBS Message	Not possible	Possible	Depends on RRC mode

Note: In case the UE is in CS-Idle and PS-Connected Mode it depends on the Radio Resource Control State whether reception of CBS messages is possible. The relevant states are described in 3GPP 25.331 [16].

~~The meaning of 'Idle State' differs in GSM and UMTS. The concrete mapping between the meaning of 'Idle State' from a users perspective and the meaning in radio resource management and mobility management in UMTS is for further study.~~

GSM only [CBS messages may be broadcast on two different cell broadcast channels, which are characterized by different QoS. A MS is always able to read the basic channel (see [8]). The reading of the extended channel may collide with other tasks of the MS. Therefore the probability of receiving a CBS message on the extended channel is smaller than on the basic channel. The reading of the extended channel for MSs is optional. The scheduling on the channels will be done independently.]

To permit mobiles to selectively display only those CBS messages required by the MS/UE user, CBS messages are assigned a message class which categorises the type of information that they contain and the language (Data Coding Scheme) in which the CBS message has been compiled. Through the use of appropriate MMI, the user is then able to ignore message types that he does not wish to receive, e.g. advertising information or messages in an unfamiliar language.

3 Network Architecture

The chosen network architectures differs for GSM and UMTS. In chapter 3.1 the GSM network architecture is descripted, in chapter 3.2 the UMTS network architecture.

3.1 GSM Network Architecture

The basic network structure of CBS is depicted by figure 1.

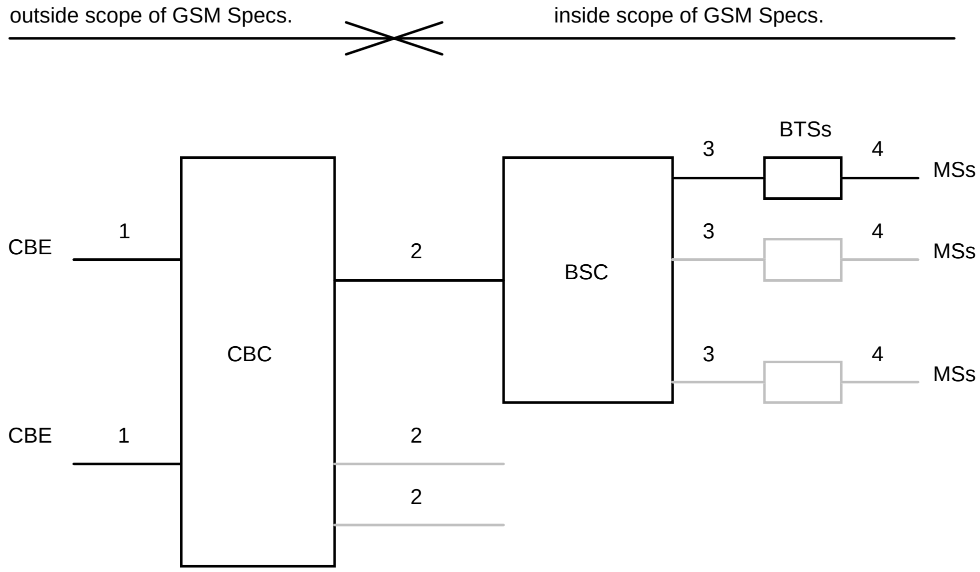


Figure 1

- message transfer on link 1 is outside the scope of GSM Specifications;
- message transfer on link 2 is described in subclause 9.1;
- message transfer on link 3 is described in GSM 08.58;
- message transfer on link 4 is described in GSM 04.12 and the timing of messages transferred on link 4 is described in GSM 05.02.

3.2 UMTS Network Architecture

The basic network structure of CBS is depicted by figure 2

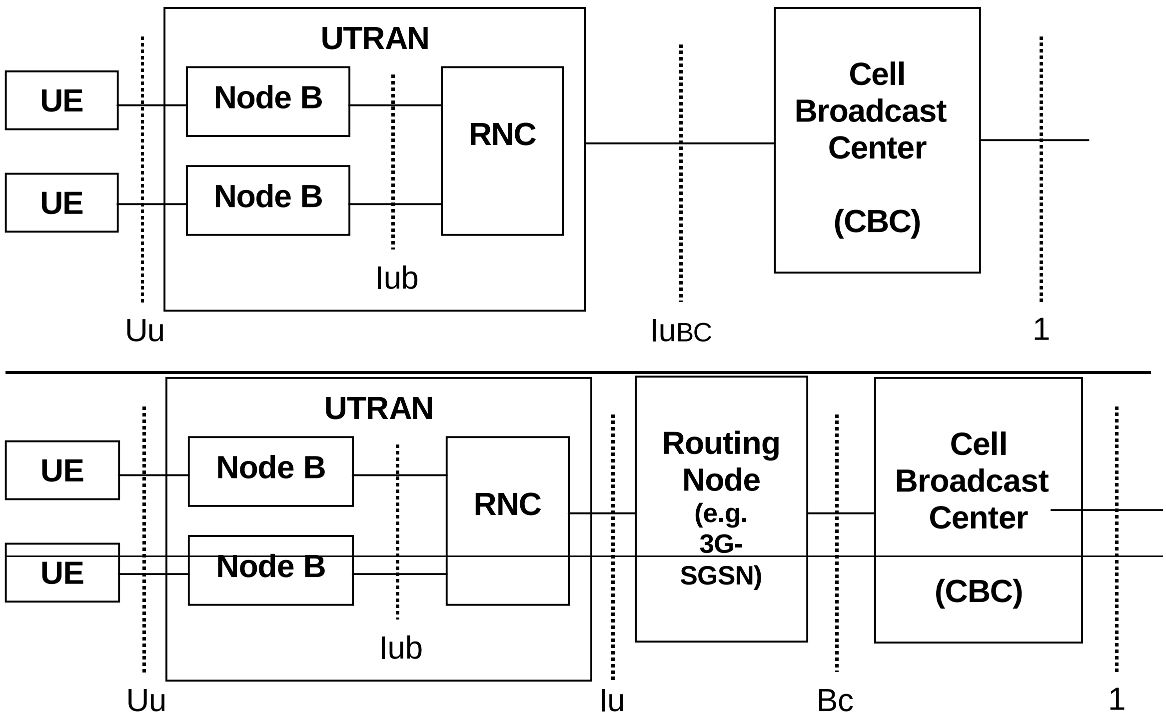


Figure 2

The basic network structure replaces the GSM BSS with the UTRAN containing the RNC and the Node B. The cell broadcast center (CBC) is part of the core network and connected to a routing node e.g. a 3G SGSN via the Bc reference point. Thus the CBC can reach every RNC via the user plane of the Iu interface. On the logical interface between the CBC and the RNC a mandatory protocol shall be defined. The other UTRAN related interfaces are described in the according UTRAN specifications based on the RAN 2 TR 25.925. Based on this architecture and the current requirements for cell broadcast the core network elements like MSC, VLR, HLR etc are not involved for the service delivery.

4 CBE Functionality

The functionality of the CBE is outside of the scope of GSM and UMTS Specifications; however it is assumed that the CBE is responsible for all aspects of formatting CBS, including the splitting of a CBS message into a number of pages.

5 CBC Functionality

GSM only [As in GSM the CBC (and any originating point for CBS messages) is regarded as a node outside the PLMN, only the requirements placed upon the CBC by CBS functionality are specified by this specification.]

In UMTS the CBC is regarded to be integrated as a node into the core network.

The CBC may be connected to several BSCs/RNCs. The CBC may be connected to several CBEs. The CBC shall be responsible for the management of ~~cell~~ CBS messages including:

- allocation of serial numbers;
- modifying or deleting CBS messages held by the BSC/RNC;
- initiating broadcast by sending fixed length CBS messages to a BSC/RNC for each language provided by the cell, and where necessary padding the pages to a length of 82 octets [see GSM 03.38];
- determining the set of cells to which a CBS message should be broadcast, and indicating within the Serial Number the geographical scope of each CBS message;

- determining the time at which a CBS message should commence being broadcast;
- determining the time at which a CBS message should cease being broadcast and subsequently instructing each BSC/RNC to cease broadcast of the CBS message;
- determining the period at which broadcast of the CBS message should be repeated;
- determining the cell broadcast channel, on which the CBS message should be broadcast.

To work efficiently on the interfaces, the BSC/RNC - which is normally controlling more than one cell of a broadcast area - should be used as a concentrator as far as CBS message handling is concerned. Hence, the CBC should work on lists of cells when issuing CB related requests towards the BSC/RNC.

6 BSC/RNC Functionality

The BSC/RNC shall interface to only one CBC. A BSC may interface to several BTSs as indicated by GSM 08.52. A RNC may interface to several Node Bs.

The BSC/RNC shall be responsible for:

BSC	RNC
interpretation of commands from the CBC;	
storage of CBS messages;	
scheduling of CBS messages on the CBCH;	Scheduling of CBS messages on the CBS related radio resources
providing an indication to the CBC when the desired repetition period cannot be achieved;	
Providing to the CBC acknowledgement of successful execution of commands received from the CBC;	
Reporting to the CBC failure when a command received from the CBC is not understood or cannot be executed;	
routing CBS messages to the appropriate BTSs;	Routing CBS messages
Transferring CBS information to each appropriate BTS via a sequence of 4 SMS BROADCAST REQUEST messages or 1 SMS BROADCAST COMMAND message (see GSM 08.58), indicating the channel which shall be used.	The Node B has no functionality regarding CBS. This implies that CBS messages do not have to be transmitted explicitely to the Node Bs for further processing.
optionally generating Schedule Messages, indicating the intended schedule of transmissions (see GSM 04.12);	Generating Schedule Messages, indicating the intended schedule of transmissions (see 3G TS 25.324). The conversion of GSM related CB DRX Information is a function of the RNC (3G TS 25.401 [17]).
optionally receiving CBCH Load Indication messages and reacting by broadcasting a burst of scheduled CBS messages or by suspending the broadcast for a period indicated by BTS (see GSM 08.58);	~~Ffs~~not applicable

To work efficiently on the interfaces, the BSC/RNC should forward CB related messages to the CBC using cell lists as far as applicable.

7 BTS Functionality

Only GSM [The BTS is responsible for conveying CBS information received via SMS BROADCAST REQUEST or SMS BROADCAST COMMAND messages over the radio path to the MS.

- optionally generating CBCH Load Indication messages, indicating an underflow or overflow situation on the CBCH (see GSM 08.58).]

8 MS/UE Functionality

Only GSM [The MS is responsible for recombination of the blocks received via the radio path to reconstitute the CBS message.]

The precise method of display of CBS messages is outside the scope of GSM Specifications, however it is assumed that an MS/UE will:

<table>
<tr><th>MS</th><th>UE</th></tr>
<tr><td>discard sequences transferred via the radio path (see GSM 04.12) which do not consist of consecutive blocks;</td><td>Discard corrupt CBS messages received on the radio interface</td></tr>
<tr><td colspan="2">have the ability to discard CBS information which is not in a suitable data coding scheme;</td></tr>
<tr><td colspan="2">Have the ability to discard a CBS message which has a message identifier indicating that it is of subject matter which is not of interest to the MS;</td></tr>
<tr><td colspan="2">Have the ability to ignore repeat broadcasts of CBS messages already received (message has not changed since it was last broadcast i.e. sequence number has not changed within the message's indicated geographical area);</td></tr>
<tr><td colspan="2">have the ability to transfer a CBS message to an external device, when supported ;</td></tr>
<tr><td>optionally enter CBS DRX mode based upon received Schedule Messages (see GSM 04.12);</td><td>Enter CBS DRX mode based upon received Schedule Messages (see 3G TS 25.324)</td></tr>
<tr><td>optionally skip reception of the remaining block(s) of a CBS message which do(es) not contain cell broadcast information (see GSM 04.12);</td><td>~~ffs.~~not applicable</td></tr>
<tr><td>Optionally read the extended channel</td><td>Not applicable for UMTS.</td></tr>
<tr><td colspan="2">enable the user to activate/deactivate CBS through MMI</td></tr>
<tr><td colspan="2">Enable the user to maintain a “search list” and receive CBS messages with a Message Identifier in the list while discarding CBS messages with a Message Identifier not in the list</td></tr>
<tr><td colspan="2">allow the user to enter the Message Identifier via MMI only for the 1000 lowest codes</td></tr>
<tr><td colspan="2">be capable of receiving CBS messages consisting of up to 15 pages</td></tr>
</table>

9 Protocols and Protocol Architecture

9.1 Requirements on the Radio Access Network

9.1.1 GSM Radio Access Network

Commands interpreted by the BSC will result in a sequence of 4 SMS BROADCAST REQUEST messages or 1 SMS BROADCAST COMMAND message being sent to a BTS, which in turn result in a sequence of 4 blocks each 22 octets long being transferred via the BTS-MS interface (see GSM 04.12).

With the SMS BROADCAST REQUEST mode of operation, the 88 octet fixed length CBS page which is specified in Section 9.3 is split into four 22 octet blocks which are carried in SMS BROADCAST REQUEST messages as follows:

octets 1-22 are transferred in the 1st SMS BROADCAST REQUEST
with a sequence number (see GSM 04.12) indicating first block

octets 23-44 are transferred in the 2nd SMS BROADCAST REQUEST
with a sequence number (see GSM 04.12) indicating second block

octets 45-66 are transferred in the 3rd SMS BROADCAST REQUEST
with a sequence number (see GSM 04.12) indicating third block

octets 67-88 are transferred in the 4th SMS BROADCAST REQUEST
with a sequence number (see GSM 04.12) indicating fourth block.

Figure 3 illustrates the protocol architecture and the scope of the various GSM Specifications for the SMS BROADCAST REQUEST mode of operation.

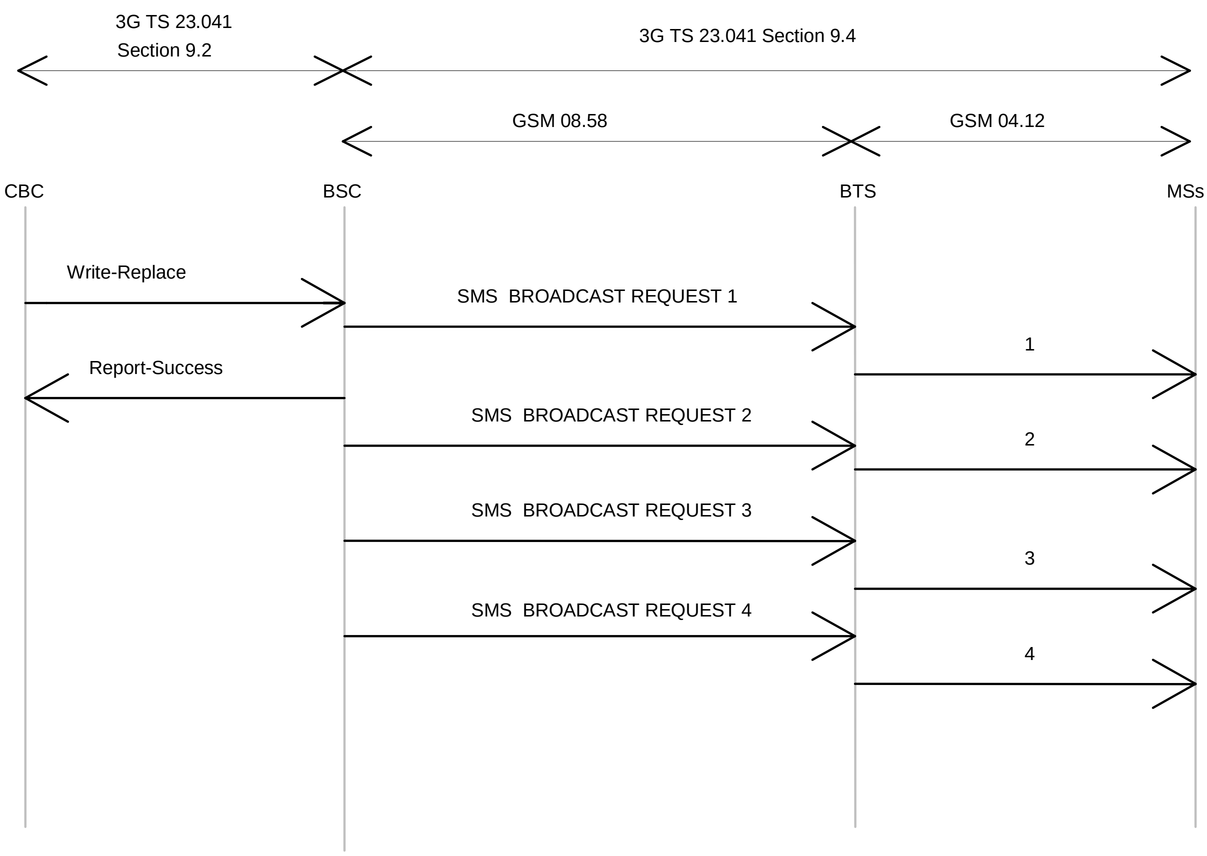


Figure 3

With the SMS BROADCAST COMMAND mode of operation, the BSC sends to the BTS in one single message the 88 octet fixed length CBS page. The BTS then splits the page into four 22 octet blocks, adds the sequence number (see GSM 04.12) and transmits the four resulting blocks on the air.

Figure 4 illustrates the protocol architecture and the scope of the various GSM Specifications for the SMS BROADCAST COMMAND mode of operation.

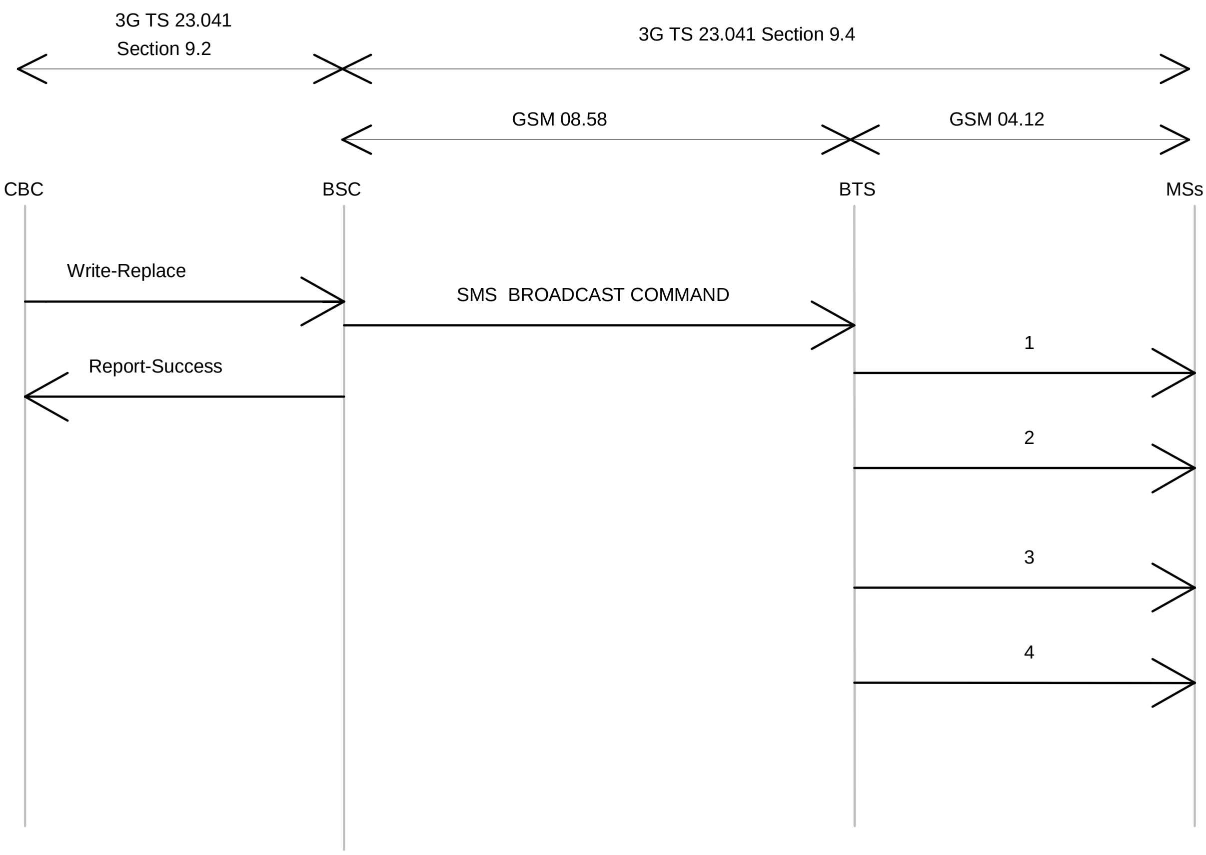
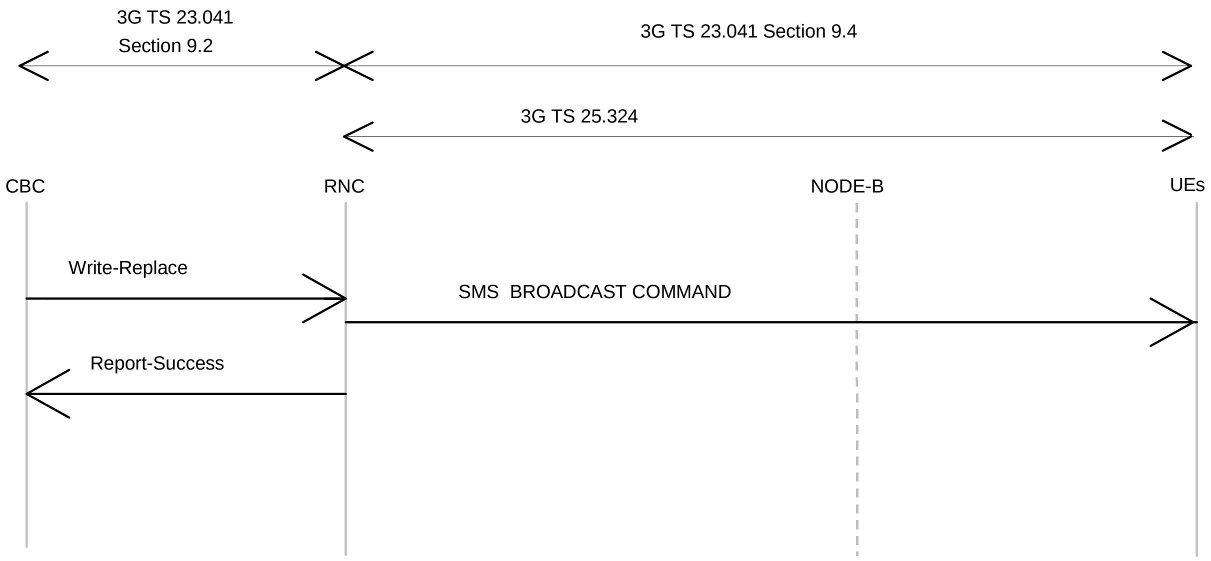


Figure 4

9.1.2 UMTS Radio Access Network

Commands interpreted by the RNC will result in one SMS BROADCAST COMMAND sent to the UE. The CBS messages are completely transparent to the Node B, i.e. no manipulation of the data like e.g. fragmentation is done at the Node B.

~~ffs.~~



9.1.3 UMTS Protocol Overview

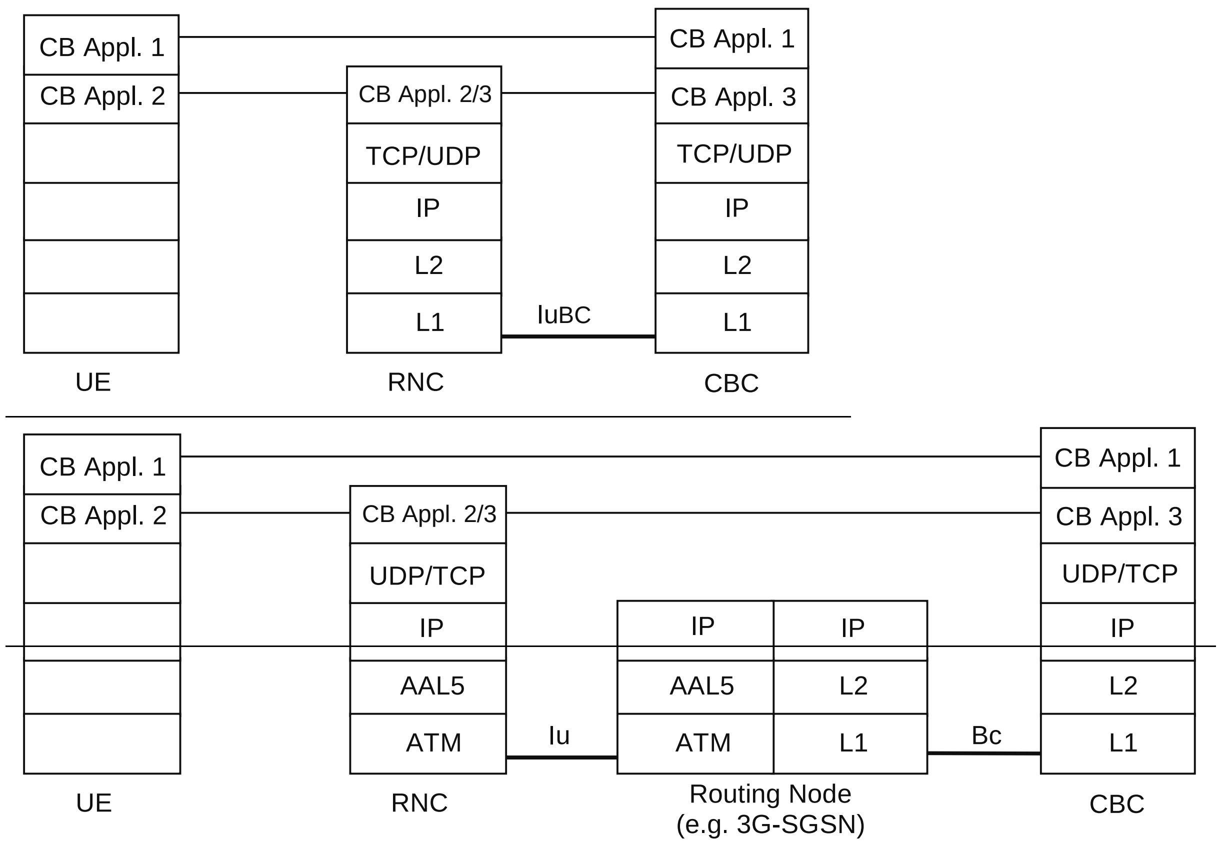


Figure 5

9.2 Requirements on the CBC-interfaces CBC-BSC and CBC-RNC

The requirements are described by primitives. The term primitive is used to indicate "an abstract, implementation independent interaction between a service user and a service provider" (see CCITT X.210). For the CBC-BSC/RNC interface, the service provider would be the protocol interconnecting CBC and BSC/RNC. A Primitive may therefore be viewed as an abstract, implementation independent request/indication or response/confirm interaction between the service user (CBC or BSC/RNC) and the service provider (protocol). A set of primitives for use between the CBC and BSC/RNC is specified appropriate to the functionality assigned to the CBC and BSC/RNC in Sections 5 and 6. In order to allow future extensions to the primitives, where possible a primitive shall not be rejected because a parameter is not recognised; the recipient shall ignore the parameter in question and process the remainder of the primitive's parameters as usual.

The following table gives an overview over the exisiting primitives:

Name	Originator	Type	Reference
WRITE-REPLACE	CBC	Request/Indication	9.2.2
KILL	CBC	Request/Indication	9.2.3
REPORT	BSC/RNC	Response/Confirm	9.2.4
STATUS-LOAD-QUERY	CBC	Request/Indication	9.2.5
STATUS-LOAD-QUERY	BSC/RNC	Response/Confirm	9.2.6
STATUS-MESSAGE-QUERY	CBC	Request/Indication	9.2.7
STATUS-MESSAGE-QUERY	BSC/RNC	Response/Confirm	9.2.8
REJECT	BSC/RNC	Response/Confirm	9.2.9
RESTART-INDICATION	BSC/RNC	Request/Indication	9.2.10
RESET	CBC	Request/Indication	9.2.11
FAILURE-INDICATION	BSC/RNC	Request/Indication	9.2.12
SET-DRX	CBC	Request/Indication	9.2.13
SET-DRX-REPORT	BSC	Response/Confirm	9.2.14
CAPACITY-INDICATION	RNC	Request/Indication	9.2.15

GSM only [No mandatory protocol between the CBC and the BSC is specified by GSM, this is a matter of agreement between CBC and PLMN operators. GSM 03.49 (see also annex A of this TS) provides example protocol stacks using the primitives defined as follows.]

In UMTS the CBC is integrated into the Core Network.This implies a mandatory protocol between CBC and RNC.

NOTE: In the following definitions, M indicates "mandatory parameter" and O indicates "optional parameter".

9.2.1 Identification of a CBS message

In GSM within a CBC-BSC interface, a CBS message is uniquely identified by the quartet (Message Identifier, Serial Number, Cell Identifier, Channel Indicator).

In UMTS within the CBC-RNC interface, a CBS message is uniquely identified by the triplet (Message Identifier, Serial Number, Cell Identifier)

This means that even when two CBS messages have the same semantic containts (for example the same weather forecast) but in different languages or coding schemes, they are considered as different and must therefore be identified by a different quartet.

The Serial Number (Old-Serial-Number or New-Serial-Number) is managed cyclically and therefore this does not prevent the re-use of the same quartet for a different CBS message when the serial number have been incremented a sufficient number of times. How to manage the ambiguity is described subsequently.

This unique identification of a CBS message across the CBC-BSC interface is used in all the primitives defined hereafter. This means that the quartet/triplet will be implicitly or explicitly present in every interface primitive which applies to a given CBS message.

This unique quartet/triplet will be referred in the rest of the document as the « message reference ».

9.2.2 WRITE-REPLACE Request/Indication

PARAMETER	REFERENCE	PRESENCE
Message-Identifier	9.3.1	M
Old-Serial-Number	9.3.2	O
New-Serial-Number	9.3.3	M
Cell-List	9.3.5.1	M
GSM only [Channel Indicator	9.3.6	O]
Category	9.3.7	O
Repetition-Period	9.3.8	M
No-of-Broadcasts-Requested	9.3.9	M
Number-of-Pages	9.3.4	M
Data Coding Scheme	9.3.18	M
CBS-Message-Information-Page 1	9.3.19	M
CBS-Message-Information-Length 1	9.3.20	M
CBS-Message-Information-Page 2	9.3.19	O
CBS-Message-Information-Length 2	9.3.20	O
:		:
CBS-Message-Information-Page n	9.3.19	O
CBS-Message-Information-Length n	9.3.20	O

This primitive is sent by the CBC to the BSC/RNC. As this primitive can be used either to broadcast a new CBS message or replace a CBS message already broadcast, the CBC will use the presence and content of the Old-Serial-Number and New-Serial-Number fields in this primitive to instruct the BSC/RNC as follows:-

- Old-Serial-Number not present/New-Serial-Number present

  This is a write request which will be interpreted by the BSC/RNC as an instruction to broadcast a new CBS message in all the cells of the Cell list.

  GSM only [The CBS message will be broadcasted on the channel derived by the Channel Indicator (see the section on parameters that describes the implicit value of the Channel Indicator when not present in the CBS message).]

  The following table identifies the BSC/RNC's behaviour:

Success/Failure of write request	BSC/RNC behaviour
Success	The BSC/RNC completes the following parameters to be returned in the Report PDU: • a '0' value is entered in the number of broadcasts completed list for the cell • no entry is made in the failure list for the cell
Failure	The BSC/RNC completes the following parameters to be returned in the Report PDU: • no entry is made in the number of broadcasts completed list for the cell • an entry is made in the failure list for the new CBS message identifying the failure cause for the cell

  The BSC/RNC will build as many message references as the number of cells in the list. These message references will be used in particular in the subsequent primitives.

  When a message reference is already known by the BSC/RNC for certain cells in the list (even if the Update field of the Serial-Number is different), the primitive will be rejected for those cells with the cause « message reference already used ». The list of cells where the message reference is not valid will be provided in the failure list of the REPORT primitive. For these cells no entry will be made in the number of broadcasts completed parameter.

- Old-Serial-Number present/New-Serial-Number present

  This is a replace request which will be interpreted by the BSC/RNC as a kill request for the CBS message with the old serial number, followed by a write request for the CBS message with the new serial number. The handling of the new serial number in the write part of this request, is as described above in the write request where no Old-Serial-Number is supplied. These two kill and write requests are executed sequentially. If the kill request is unsuccessful, the BSC/RNC does not proceed to execute the write request. The kill request will stop broadcast of, and cause all information currently associated with the combination of message identifier, old serial number, GSM only [Channel Indicator] and the list of cells in the Cell list to be deleted from the cells in the BSC/RNC (i.e. for all cells provided in the Cell-List parameter). If the kill request is successful, the subsequent write request information conveyed in the primitive replaces the killed CBS message. The following table identifies the BSC/RNC's behaviour:

Success/Failure of kill request	BSC/RNC behaviour
Success	The BSC/RNC proceeds to execute the write request: • Write successful: the BSC/RNC completes the following parameters to be returned in the Report PDU: • An entry is made in the number of broadcasts completed list for the cell • No entry is made in the failure list for the cell • Write unsuccessful: the BSC/RNC completes the following parameters to be returned in the Report PDU: • An entry is made in the number of broadcasts completed list for the cell • An entry is made in the failure list for the new CBS message identifying the failure cause for the cell
Failure	The BSC/RNC does not proceed to execute the write request, and completes the following parameters to be returned in the Report PDU: • no entry is made in the number of completed broadcasts list • an entry is made for the old CBS message in the failure list identifying the failure cause for the cell

All cells which should perform the broadcasting are mentioned in the Cell-List parameter.

The broadcast of the referenced CBS message in the cells which are not mentioned in the Cell-List remains unaffected.

If no category is present, the default category is interpreted by the BSC/RNC, see the parameter section.

This primitive is responded by a REPORT or REJECT primitive.

NOTE: GSM only [In the case of multipage CBS messages, the individual pages are considered as independent by the BSC scheduling algorithm.]

9.2.3 KILL Request/Indication

PARAMETER	REFERENCE	PRESENCE
Message-Identifier	9.3.1	M
Old-Serial-Number	9.3.2	M
Cell-List	9.3.5.1	M
GSM only [Channel Indicator	9.3.6	O]

This primitive is sent by the CBC to the BSC/RNC. The CBC will use this primitive to kill the message indicated by the combination of message identifier, serial number, GSM only [Channel Indicator] and the cells indicated in the Cell-List of this KILL request, i.e. the primitive will halt broadcast of the message in the indicated cells and remove any knowledge of the message from the BSC/RNC for these cells. The broadcast of the referenced message in the cells which are not mentioned in the Cell-List remains unaffected. This primitive is responded with a REPORT or REJECT primitive.

9.2.4 REPORT Response/Confirm

PARAMETER	REFERENCE	PRESENCE
Message-Identifier	9.3.1	M
Serial-Number	9.3.2/9.3.3	M
GSM only [Channel Indicator	9.3.6	O]
No-of-Broadcasts-Completed-List	9.3.10	O
Failure-List	9.3.14	O

This primitive will be sent by the BSC/RNC to the CBC in response to WRITE-REPLACE and KILL primitives. The Serial-Number field will contain the old serial number if this primitive is sent in response to a KILL primitive, and the new serial number if the primitive is sent in response to a WRITE-REPLACE primitive.

The No-of-Broadcasts-Completed-List if present, may contain for each cell the number of broadcasts of the (replaced or killed) CB message with the old message reference sent to this particular cell for broadcast. The serial number information element in the case of a WRITE-REPLACE does not refer to the message for which the number of broadcasts completed information is supplied. The Failure-List if present, may contain those cells which were present in the related WRITE-REPLACE or KILL primitive and failed the requested operation.

9.2.5 STATUS-LOAD-QUERY Request/Indication

PARAMETER	REFERENCE	PRESENCE
Cell-List	9.3.5.1	M
GSM only [Channel Indicator	9.3.6	O]

This primitive is sent by the CBC to the BSC/RNC in order to obtain the current loading of the CBCH/UTRAN Radio Resource of particular cells referenced in the Cell-List parameter. This primitive is responded by a STATUS-LOAD-QUERY Response/Confirm or a REJECT primitive.

9.2.6 STATUS-LOAD-QUERY Response/Confirm

PARAMETER	REFERENCE	PRESENCE
Radio-Resource-Loading-List	9.3.15	O
Failure-List	9.3.14	O
GSM only [Channel Indicator	9.3.6	O]

This primitive will be sent by the BSC/RNC in response to the STATUS-LOAD-QUERY Request/Indication primitive.

The Radio-Resource-Loading-List, if present, may contain each cell which successfully performed the requested operation and for each of these cells the CBCH loading/ UTRAN Radio Resource loadingof this particular cell. (Note that for cells with DRX the load caused by the schedule messages will be included in the load calculation). The Radio-ResourceLoading-List will not be present if all cells indicated in the related STATUS-LOAD-QUERY Request/Indication failed the requested operation.

The Failure-List, if present, may contain all cells for which the requested operation failed (e.g. because the cells CBCH is not available in a BTS). The STATUS-LOAD-QUERY Response/Confirm will not contain the Failure-List parameter if none of the cells in the Cell-List of the related STATUS-LOAD-QUERY Request failed the requested operation.

9.2.7 STATUS-MESSAGE-QUERY Request/Indication

PARAMETER	REFERENCE	PRESENCE
Message-Identifier	9.3.1	M
Old-Serial-Number	9.3.2	M
Cell-List	9.3.5.1	M
GSM only [Channel Indicator	9.3.6	O]

This primitive is sent by the CBC to the BSC/RNC in order to obtain the current status of a CB-message for the cells referenced in the Cell-List parameter. This primitive is responded by the STATUS-MESSAGE-QUERY Response/Confirm or by a REJECT Response/Confirm.

9.2.8 STATUS-MESSAGE-QUERY Response/Confirm

PARAMETER	REFERENCE	PRESENCE
Message-Identifier	9.3.1	M
Old-Serial-Number	9.3.2	M
No-of-Broadcasts-Completed-List	9.3.10	O
Failure-List	9.3.14	O
GSM only [Channel Indicator	9.3.6	O]

This primitive will be sent by the BSC/RNC to the CBC in response to a STATUS-MESSAGE-QUERY Request/Indication primitive.

The No-of-Broadcasts-Completed-List, if present, may contain each cell which successfully performed the requested operation and for each of these cells the number of times this CB message has been sent to this particular cell for broadcast (parameter Number-of-Broadcasts-Completed; this parameter is not included for the cell if the old message reference is not known to the BSC/RNC, and an entry is made in the failure list). The No-of-Broadcasts-Completed-List will not be present if all cells indicated in the related STATUS-MESSAGE-QUERY Request failed the requested operation.

The Failure-List may contain all cells for which the requested operation failed (e.g. because the broadcast of the requested message was never requested before or because the cells CBCH is not available). The STATUS-MESSAGE-QUERY Response/Confirm will not contain the Failure-List parameter if none of the cells in the Cell-List of the related STATUS-MESSAGE-QUERY Request failed the requested operation.

9.2.9 REJECT Response/Confirm

PARAMETER	REFERENCE	PRESENCE
Cause	9.3.16	M
Diagnostic	9.3.17	O
Message-Identifier	9.3.1	O
Serial Number	9.3.2	O

This primitive is sent by the BSC/RNC to the CBC in response to any primitive which is not understood (e.g. invalid parameter or parameter value).

9.2.10 RESTART-INDICATION Request/Indication

PARAMETER	REFERENCE	PRESENCE
Cell-List	9.3.5.2	M
Recovery Indication	9.3.20	O

The RESTART-INDICATION Request is used by the BSC/RNC to indicate to the CBC a CB related restart situation in one or more of its cells (e.g. when an existing or a new cell becomes operational during normal BSC/RNC operation or when the BSC/RNC initialises).

Any referenced cell are again in CB-operational state (have resumed CB operation). The parameter Recovery Indication, if present, indicates whether CB related data are lost for the cells referenced in the Cell-List and have to be re-loaded. If the Recovery Indication parameter is absent, the CBC shall interpret it as the Recovery Indication with the value data lost.

The CBC upon receiving a RESTART INDICATION indication, marks the cell as operational again. It will usually generate WRITE-REPLACE requests for this cell, according to the actual CB message loading at the moment of the restart.

Note that a RESTART INDICATION indication may be triggered from the CBC by a RESET Request. This allows to recover from situations, where a PDU occasionally may be lost.

9.2.11 RESET Request/Indication

PARAMETER	REFERENCE	PRESENCE
Cell-List	9.3.5.1	M

The RESET Request is used by the CBC to force one or more cells of one BSC/RNC into CB-idle state.

The RESET Request may also be used by the CBC to ask for the CB operational state of cells earlier indicated to have failed (polling CB operational state).

If a BSC/RNCreceives a RESET Indication, the indicated cells enter idle state (same state as after "power on"). All CB related information concerning earlier CB messages in a referenced cell is lost.

The BSC/RNC acknowledges the RESET Indication for each cell by an RESTART- or, if not adequate, by a FAILURE-INDICATION request.

Of course, several responses may be combined using a cell list in the RESTART or FAILURE INDICATION.

9.2.12 FAILURE-INDICATION Request/Indication

PARAMETER	REFERENCE	PRESENCE
Cell-List	9.3.5.2	M

The FAILURE-INDICATION Request is used by the BSC/RNC to indicate to the CBC a CB related problem situation in one or more of its cells.

Any referenced cell enters CB-not-operational state. The status of the CBS messages is undefined until the Restart-Indication is sent. It remains in not-operational state until a RESTART-INDICATION request (see 9.1.10) indicates normal CB operation (again).

The CBC upon receiving a FAILURE indication, marks this cell as failed. It will generally not generate further WRITE-REPLACE requests for this cell, up to the point, when the CBC is informed by a RESTART indication, that the cell has resumed CB operation.

The BSC/RNC refuses further WRITE-REPLACE requests from the CBC with the cause “cell-broadcast-not-operational” when any referenced cell is in the CB-not-operational state.

Note, that a Failure-Indication may be triggered by a RESET Request. This allows to recover from situations, where a PDU occasionally may be lost.

9.2.13 SET-DRX Request/Indication

PARAMETER	REFERENCE	PRESENCE
Cell-List	9.3.5.1	M
Schedule-Period	9.3.12	O
Reserved-Slots	9.3.13	O
GSM only [Channel Indicator	9.3.6	O]

This primitive is applicable in GSM only. In UMTS DRX is a mandatory feature in the RNC and no activation/ deactivation function on CBS related radio resources controlled by the CBC is necessary.

The SET-DRX Request is used by the CBC to set DRX specific parameters i.e. the schedule period and the number of slots reserved for high priority CBS messages, see GSM 04.12. At least one of the Schedule-Period or Reserved-Slots parameters must be present in the primitive. If this primitive is not supported, the BSC~~/RNC~~ may use default values.

If a BSC~~/RNC~~ receives a SET-DRX Indication, the new DRX parameters will be taken into account starting from the next schedule period in each cell, see GSM 04.12.

If a BSC~~/RNC~~ receives a SET-DRX Indication, the new DRX parameters will be applied for all cells that do not handle any broadcast message (null loading).

9.2.14 SET-DRX- REPORT Response/Confirm

PARAMETER	REFERENCE	PRESENCE
Cell-List	9.3.5.2	O
Failure-List	9.3.14	O
GSM only [Channel Indicator	9.3.6	O]

This primitive will be sent by the BSC~~/RNC~~ to the CBC in response to a SET-DRX Request/Indication primitive.

The Failure-List will contain those cells which were present in the Request message and which failed the requested operation.

If the new schedule period parameters are not acceptable on a cell due to the load of the cell, the cause “bss-capacity-exceeded” is used in the Failure-list.

9.2.15 CAPACITY-INDICATION Request/Indication

PARAMETER	REFERENCE	PRESENCE
Cell-List	9.3.5.2	O
Available-Capacity	9.9.22	O

This primitive is applicable in UMTS only.

This primitive is used by the RNC to indicate a change in the available broadcast capacity per cell to the CBC.

9.3 Parameters

9.3.1 Message-Identifier

This parameter identifies source/type of a CBS message and is passed transparently from the CBC to the MS/UE. Its format is defined in 9.4.2.2.

9.3.2 Old-Serial-Number

This parameter equates to the parameter - Serial Number sent between the BSC/RNC and the MS/UE. Its format is defined in 9.4.2.1.

This parameter enables a particular existing CBS message, from the source/type indicated by the message identifier, to be identified.

9.3.3 New-Serial-Number

This parameter equates to the parameter - Serial Number sent between the BSC/RNC and the MS/UE. Its format is defined in 9.4.2.1.

This parameter enables CBS message change to be indicated since it is altered every time the CBS message is changed. The serial number identifies a particular CBS message, which may be several pages in length, from the source indicated by the message identifier.

9.3.4 Number-of-Pages

This parameter enables the number of pages in the CBS message to be indicated.

9.3.5 Cell-List

The cell-list identifies a sequence of one or more cells to which the primitives apply.

The following applies for GSM only:

The cells in the list are described in GSM 08.08 and can be identified by the CBC or BSC in LAC and CI format or CI format only.

In addition (see GSM 08.08) it is possible for the CBC to refer to all cells in a LAC or in a complete BSC. If supplied, the Cell-List parameter must refer to at least one cell.

The following applies for UMTS only:

For CBS the cells are refered to as Service Areas. As described in 3G TS 25.401 [17] a Service Area Identifier (SAI) is used to uniquely identify an area consisting of one or more cells belonging to the same Location Area. Such an area is called a Service Area and can be used for indicating the location of a UE to the CN.

The Service Area Code (SAC) together with the PLMN-Id and the LAC will constitute the Service Area Identifier.

- **SAI = PLMN-Id + LAC + SAC**

The SAC is defined by the operator, and set in the RNC via O&M.

NOTE: For CBS, a Service Area shall consist of only one Cell. The mapping of SAI onto cell is controlled by the RNC and managed by an O&M function.

Given the above differences between cell identification in the two directions, a cell list sent from the CBC to the BSC/RNC has a different structure compared to a cell list sent from the BSC/RNC to the CBC. The different cell lists are described in sections 9.3~~2~~.5.1 and 9.3~~2~~.5.2.

~~The following applies for UMTS only:~~

~~ffs.~~

9.3.5.1 Cell-List sent from CBC to BSC/RNC

The CBC to BSC/RNC Cell-List contains a length parameter identifying the number of cell-identifications present in the list, a Cell-Id-Discriminator, which is common for all cell-identifications in the list, and a sequence of cell-identifications.

Description of list elements:

PARAMETER	PRESENCE
Length Cell-Id-Discriminator Cell-Identification	M M M

~~The following applies for GSM only:~~

The Cell-Id-Discriminator ~~is described in GSM 08.08 and~~ has one of the following formats:

Format	Description
LAC and CI in GSM;	GSM 08.08 [13]
CI only;	GSM 08.08 [13]
all cells in the BSC/RNC belonging to a certain Location Area;	Example in GSM 03.49 [6]
all cells in the BSC/RNC;	Example in GSM 03.49 [6]
SAI in UMTS	3G TS 25.401 [17]

The Cell-identification is repeated for each cell included in the list. The Cell-List must refer to at least one cell.

~~The following applies for UMTS only:~~

~~ffs.~~

9.3.5.2 Cell-List sent from BSC/RNC to CBC

The BSC/RNC to CBC Cell-List contains a sequence of cell-identifiers as defined in 9.3.11. The Cell-List must contain at least one cell-identifier as defined in 9.3.11.

9.3.6 Channel Indicator

The following applies for GSM only:

This parameter indicates the CB channel, which shall be used for broadcasting the data.

basic channel;

extended channel (supporting such a channel by the network or MSs is optional);

If no channel indicator is present, it shall be interpreted as an indication to the basic channel.

9.3.7 Category

~~The following applies for GSM only:~~

This indicates the category of the CBS message:

High Priority: to be broadcast at the earliest opportunity. ~~in the reserved slots of the current schedule period (i.e. until the emission of the next schedule message), then according to the associated repetition period in the next schedule periods, in non reserved slots.~~

Background: to be broadcast ~~in the slots left free by~~ when no CBS messages of category "High Priority" ~~and~~or "Normal" are broadcast. ~~, possibly shared with unscheduled schedule messages, see GSM 04.12.~~ The repetition period defines the minimum broadcast requirement.

Normal: to be broadcast according to the associated repetition period.

If the category is omitted, the default category implied is "Normal" message.

~~The following applies for UMTS only:~~

~~ffs.~~

9.3.8 Repetition-Period

~~The following applies for GSM only:~~

This indicates the period of time after which broadcast of the CBS message should be repeated. The minimum period with which a CBS message consisting of one page may be broadcast over the air interface is ~~one 8 x 51 multiframe sequence which corresponds to~~ a period of ~~approximately~~ 1.883 seconds.

The value of "Repetition-Period" shall be in the range 1 to 1024 where each unit will represent ~~one 8 x 51 multiframe sequence~~the value of one minimum period.

In the event of a conflict where the BSS/RNS has more than one CBS message to send at the same time, the BSC/RNC shall decide the order of such CBS messages as an implementation matter.

Note: The time period 1.883 seconds approximately reflects one 8 x 51 multiframe sequence of the GSM radio interface. It is also used as minimum repetition rate in UMTS. The higher capacity of the RNS enables the CBC to send more than one CBS message consisting of one page with the minimum repetition rate to a Node B.

~~The following applies for UMTS only:~~

~~ffs.~~

9.3.9 No-of-Broadcasts-Requested

This specifies the number of times the CBS message is to be broadcast.

~~The following applies for GSM only:~~

The parameter may take any value up to 65535 (this maximum allows the CBS message to be broadcast approximately every 1.883 seconds for more than 24 hours). If the parameter is set to 0 then the CBS message will be broadcast indefinitely (i.e. until the BSC receives an appropriate Kill-Message Request/Indication primitive).

~~The following applies for UMTS only:~~

~~ffs.~~

9.3.10 No-of-Broadcasts-Completed-List

This parameter is a list indicating the number of times that the CBS message (i.e. all pages of the CBS message) has been sent to each cell in the Cell-List for broadcast over the air interface.

~~The following applies for GSM only:~~

The cells in the list are described as per section ~~3.2.2.17 of GSM 08.08 and can be identified by LAC and CI or CI only~~9.3.11.

~~The following applies for UMTS only:~~

~~ffs.~~

Description of list elements:

PARAMETER	PRESENCE
Cell Identifier	M
No-of-Broadcasts-completed	M
No-of-Broadcasts-Compl-Info	O

The information above is repeated for the number of cells in the list.

To each cell in the list the information element No-of-Broadcasts-completed is associated. This information element is related to the particular referenced cell in the list and contains the number of times a CBS message (i.e. all pages of a CBS message) has been sent to this cell for broadcast. The No-of-Broadcasts-completed information element represents the number of full broadcasts made of a CBS message, and that the CBS message is being (or had been) broadcast.

The optional No-of-Broadcasts-Compl-Info information element may be supplied to indicate to the CBC one of the following cases:

- overflow

  the count of the number of full broadcasts made of a CBS message has overflowed, and that the CBS message is being (or had been) broadcast. The actual number of broadcasts completed is greater than the value indicated in the No-of-Broadcasts-completed information element.

- unknown

  indicates that there is no information regarding the number of broadcasts completed in the BSC/RNC for the CBS message with the old serial number. The value indicated in the No-of-Broadcasts-completed information element is undefined in this case.

The No-of-Broadcasts-Completed-List must contain at least one cell.

9.3.11 Cell-Identifier

~~The following applies for GSM only:~~

The cell-identifier consists of a cell-id-discriminator and cell-identification pair.

Description of list elements:

PARAMETER	PRESENCE
Cell-Id-Discriminator	M
Cell-Identification	M

The Cell-Id-Discriminator ~~is described inGSM 08.08 and~~ has one of the following formats:

Format	Description
LAC and CI in GSM~~,~~	GSM 08.08 [13]
CI only~~.~~	GSM 08.08 [13]
SAI in UMTS	3G TS 25.401 [17]

The BSC can use the 'LAC and CI' format for a cell identifier in any response to the CBC. The BSC may also use the 'CI only' format for a cell identifier when responding to a CBC primitive that had contained a cell with 'CI only' format for a cell identifier. The RNC uses the SAI format for a cell identifier in any response to the CBC.

~~The following applies for UMTS only:~~

~~ffs.~~

9.3.12 Schedule-Period

The following applies for GSM only:

Indicates the DRX schedule period length, see GSM 04.12.

The following values should be coded:

- no DRX;

- length of the schedule period.

If a schedule period length greater than 40 is used, the schedule message cannot be built entirely if more than 40 CBS messages have to be described in the period. Therefore, schedule period length shall be reduced to 40.

~~The following applies for UMTS only:~~

~~ffs.~~

9.3.13 Reserved-Slots

The following applies for GSM only:

Indicates the number of slots marked as "free slots reading advised" in the schedule message and considered as reserved in a DRX schedule period for incoming high priority CBS messages, not scheduled in the current schedule period, see GSM 04.12.

The spacing of the reserved slots is implementation dependent.

Reserved slots shall receive a 40 value at maximum, taking into account the constraint for schedule period length.

~~The following applies for UMTS only:~~

~~ffs.~~

9.3.14 Failure-List

This identifies the list of cells for which the BSC/RNC could not complete the request. The failure cause for each cell is indicated.

~~The following applies for GSM only:~~

The cells in the list are described as per section ~~3.2.2.17 of GSM 08.08 and can be identified by LAC and CI or CI only~~9.3.11.

Description of list elements:

PARAMETER	PRESENCE
Cell Identifier	M
Cause	M
Diagnostic	O

The information above is repeated for the number of cells that failed.

To each cell in the list the information elements Cause and, as an implementation option, Diagnostic are associated. These are related to the particular referenced cell in the list.

The Failure-List must contain at least one cell.

~~The following applies for UMTS only:~~

~~ffs.~~

9.3.15 Radio-Resource-Loading-List

~~The following applies for GSM only:~~

A list of the predicted short term load of each cell in the list expressed as a percentage. The calculation of this percentage is an implementation matter. The load should reflect the number of used slots, and schedule messages and reserved slots must be taken into account. The cells in the list are described ~~inGSM 08.08 and can be identified by LAC and CI or CI only~~as per section 9.3.11.

Description of list elements:

PARAMETER	PRESENCE
Cell Identifier	M
~~CBCH~~Radio-Resource-Loading	M

The information above is repeated for the number of cells in the list.

To each cell in the list the information element ~~CBCH~~Radio-Resource-Loading is associated. This information element is related to the particular referenced cell in the list and contains the cells load.

Note that for cells with DRX the load caused by the schedule messages will be included in the ~~CBCH~~ Radio-Resource load.

The ~~CBCH~~Radio-Resource-Loading-List must contain at least one cell.

~~The following applies for UMTS only:~~

~~ffs.~~

9.3.16 Cause

Indicates reason why the BSC/RNC was not able to interpret or execute the received primitive. The causes are given in table 1.

Table 1

Cause	Reason
Parameter-not-recognized	Sent when the recipient (CBC or BSC/RNC) was unable to act upon the primitive received due to an unrecognized parameter. A primitive should not be rejected only because a parameter is not recognized as this would prevent extensions to the service
parameter-value-invalid	Sent when a failure occurred due to the value of a parameter being invalid, e.g. out of range, or in Write-Replace, the parameter "no of pages" does not equal the number of pages received
valid-CBS-message-not- identified	Sent when the BSC/RNC does not recognize the CBS message reference
cell-identity-not-valid	Sent when the BSC/RNC does not recognize a cell Identity
unrecognized-primitive	Sent when the BSC/RNC did not recognize the primitive at all
missing-mandatory-element	Sent when a mandatory element is missing from the primitive
bss-capacity-exceeded	Sent when a write-replace fails because the BSC/RNC cannot meet the requested repetition period or when the set-drx parameters cannot be applied because of the cell loading
GSM only [cell-memory-exceeded	Sent when the local cell memory has been exceeded]
bss-memory-exceeded	Sent when the BSS/RNS is unable to store a CBS message as the BSS/RNS memory has been exceeded
cell-broadcast-not-supported	Sent when the CBCH/CBS related Radio Resource is not configured for a cell
cell-broadcast-not-operational	Sent when the CBCH/CBS related radio resource is not available because of error conditions or due to maintenance activities
incompatible-DRX-parameter	Sent when the DRX parameter(s) cannot be applied.
GSM only [Extended-channel-not-supported	Sent when a write-replace fails because the extended channel is not configured for a cell]
message-reference already-used	Sent when the recipient (BSC/RNC) was unable to act upon the write_replace received due to a previous write_replace received with the same message_reference.
unspecified-error	Sent when none of the above cause values apply

9.3.17 Diagnostic

Provides additional information associated with Cause parameter and may contain parameter which could not be interpreted/executed.

9.3.18 Data Coding Scheme

This parameter identifies the alphabet or coding employed for the message characters and message handling at the MS/UE and is passed transparently from the CBC to the MS/UE. This parameter is defined in 3G TS 23.038 [3].

9.3.19 CBS-Message-Information-Page n

This parameter is of a fixed length of 82 octets and carries up to and including 82 octets of user information. Where the user information is less than 82 octets, the remaining octets must be filled with padding (see 3G TS 23.038 [3]).

The content of a CBS-Message-Information-Page is passed transparently from the CBC to the MS/UE.

In GSM the CBS-Message-Information-Page n becomes the 'Content of Message' parameter at the MS.

In UMTS the CBS-Message-Information-Pages together with the associated CBS-Message-Information-Length parameter is broadcasted as a single unit over the radio inteface.

In the case where the user information is GSM 7 bit default alphabet encoded, the appropriate padding characters and bit-fill are added to the end of the user information to complete the CBC-Message-Information-Page (see 3G TS23.038).

In the case where the user information is 8 bit encoded, the appropriate padding octets are added to the end of the user information to complete the CBC-Message-Information-Page (see 3G TS 23.038).

9.3.20 CBS-Message-Information-Length n

This parameter gives the number of octets of the CBS-Message-Information-Page n containing user information. The remaining octets of the CBS-Message-Information-Page n contain only padding information and are not included in this parameter.

In the case where the user information is encoded using the GSM 7 bit default alphabet and the last character terminates at an octet boundary, this parameter indicates the number of octets of user information. In the case where the last character does not terminate at an octet boundary, this parameter indicates the number of octets up to the octet boundary immediately following the last GSM 7 bit default alphabet character of user information.

In UMTS the CBS-Message-Information-Pages together with the associated CBS-Message-Information-Length parameter is broadcasted as a single unit over the radio inteface.

9.3.21 Recovery-Indication

Indicates whether the CBS related data was lost or is still available.

The following values should be coded:

- Data-available;
- Data-lost.

9.3.22 Available-Capacity

This parameter is applicable for UMTS only. It indicates the capacity on the radio interface of a cell which is currrently available for CBS.

9.4 Message Format on the Radio Network – MS/UE Interface

9.4.1 GSM

The CBS messages which are transmitted by the BTS for the MS include the CBS Message (information for the user) and Schedule Message (schedule of CBS messages).

The use and the formatting of the CBS messages, which contain information for the MS user, is described in this section.

The Schedule Message is broadcast to support CBS DRX mode for Mobile Stations. The Schedule Message is helpful in minimizing battery usage for Cell Broadcast in the Mobile Station, because it allows the MS to ignore transmissions of

CBS messages the customer is not interested in. The use and formatting of the Schedule Message is described in GSM 04.12.

9.4.1.1 General Description

Each page of a CBS Message sent to the MS by the BTS is a fixed block of 88 octets as coded in GSM 04.12. This is sent on the channel allocated as CBCH by GSM 05.02. The 88 octets of the CBS Message are formatted as described in 9.3.2.

9.4.1.2 Message Parameter

Octet Number(s)	**Field**
1-2	Serial Number
3-4	Message Identifier
5	Data Coding Scheme
6	Page Parameter
7-88	Content of Message

The octets in the above table are transmitted in order, starting with octet 1. The bits within these octets are numbered 0 to 7; bit 0 is the low order bit and is transmitted first.

9.4.1.2.1 Serial Number

This parameter is a 16-bit integer which identifies a particular CBS message (which may be one to fifteen pages in length) from the source and type indicated by the Message Identifier and is altered every time the CBS message with a given Message Identifier is changed.

The two octets of the Serial Number field are divided into a 2-bit Geographical Scope (GS) indicator, a 10-bit Message Code and a 4-bit Update Number as shown below:

<table>
<tr><td colspan="8">Octet 1</td><td colspan="8">Octet 2</td></tr>
<tr><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td colspan="2">GS</td><td colspan="10">Message Code</td><td colspan="4">Update Number</td></tr>
</table>

The most significant bit of the update number is octet 2 bit 3. The most significant bit of the Message Code is octet 1 bit 5 and the least significant bit of the Message Code is octet 2 bit 4. The most significant bit of the Geographical Scope is octet 1 bit 7.

- Message Code

  The Message Code differentiates between CBS messages from the same source and type (i.e. with the same Message Identifier). Message Codes are for allocation by PLMN operators.

  The Message Code identifies different message themes. For example, let the value for the Message Identifier be "Automotive Association" (= source), "Traffic Reports" (= type). Then "Crash on A1 J5" could be one value for the message code, "Cow on A32 J4" could be another, and "Slow vehicle on M3 J3" yet another.

- Geographical Scope

The Geographical Scope (GS) indicates the geographical area over which the Message Code is unique, and the display mode. The CBS message is not necessarily broadcast by all cells within the geographical area. When two CBS messages are received with identical Serial Numbers/Message Identifiers in two different cells, the Geographical Scope may be used to determine if the CBS messages are indeed identical.

In particular, the Geographical Scope tells the mobile if the CBS message is only cell wide (which means that any CBS message if received in the next cell is regarded as "new"), or PLMN wide (which means that the Message Code and/or Update Number must change in the next cell for the CBS message to be "new"), or Location Area wide (which means that a CBS message with the same Message Code and Update Number may or may not be "new" in the next cell according to whether the next cell is in the same Location Area as the current cell).

The display mode indicates whether the CBS message is supposed to be on the display all the time ("immediate") or only when the user wants to see it ("normal"). In either case, the CBS message will be displayed only if its Message Identifier is contained within the "search list" of the mobile (see 9.3.2). These display modes are indicative of intended use, without indicating a mandatory requirement or constraining the detailed implementation by mobile manufacturers. The user may be able to select activation of these different modes.

The coding of the Geographical Scope field is shown below:

GS Code	**Display Mode**	**Geographical Scope**
00	Immediate	Cell wide
01	Normal	PLMN wide
10	Normal	Location Area wide
11	Normal	Cell wide

Immediate = default direct display
Normal = default display under user interaction
NOTE: Code 00 is intended for use by the network operators for base station IDs.

- Update Number

The Update Number indicates a change of the message content of the same CBS message, i.e. the CBS message with the same Message Identifier, Geographical Scope, and Message Code.

In other words, the Update Number will differentiate between older and newer versions of the same CBS message, within the indicated geographical area. A new CBS message may have Update Number 0000; however this number will increment by 1 for each update. Any Update Number eight or less higher (modulo 16) than the last received Update Number will be considered more recent, and shall be treated as a new CBS message, provided the mobile has not been switched off.

9.4.1.2.2 Message Identifier

This parameter identifies the source and type of the CBS message. For example, "Automotive Association" (= source), " Traffic Reports" (= type) could correspond to one value. A number of CBS messages may originate from the same source and/or be of the same type. These will be distinguished by the Serial Number. The Message Identifier is coded in binary.

The ME shall attempt to receive the CBS messages whose Message Identifiers are in the "search list". This "search list" shall contain the Message Identifiers stored in the EF_{CBMI}, EF_{CBMID} and EF_{CBMIR} files on the SIM (see GSM 11.11) and any Message Identifiers stored in the ME in a "list of CBS messages to be received". If the ME has restricted capabilities with respect to the number of Message Identifiers it can search for, the Message Identifiers stored in the SIM shall take priority over any stored in the ME.

The use/application of the Message Identifier is shown in the following list, with octet 3 of the Message Identifier shown first, followed by octet 4. Thus "1234" (hex) represents octet 3 = 0001 0010 and octet 4 = 0011 0100.

0000 - 03E7 (hex): To be allocated by PLMN operator associations. If a Message Identifier from this range is in the "search list", the ME shall attempt to receive such CBS message.

This version of GSM 03.41 does not prohibit networks from using Message Identifiers in the range 0000 - 03E7 (hex) for Cell Broadcast Data Download to the SIM.

03E8 (hex): LCS CBS Message Identifier for E-OTD Assistance Data message

03E9 (hex): LCS CBS Message Identifier for GPS Assistance Data message

03EA - 0FFF (hex): Intended for standardization in future versions of GSM 03.41. These values shall not be transmitted by networks that are compliant to this version of GSM 03.41. If a Message Identifier from this range is in the "search list", the ME shall attempt to receive this CBS message.

1000 - 107F (hex): Networks shall only use Message Identifiers from this range for Cell Broadcast Data Download in "clear" (i.e. unsecured) to the SIM (see GSM 11.14). If a message Identifier from this range is in the "search list", the ME shall attempt to receive this CBS message.

1080 – 10FF (hex): Networks shall only use Message Identifiers from this range for Cell Broadcast Data Download secured according to GSM 03.48 [15] to the SIM (see GSM 11.14). If a message Identifier from this range is in the "search list", the ME shall attempt to receive this CBS message.

1100 - 9FFF (hex): intended for standardization in future versions of GSM 03.41. These values shall not be transmitted by networks that are compliant to this version of GSM 03.41. If a Message Identifier from this range is in the "search list", the ME shall attempt to receive this CBS message.

A000 - AFFF (hex): PLMN operator specific range. The type of information provided by PLMN operators using these Message Identifiers is not guaranteed to be the same across different PLMNs. If a Message Identifier from this range is in the "search list", the ME shall attempt to receive this CBS message.

B000 - FFFE (hex): intended as PLMN operator specific range in future versions of GSM 03.41. These values shall not be transmitted by networks that are compliant to this version of GSM 03.41. If a Message Identifier from this range is in the "search list", then the ME shall attempt to receive this CBS message.

FFFF (hex): Reserved, and should not be used for new services, as this value is used on the SIM to indicate that no Message Identifier is stored in those two octets of the SIM. If this Message Identifier is in the "search list", the ME shall attempt to receive this CBS message.

Generally, the MMI for entering these codes in the ME is left to the manufacturers' discretion. However, the 1000 lowest codes shall be capable of being specified via their decimal representation i.e.:

Octet 3	Octet 4	
0000 0000	0000 0000	(decimal '000')
0000 0000	0000 0001	(decimal '001')
0000 0000	0000 0010	(decimal '002')
0000 0000	0000 0011	(decimal '003')
:	:	:
:	:	:
0000 0011	1110 0111	(decimal '999')

9.4.1.2.3 Data Coding Scheme

This parameter indicates the intended handling of the CBS message at the MS, the alphabet/coding, and the language (when applicable). This is defined in 3G TS 23.038 [3].

When the SIM indicates one or more language preferences, the ME shall, by default, use the language(s) stored in the SIM (in the EF$_{\cancel{L}PL}$ file) to set any language filter mechanisms provided by the ME.

Optionally, the user can select the language(s) required by using an MMI, to determine whether a particular CBS message should be read and displayed.

9.4.1.2.4 Page Parameter

This parameter is coded as two 4-bit fields. The first field (bits 0-3) indicates the binary value of the total number of pages in the CBS message and the second field (bits 4-7) indicates binary the page number within that sequence. The coding starts at 0001, with 0000 reserved. If a mobile receives the code 0000 in either the first field or the second field then it shall treat the CBS message exactly the same as a CBS message with page parameter 0001 0001 (i.e. a single page message).

9.4.1.2.5 Content of Message

This parameter is a copy of the 'CBS-Message-Information-Page' as sent from the CBC to the BSC.

9.4.2 UMTS

~~The CBS message format is described in 3G TS 25.324. The information elements Serial Number, Message Identifier and Data Coding Scheme are identical with those described for GSM in section 9.4.1 with respect to their structure and possible values. Any other differences to GSM, e.g. concerning the storage of the parameters on the USIM are for further study.~~

The CBS messages which are transmitted by the RNS to the UE include two types of messages: CBS Message (user information) and Schedule Message (schedule of CBS messages).

The format of the CBS Message containing user information is described in this section and in 3G TS 25.324 [19].

The format of the Schedule Message is described in 3G TS 25.324 [19].

9.4.2.1 General Description

The CBS message is transmitted as one unit over the radio interface. On layer two of the UMTS radio interface the logical channel CTCH is used.

9.4.2.2 Message Parameter

Octet Number(s)	Parameter
1	Message Type
2 – 3	Message ID
4 – 5	Serial Number
6	Data Coding Scheme
7 – n	CB Data

The octets in the above table are transmitted in order, starting with octet 1. The bits within these octets are numbered 0 to 7; bit 0 is the low order bit and is transmitted first.

9.4.2.2.1 Message Type

This parameter indicates the type of a message, either a CBS message or a Schedule Message. The Coding of the Message Type is described in 3G TS 25.324 [19].

9.4.2.2.2 Message ID

This parameter identifies the source and type of the CBS Message (see also 3G TS 25.324 [19]). It is identical with the Message Identifier described in 9.4.1.2.2 with respect to its structure and possible value range.

The UE shall attempt to receive the CBS messages whose Message ID's are in the "search list". This "search list" shall contain the Message IDs stored in the EF_{CBMI}, EF_{CBMID} and EF_{CBMIR} files on the USIM (see 3G TS 31.102 [18]) and any Message Identifiers stored in the UE in a "list of CBS messages to be received". If the UE has restricted capabilities with respect to the number of Message ID's it can search for, the IDs stored in the USIM shall take priority over any stored in the UE.

9.4.2.2.3 Serial Number

This parameter identifies a particular CBS Message from the source and type indicated by the Message ID (see also 3G TS 25.324 [19]). It is identical with the Serial Number described in 9.4.1.2.1 with respect to its structure and possible value range.

9.4.2.2.4 Data Coding Scheme

This parameter identifies the the alphabet/coding and the language applied to a CBS Message as defined in 3G TS 23.038 [3].

When the USIM indicates one or more language preferences, the UE shall, by default, use the language(s) stored in the USIM (in the EF_{PL} file) to set any language filter mechanisms provided by the UE.

Optionally, the user can select the language(s) required by using an MMI, to determine whether a particular CBS message should be read and displayed.

9.4.2.2.5 CB Data

This parameter consists of the WRITE-REPLACE primitive parameters Number-of-Pages, CBS-Message-Information-Page and CBS-Message-Information-Length as received from the CBC (see also 3G TS 25.324 [19]). The CBS-Message-Information-Page contains the user information (see section 9.2.2).

9.5 CBS Compression

Cell Broadcast messages may be compressed in accordance with the compression algorithm described in 3G TS 23.042 [14].

The Data Coding Scheme parameter (see 9.4.1.2.3) indicates whether or not a CBS Message is compressed.

Compression and decompression may take place between a CBE and an MS or between a CBC and an MS.

The compression applies only to user information sent between the CBC and the MS i.e. excludes any padding octets.

Padding in the case of CBS compression is defined as an integral number of octets where each padding octet has a value FF hexadecimal. The insertion of padding for different scenarios is described in the paragraphs below.

The compression footer (see 3G TS 23.042) delimits the compressed user information bit stream at an octet boundary. The remainder of the 'CBS-Message-Information-Page' sent between the CBC and the BSC contains padding octets. The parameter 'CBS-Message-Information-Length' identifies the sum of the compressed octets, the compression header, and the compression footer (see 3G TS 23.042), but not any padding.

Compression may apply to a single 'CBS-Message-Information-Page' or across multiple 'CBS-Message-Information-Page's.

In the case where Compression applies only to a single 'CBS-Message-Information-Page', the compression header shall be the first octet in that 'CBS-Message-Information-Page' and the compression footer shall immediately follow the compressed data stream. Any remaining octets after the compression footer shall contain padding up to and including the 82nd octet position. However, if the 82nd octet position contains the compression footer then there is no padding.

In the case where compression applies across multiple 'CBS-Message-Information-Page's, the compression header shall be present only in the first octet position of the first 'CBS-Message-Information-Page'. The compression footer shall immediately follow the compressed data stream which will terminate within the last ‘CBS-Message-Infirmation-Page’. Any remaining octets after the compression footer in the last 'CBS-Message-Information-Page' shall contain padding up to and including the 82nd octet position in the last ‘CBS-Message-Information-Page’. However, if the 82nd octet position of the last 'CBS-Message-Information-Page' contains the compression footer then there is no padding.

If it is required to convey different blocks of information which are to be treated by the MS as though they were physically independent pages rather than concatenated information then page break characters (see 3G TS 23.038) may be inserted in the character stream prior to compression. The boundaries created by the page breaks will not normally align with the boundaries set by the page number parameters and so the page number parameters cannot be used to identify physically separate blocks of meaningful information.

The decoding at the MS may be achieved by first locating the compression footer octet by working back from the 82nd octet in the last 'CBS-Message-Information-Page'. If padding is present, the MS must skip backwards over the padding until a non padding octet is found. By definition this octet must be the compression footer. The compression footer has a pre-defined bit combination which can never replicate a padding octet. If padding is not present in the 82nd octet position of the last 'CBS-Message-Information-Page', by definition the 82nd octet must be the compression footer.

The compression footer defined in 3G TS 23.042 indicates whether there are any compressed data bits contained within the compression footer octet and, if not, how many compressed data bits are contained within the octet immediately preceding the compression footer. In order to prevent possible replication of the padding octet value in the compression footer octet value, the compression mechanism must ensure that when bits 0,1,2 in the compression footer are all ones all other bits in the compression footer octet are set to 0

10 CBS Index

An index structure is defined in this section. Index can be used by the operator to inform the end user about the type of CBS services available. Index has the structure of a tree. It can thus have sub parts which are called subindexes. A subindex can be embedded in the same index message as its parent ("embedded subindex") or it can physically be in a separate index message ("child subindex"). Every index message has a unique message identifier. They are always of the same type. Message Code 1010101010b shall be used to indicate this type. The root of the index structure shall be the index message with message identifier 0. Other index messages are linked to the root index with links. Definition of their message identifiers is left to the operator.

A format ("enhanced format") for the index messages is described in this section. If this enhanced format is used in the index message the ms can present the index messages in its preferred format.

Available CBS services are introduced in the index. This means that their message identifier and name are stated. Enhanced format includes a mechanism for separating a normal service introduction from embedded subindex introduction and child subindex introduction. The introduction of an embedded subindex specifies the "subindex-id" used for identifying services that belong to this subindex. Embedded subindexes can have subindexes embedded in them etc. If these "second level embedded subindexes" are introduced their subindex-id shall begin with the subindex-id of their parent. Same principle applies for subindexes in third, fourth etc. level. An example of an index structure is given in figure 6.

Enhanced format includes a mechanism which allows the terminals to identify that the format of the index message is enhanced. The index-id -field and the above mentioned Message Code (1010101010b) constitute this mechanism:

message-format = index-id index-element-intro+

index-id = "EI" version crlf

version = number+

number = "1" | "2" | "3" | "4" | "5" | "6" | "7" | "8" | "9" | "0"

index-element-intro = subindex-intro | service-intro

subindex-intro = subindex-id " " subindex-name crlf

subindex-id = subindex-character+

subindex-character = "a" | "b" | … | "z" | "A" | "B" | … | "Z"

subindex-name = name-character+

name-character = <gsm03.38character excluding <CR> and <LF> >

crlf = <CR> <LF>

service-intro = subindex-id message-id delimiter service-name crlf.

message-id = number+

delimiter = "." | " "

service-name = name-character+

Current version used is 1.

The use of "." as delimiter means that this service is a child subindex of the index structure.

Delimiter " " is used in all other cases.

Subindex-id shall not be used if the service introduced is in the first level of the index. Subindex-id:s are used in alphabetical order within an index message. They can be re-used in a child subindex.

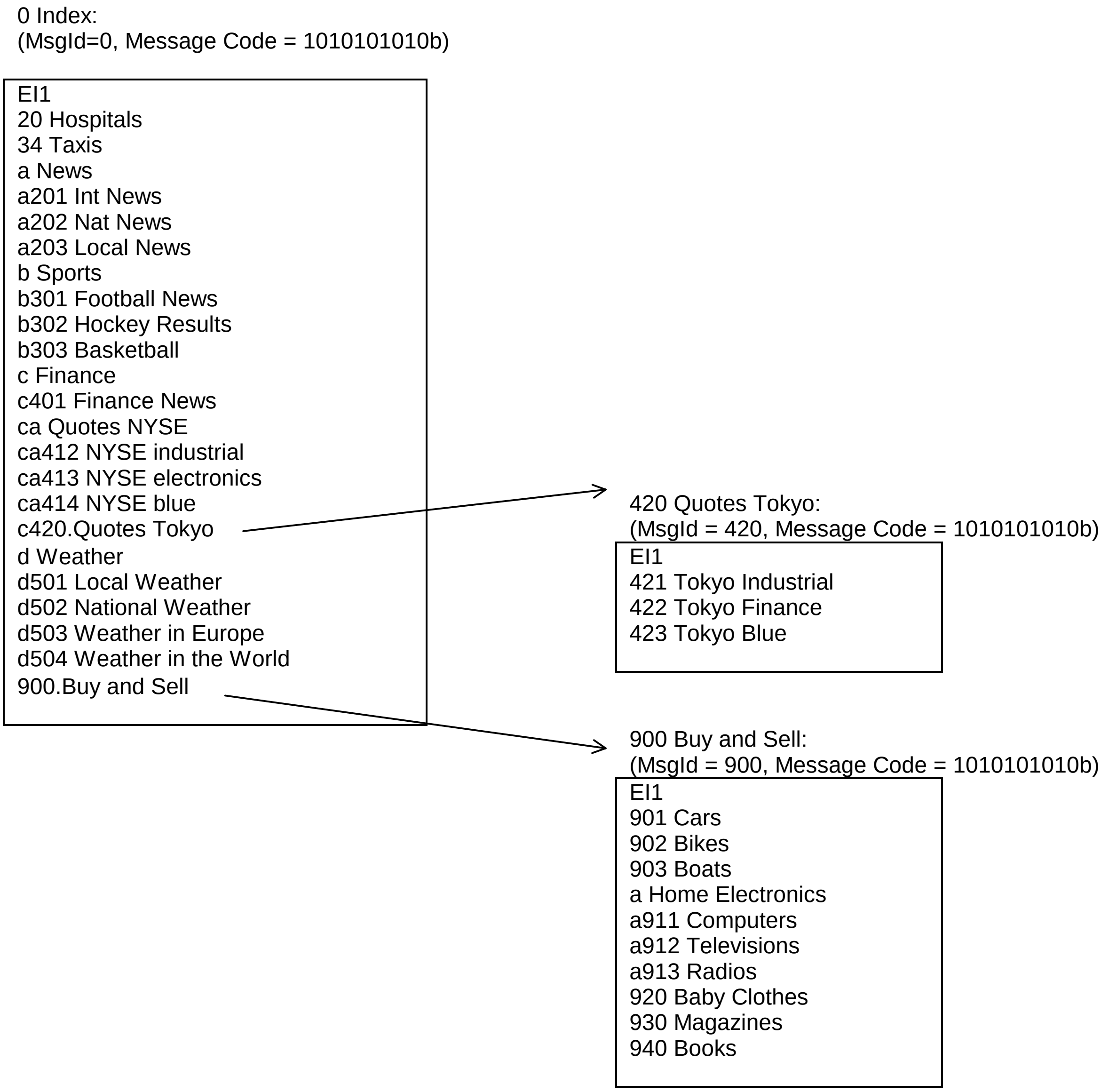


Figure 6

Annex A (informative): Protocols for interconnecting CBC and BSC

The following is applicable for GSM only:

No mandatory protocol between the Cell Broadcast Centre (CBC) and the Base Station Controller (BSC) is specified by GSM; this is a matter of agreement between CBC and PLMN operators.

Some example protocols are provided in GSM 03.49 to assist CBC and PLMN operators. These are based on the following principles, which CBC and PLMN operators are recommended to follow even if they choose not to use one of the examples given in GSM 03.49.

The protocol(s) between CBC and BSC should:

a) provide the service defined for the CBC-BSC interface (see section 9);

b) be based on protocols normally used for communication between switching and/or computer equipment;

c) permit open interconnection - preferably using the OSI stack or equivalent (e.g. CCITT Number 7 Stack).

Annex B (informative): Change Request History

TSG	TSG Tdoc	T2-Tdoc	CR	PH	VERS	NEW VERS	SUBJECT
T#5	TP-99179		New	R99	2.0.0	3.0.0	Transfer of GSM 03.41 v7.1.0 to 3GPP
T#6	TP-99237	T2-991064	001	R99	3.0.0	3.1.0	Adaptation of the scope of TS 23.041 from “GSM only” to “GSM and UMTS”
T#6	TP-99237	T2-991062	002	R99	3.0.0	3.1.0	LCS Utilization of CBS

History

Document history		
V 3.0.0	October 1999	
V 3.1.0	December 1999	

3GPP TSG-T2 #8 / ETSI SMG4
Mexico, Puerto Vallarta, 1-4 February 2000

TSGT2#8(00)47

CHANGE REQUEST

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23.057 CR 001 Current Version: 3.0.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSG-T#7
list expected approval meeting # here ↑

for approval	X	strategic		*(for SMG*
for information		non-strategic		*use only)*

Proposed change affects:
(at least one should be marked with an X)

(U)SIM	ME	UTRAN / Radio	Core Network
	X		

Source: T2 **Date:** 1.02.2000

Subject: Corrections to WAP chapters

Work item: MExE

Category:
(only one category shall be marked with an X)

F	Correction	
A	Corresponds to a correction in an earlier release	X
B	Addition of feature	
C	Functional modification of feature	
D	Editorial modification	

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change: Make corrections to call control description

Clauses affected: 5.3

Other specs affected:

Other 3G core specifications		→ List of CRs:
Other GSM core specifications		→ List of CRs:
MS test specifications		→ List of CRs:
BSS test specifications		→ List of CRs:
O&M specifications		→ List of CRs:

Other comments:

help.doc

<--------- double-click here for help and instructions on how to create a CR.

5.3 Call control

WAP telephony services are written in WML and WMLScript. The WAP Telephony API (WTAI) exposes telephony functions to service authors as a set of libraries. The WTAI function libraries can be accessed from WML as URIs, and from WMLScript as script functions. The following libraries have been specified:

- Public library
  This includes functions that are available in all networks, and can be provided by any third party service provider; and not only the network operator. The user must acknowledge the function before it is carried out. ~~One Three f~~Functions ~~has~~ have been specified, which can~~.~~ ~~It They can~~ be used e.g. to initiate a mobile originated call, send DTMF tones and add phonebook entry.

- Network Common library
  This includes functions that are available in all networks, and can be provided only by the network operator. E.g. ~~F~~functions for advanced call control, accessing the phonebook, and sending and reading network text (SMS) have been specified.

- Network Specific library
  Functions that are only available in certain types of networks, and can be provided only by the network operator. For GSM, e.g. functions for call reject, call hold, call transfer, ~~and~~ multiparty, getting location information and sending USSD have been specified.

The WML and WMLScript author uses the WTAI libraries to create web services for mobile phones with telephony capabilities.

Call control shall be performed using WTA authenticated scripts.

3GPP TSG-T2 #8 / ETSI SMG4
Mexico, Puerto Vallarta, 1-4 February 2000

TSGT2#8(00)49

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

23.057	**CR**	**002**		Current Version:	3.0.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSG-T#7
list expected approval meeting # here ↑

for approval	X	strategic		*(for SMG use only)*
for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects:
(at least one should be marked with an X)

(U)SIM	ME	UTRAN / Radio	Core Network
	X		

Source: T2 **Date:** 02.02.2000

Subject: QoS

Work item: MExE

Category:
(only one category shall be marked with an X)

F	Correction	
A	Corresponds to a correction in an earlier release	X
B	Addition of feature	
C	Functional modification of feature	
D	Editorial modification	

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change: Clarification of the definitions.

Clauses affected: 3.1,3.2, 9

Other specs affected:

Other 3G core specifications		→ List of CRs:
Other GSM core specifications		→ List of CRs:
MS test specifications		→ List of CRs:
BSS test specifications		→ List of CRs:
O&M specifications		→ List of CRs:

Other comments:

help.doc

<--------- double-click here for help and instructions on how to create a CR.

3 Definitions and abbreviations

3.1 Definitions

For the purposes of this TS the following definitions apply:

administrator: The administrator of the MExE MS is the entity which has the control of the third party trusted domain, and all resources associated with the domain. The administrator of the device could be the user, the operator, the manufacturer, the service provider, or a third party as designated by the owner of the device.

best effort QoS (Quality of Service): ~~The bearer network delivers best effort QoS where it cannot or will not deliver any guaranteed QoS.~~ The best effort QoS refers to ~~is~~ the lowest of all QoS ~~levels~~ traffic classes. If the guaranteed QoS cannot be delivered, the bearer network delivers the QoS which can also be called best effort QoS.[28].

certificate: An entity that contains the issuer's public key, identification of the issuer, identification of the signer, and possibly other relevant information. Also, a certificate contains a signed hash of the contents. The signer can be a 3rd. party other than the issuer.

delivered QoS: ~~The measured~~ Actual QoS parameter values with which the content was delivered over the lifetime of a QoS session. [28]

fine grain: Refers to the capabilities of the Java security system to allow applications, sections of code or Java classes to be assigned permissions to perform a specific set of privileged operations. The smallest programming element that can be given permission attributes is a Java class [19]

key pair: Key pairs are matching private and public keys. If a block of data is encrypted using the private key, the public key from the pair can be used to decrypt it. The private key is never divulged to any other party, but the public key is available, e.g. in a certificate.

negotiated QoS: In response to a QoS request, the network shall negotiate each QoS attribute to a level that is in accordance with the available network resources. After QoS negotiation, the bearer network shall always attempt to provide adequate resources to support all of the negotiated QoS profiles. [31]

personal certificate: This is a certificate loaded by the user or a user application which is limited to the application that it is intended for, and is not a MExE Certificate. E.g. an e-mail application could load certificates for its usage. Personal certificates are out of scope for MExE.

phonebook: A phonebook is a dataset of personal or entity attributes. The simplest form is a set of name-number pairs as supported by GSM SIMs.

MExE: MExE (Mobile station application Execution Environment) is defined in detail in this document, but the scope of MExE does not include the operating system, or the manufacturer's execution environment.

MExE certificate: This is a certificate used in the realisation of MExE security domains. A MExE Certificate can be used to verify downloaded MExE executables. Use of the word "certificate" in this document implies a MExE certificate. Other varieties of certificate will be explicitly qualified as a e.g. "Personal Certificate".

MExE executable: An executable is an applet, application, or executable content, which conforms to the MExE specification and may execute on the ME.

MExE Java VM: This is a standard Java virtual machine used to execute MExE Java applets and applications

MExE native library: This is a downloaded native library that can be accessed by MExE executables

MExE-SIM: A SIM that is capable of storing a security certificate that is accessible using standard mechanisms..

owner: An owner of the MExE MS. An owner could be a user, operator (e.g. where the MS is obtained as part of a subscription and the cost of the MS is subsidised), service provider, or a third party (e.g. the MS is owned by the user's company and this company wishes to control how the MS is used)

power up event: An abstract event that occurs when the MExE MS is cold started (i.e. switched on).

QoS session: Lifetime of PDP context. The period between the opening and closing of a network connection whose characteristics are defined by a QoS profile. Multiple QoS sessions may exist, each with a different QoS profile. [28]

~~quality of service (~~QoS~~)~~ profile: A QoS profile comprises of a number of QoS parameters. A QoS profile is associated with each QoS session. The QoS profile defines the performance expectations placed on the bearer network. [28]

requested QoS: A QoS profile is requested at the beginning of a QoS session. QoS modification requests are also possible during the lifetime of a QoS session. [28],[31]

sandbox: A sandbox is a safe area to run Java code. Untrusted Java code executing in a sandbox has access to only certain resources [18]

service: A service (which may consist of an application or applet, and its related content) is a set of functions offered to a user by an organisation, and may be performed on the MExE MS and/or remotely

service name: An identifier associated with a service, which could be a string, a fully qualified Java class name, a unique URI or other identifier.

session: The period between the launching of a MExE executable and its execution termination. A WAP-session is established between the mobile and the WAP Gateway. The duration of a WAP-session can range from a second to years. The WAP-session can be associated with a particular subscription in the WAP Gateway.

signature: "Signing" is the process of encrypting a hash of the data using a private key. If the signature can be decrypted using the public key, then the signature is valid.

signed JAR file: Archives of Java classes or data that contain signatures that also include a way to identify the signer in the manifest. (The Manifest contains a file which has attributes defined in it.)

subscribed QoS: The network will not grant a QoS greater than that subscribed. The QoS profile subscription parameters are held in the HLR ~~[31]~~. An end user may have several QoS subscriptions. For security and the prevention of damage to the network, the end user cannot directly modify the QoS subscription profile data. [31]

user: The user of the MExE MS

Further definitions specific to MExE are in GSM given in 3G TS 22.057 (MExE stage 1) [2].

3.2 Abbreviations

For the purposes of this TS the following abbreviations apply:

API	Application Programming Interface
APDU	Application protocol data unit

CA	Certification Authority
CC/PP	Composite Capability/Preference Profiles
Diff-serv	Differentiated Services
CGI	Common Gateway Interface
CCM	Certificate Configuration Message
CP-Admin	Certificate Present (in the MExE SIM) - Administrator
CP-TP	Certificate Present (in the MExE SIM) - Third Party
DHCP	Dynamic Host Configuration Protocol
GSM	Global System for Mobile Communication
GPRS	General Packet Radio Service
HTTP	HyperText Transfer Protocol
HTTPS	HyperText Transport Protocol Secure (https is http/1.1 over SSL, i.e. port 443)
IETF	Internet Engineering Task Force
IP	Internet Protocol
JNDI	Java Naming Directory Interface
JTAPI	Java Telephony Application Programming Interface
JAR file	Java Archive File
MMI	Man-Machine Interface
MSE	MExE Service Environment
OCF	OpenCard Framework
QoS	Quality of Service
PDP	Packet Data Protocol
RDF	Resource Description Format
RFC	Request For Comments
SAP	Service Access Point
SMS	Short Message Service
TLS	Transport Layer Security
TP	Third Party
UDP	User Datagram Protocol
UE	User Equipment
UI	User Interface
UMTS	Universal Mobile Telecommunications System
URL	Uniform Resource Locator
URI	Uniform Resource Identifier
USSD	Unstructured Supplementary Service Data
WAE	Wireless Application Environment
WAP	Wireless Application Protocol
WDP	Wireless Datagram Protocol
WSP	Wireless Session Protocol
WTA	Wireless Telephony Applications
WTAI	Wireless Telephony Applications Interface
WTLS	Wireless Transport Layer Security
WTP	Wireless Transaction Protocol
WWW	World Wide Web

Further abbreviations are given in 3G TS 22.057 (MExE stage 1) [2] and GSM 01.04 [1].

9 Quality of Service

QoS aware MExE executables may be executing on the MExE device. To ensure correct operation with the QoS provisioning of the bearer network(s) the associated API's and the MExE QoS manager shall be supported by MExE MS supporting bearers defined by QoS– see figure 13. Non QoS aware MExE executables shall operate with the defined QoS by the user or the network.

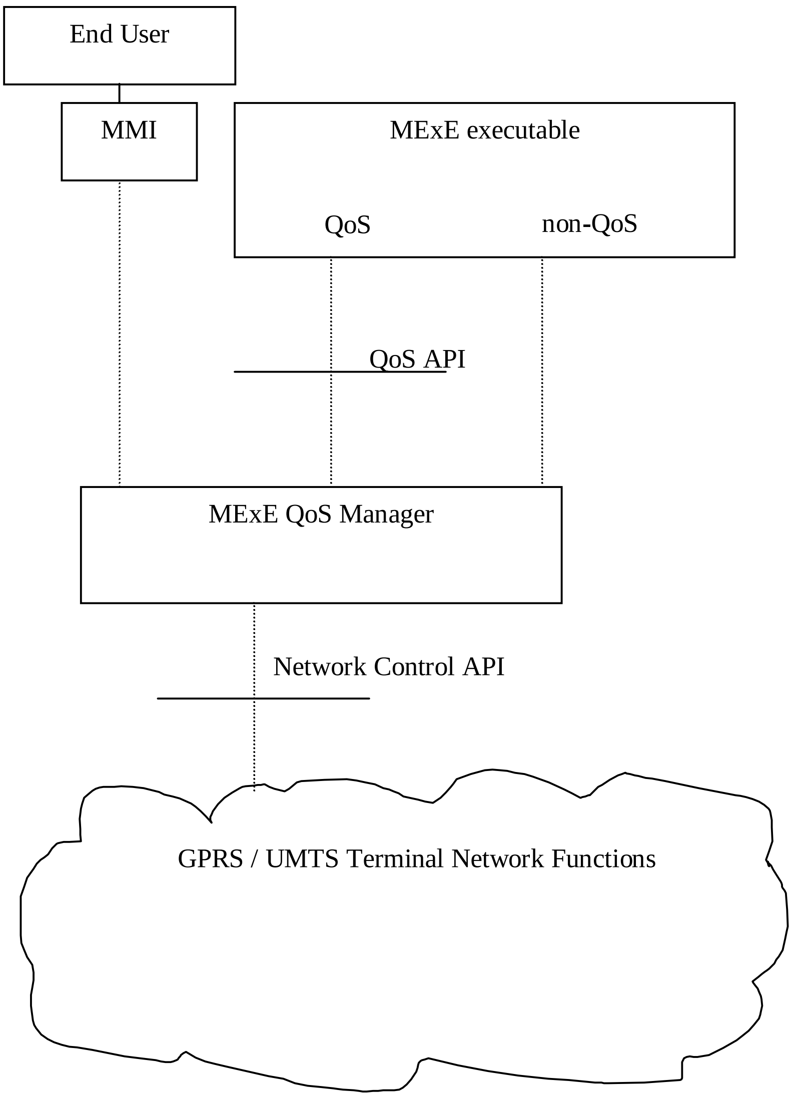

Figure 13: Logical MExE Terminal QoS manager elements

9.1 MExE QoS Support

A MExE QoS manager exists between the MExE executable and the Network Control API. To interface this, an API to the MExE executable is provided and another API to the network, see figure 13. The MExE QoS functions accommodates standard methods of end to end QoS provisioning – e.g. differentiated services (Diff-serv).

For MExE devices supporting bearers defined by QoS, the MExE device shall support the following basic QoS operations :-

a mapping between the QoS requirements of the MExE executable and the network layer

MExE executables shall be able to indicate and interpret QoS values of the network via the MExE QoS Manager

MExE executables shall be able to modify the QoS dynamically

MExE executables shall be able to react to changes in the provided QoS

The end user shall be able to manage the QoS directly via the MMI.

MExE introduces two new elements to cater for QoS – the MExE QoS manager and the QoS API. The MExE QoS manager shall handle the fact that the network may not have QoS capabilities.

9.2 MExE QoS Manager

The MExE QoS manager is responsible for:

Managing the QoS streams for MExE executables

Notification of the negotiated and delivered QoS to the end user / MExE executable

The MExE QoS manager shall support the MExE QoS API according to the bearer supported by the device, and provide functions such as:-

- insert additional QoS signalling parameters (e.g. Diff-serv)
- add the functionality of the MExE QoS API at best effort, if the network does not support it directly
- translate between the QoS parameters from the MExE executable and those of the network
- monitor the QoS delivered by the network and manage QoS requests between the MExE executable and the network
- be informed by the MExE executable of the requested QoS traffic class.
- be informed by the MExE executable of ~~minimum~~ the lowest QoS traffic class which can be accepted by the MexE executable.
- attempt to re-negotiate the QoS if ~~it falls below a threshold.~~ it falls below the lowest QoS traffic class.

The MExE QoS manager may request information from the network regarding the QoS available.

The MExE QoS manager does not need to know the end user's subscribed QoS, this is held within the network and used to validate a requested QoS level.

The MExE QoS manager may also be accessed through the device's MMI.

9.3 Network Control API

The network control API shall provide the QoS manager with access to the network specific QoS control (defined for GPRS/UMTS in [29] and [30].

The MExE QoS manager may perform some QoS control, if it is not provided in the network control.

9.4 QoS API

The QoS API provides the MExE executable with an interface to the QoS management. It does not require the MExE executable to have any knowledge of the underlying network, or how QoS is implemented in the network.

The QoS API shall provide the MExE executable with a standard set of parameters . Refer to [28] for details of these parameters[1].

Table 5 shows the set of example parameters.

Parameter	Units	Type
Token Bucket Rate	bytes /sec	32-bit IEEE floating point number
Token Bucket Size	bytes	32-bit IEEE floating point number
Peak Data Rate	bytes/sec	32-bit IEEE floating point number
Minimum Policed Unit	bytes	32-bit integer
Maximum Packet Size	bytes	32-bit integer
Latency	micro secs	32-bit integer
Delay Variation	micro secs	32-bit integer
Service Type		service type

Table 5: Example parameters

As a minimum the following three parameters shall be supported by the MExE QoS manager:-

Token Bucket Rate

Token Bucket Size

Peak Data Rate

Note: The discussion of UMTS bearer service parameters as well as radio access bearer parameters is still going on. Especially the bitrate parameters and reliability parameter are under discussion [28].

[1] The FLOWSPEC parameters, defined by the IETF Integrated Services Working Group, provide the QoS information required by QoS capable network elements.

If the MExE executable does not provide a full set of QoS parameters, then the MExE QoS manager shall the provide QoS parameters based on information available to it (e.g. from the MMI settings), see subclause 'Sources of UMTS Bearer Service Parameters'.

9.5 Sources of Bearer Service Parameters

A set of QoS parameters (QoS profile) specify the service provided to the user by the network. At bearer service establishment or modification different QoS profiles have to be taken into account. This is based on:-

- The UE capabilities
- The UE or the TE within the terminating network
- A QoS profile in the QoS subscription (describes the upper limits)
- Default QoS profile (of the user or network)
- A Network specific QoS profile characterising for example the current resource availability or other network capabilities.

9.6 QoS Streams

Several MExE executables may be executing in the MExE device, each with a different QoS requirement. Also, a MExE executable may operate several QoS streams, each with different parameter settings. The MExE QoS manager within the MExE device shall be able to deal with each stream independently.

9.7 QoS Security

Only the end user, MExE executable or the network using a QoS stream should be able to modify the QoS of that stream.

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Puerto Vallarta, Mexico, 1-4 February 2000

***Document* T2-000058**
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

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27.007 CR 023 Current Version: 3.3.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSG-T#7	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑	for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: (U)SIM [ ] ME [X] UTRAN / Radio [ ] Core Network [ ]
(at least one should be marked with an X)

Source: T2 **Date:** 1 Feb 2000

Subject: Deletion of the AT+CPROT? read command

Work item: TEI

Category: *(only one category shall be marked with an X)*

F	Correction	X	**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature			Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change: In the functional behaviour of the AT+CPROT command, the read command is non significant.

Clauses affected: 2, 8.41

Other specs affected:

Other 3G core specifications		→ List of CRs:	
Other GSM core specifications		→ List of CRs:	
MS test specifications		→ List of CRs:	
BSS test specifications		→ List of CRs:	
O&M specifications		→ List of CRs:	

Other comments:

help.doc

<--------- double-click here for help and instructions on how to create a CR.

2 References

[43] Infrared Data Association; Specification of Ir Mobile Communications (IrMC) ~~version 1.1, March 01,1999~~

[44] IrDA Object Exchange Protocol ~~version 1.2, March 18, 1999~~

8.41 Enter protocol mode+CPROT

Table 95~~XX~~ : +CPROT parameter command syntax

Command	Possible response(s)
+CPROT=<proto>[,<version> [,<lsap1>[,...[<lsapN>]]]]	CONNECT NO CARRIER OK ERROR *+CME ERROR: <err>*
~~+CPROT?~~	~~+CPROT : <proto>[,<version>[,<lsap1> [,...[,<lsapN]]]]~~
+CPROT=?	+CPROT: <proto1>[,(list of supported <version>s)[,(list of supported <lsap1>s)[,...[,(list of supported <lsapN>s)]]]] [<CR><LF> +CPROT : <proto2>[,(list of supported <version>s)[,(list of supported <lsap1>s)[,...[,(list of supported <lsapN>s)]]]]] [...]]]]]

Description

Set command informs TA that TE wants to establish a peer-to-peer protocol <proto> or upper layer connection (indicating by the <lsap>s setting) with the ME on the link from which the command was received.
This command can be used in case the link between TE and ME does not provide itself such a mechanism.

If ME has succeeded in establishing a logical link between application protocols and external interface, it will send CONNECT message to the TE. Otherwise, the NO CARRIER response will be returned.

If the CONNECT response is received, TE can start sending <proto> or upper layer frames.

The connection shall always return for <proto> mode when the protocol session is ended. When the ME receives a disconnect request from its peer entity, it will process it and send OK response to the TE indicating its capability for receiving new AT commands. Since <proto> or upper layers can be accessed in other ways, TA must have pre-knowledge of the fact that connection is initiated with AT+CPROT command. This means that switch to <proto> mode must include some sort of notification to the protocol entity.

This command can be aborted by sending a <proto> or upper layer disconnection frame. In that case, ME will return in command mode by sending the OK response.

Refer subclause 9.2 for possible <err> values.

~~Read command return the current <proto> optionally including <version> and <lsapI> settings.~~

Test command returns values supported by the TA as a compound value.

Defined values

<proto>

0 OBEX (refer.[44~~x2~~])

…15reserved by this TS

16... manufacturer specific

`<version>:` version number of `<proto>`. String type.~~>. The total number of characters, including line terminators, in the information text shall not exceed 2048 characters.~~

`<lsap1>:` defines a level of service or application protocol on the top of `<proto>` layer. It may refer to services or protocols defined in other standards development organisations (SDOs).

1 IrMC level 1 (Minimum Level) Only .(refer [43~~x1~~] subclause 2.9.4)

2 IrMC level 1 and 2 (Minimum and Access Levels) Only. .(refer [43~~x1~~] subclause 2.9.4)

4 IrMC level 1, 2 and 3 (Minimum, Access, Index Levels) Only- implies static index support. .(refer [43~~x1~~] subclause 2.9.4)

8 IrMC level 1, 2 and 4 (Minimum, Access and Sync Levels) Only-implies unique index support. .(refer [43~~x1~~] subclause 2.9.4)

10 IrMC level 1, 2, 3 and 4 (Minimum, Access, Index and Sync Levels)-implies support of static and unique index. .(refer [43~~x1~~] subclause 2.9.4)

…15 reserved by this TS

16... manufacturer specific

`<lsap2>...<lsapN>`

In case <lsapN>,<lsapN+1> received in the +CPROT command identifies protocol layers, the protocol identified by N+1 shall be on the top of the protocol identified by N on a framework point of view.

0…15 reserved by this TS

16... manufacturer specific

Implementation

Optional.

3GPP TSG-T2 meeting #8
Puerto Vallarta, Mexico, 1-4 February 2000

***Document* T2- 000071**

e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

27.007	**CR**	**024**		Current Version:	3.3.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	TSG-T#7	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)*	(U)SIM		ME	X	UTRAN / Radio		Core Network	

Source:	T2	**Date:**	06/02/2000
Subject:	Additional format(4 digits) for +CCLK		
Work item:	Technical Enahncements		

Category:	F	Correction		**Release:**	Phase 2	
	A	Corresponds to a correction in an earlier release			Release 96	
(only one category	B	Addition of feature	X		Release 97	
shall be marked	C	Functional modification of feature			Release 98	
with an X)	D	Editorial modification			Release 99	X
					Release 00	

Reason for change:	`To allow 4 digits format for year field`
Clauses affected:	8.15

Other specs affected:	Other 3G core specifications		→ List of CRs:	
	Other GSM core specifications		→ List of CRs:	
	MS test specifications		→ List of CRs:	
	BSS test specifications		→ List of CRs:	
	O&M specifications		→ List of CRs:	

Other comments:	

help.doc

<--------- double-click here for help and instructions on how to create a CR.

8.15 Clock +CCLK

Table 1: +CCLK parameter command syntax

Command	Possible response(s)
+CCLK=<time>	*+CME ERROR: <err>*
+CCLK?	+CCLK: <time>[<CR><LF>+CCLK: <time>] *+CME ERROR: <err>*
+CCLK=?	+CCLK: (list of supported <time>s)

Description

Set command sets the real-time clock of the ME. If setting fails in an ME error, `+CME ERROR: <err>` is returned. Refer subclause 9.2 for `<err>` values.

Read command returns the current setting of the clock. If a 4-digit year is supported, two successive result strings must be returned; the first one representing the year in 2 digits and the second one representing the year in 4 digits.

Test command returns formats supported by TA as a compound value. If TA supports "yy/MM/dd,hh:mm:ss±zz" and "yyyy/MM/dd,hh:mm:SS±zz ", +CCLK:("yy/MM/dd,hh:mm:ss±zz", "yyyy/MM/dd,hh:mm:ss±zz")is returned.

Defined values

`<time>`: string type value; format is "yy/MM/dd,hh:mm:ss±zz", where characters indicate year (two last digits), month, day, hour, minutes, seconds and time zone (indicates the difference, expressed in quarters of an hour, between the local time and GMT; range -47...+48). E.g. 6th of May 1994, 22:10:00 GMT+2 hours equals to "94/05/06,22:10:00+08"
Optionally format "yyyy/MM/dd,hh:mm:SS±zz ", where characters indicate year (four digits),month, day, hour, minutes, seconds and time zone. E.g. 6th of May 1994, 22:10:00 GMT+2 hours equals to "1994/05/06, 22:10:00+08".

NOTE: If ME does not support time zone information then the three last characters of <time> are not returned by +CCLK?.

Implementation

Optional.

Technical Specification

3rd Generation Partnership Project; Technical Specification Group Terminals; AT command set for 3GPP User Equipment (UE) (3G TS 27.007 version 3.4~~3~~.0)

Reference

DTS/TSGT-0227007U

Keywords

<keyword[, keyword]>

3GPP

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Contents

Foreword

This Technical Specification has been produced by the 3GPP.

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of this TS, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 Indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the specification;

~~Introduction~~

~~In order to make it easier for readers of this document to find release 97 and release 98 features compared to the release 96 version, special markers are used in the text. The following table lists all the new release 97 and release 98 features and the corresponding marker for each feature.~~

~~Feature~~	~~Designator~~
~~Technical enhancement and improvement: New AT-commands~~	~~$(AT R97)$~~
~~Technical enhancement and improvement: New AT-commands~~	~~$(AT R98)$~~
~~Support of Multiplexer according to GSM 07.10~~	~~$(MUX MS-TE)$~~

1 Scope

The present document~~is Specification~~ specifies a profile of AT commands and recommends that this profile be used for controlling Mobile Equipment (ME) functions and GSM/UMTS network services from a Terminal Equipment (TE) through Terminal Adaptor (TA). The command prefix `+C` is reserved for Digital Cellular in ITU-T Recommendation V.25ter [14]. This TS has also the syntax details used to construct these extended ~~GSM~~GSM/UMTS commands. Commands from ITU-T Recommendation V.25ter [14] and existing digital cellular standards (TIA IS-99 [15] and TIA IS-135 [16]) are used whenever applicable. Some of the new commands are defined such way that they can be easily applied to ME of networks other than ~~GSM~~GSM/UMTS. ITU-T T.31 [11] and T.32 [12] fax AT commands may be used for ~~GSM~~GSM/UMTS fax transmission from TE. ~~GSM~~GSM/UMTS Short Message Service AT commands are defined in ~~GSM 07.05~~3G TS 27.005 [24]. GPRS AT commands are defined in clause 10 of this specification. This TS assumes an abstract architecture comprising a TE (e.g. a computer) and a ME interfaced by a TA (see figure 1). The span of control of the defined commands should allow to handle any physical implementation that this abstract architecture may lead to:

- TA, ME and TE as three separate entities;
- TA integrated under the ME cover, and the TE implemented as a separate entity;
- TA integrated under the TE cover, and the ME implemented as a separate entity;
- TA and ME integrated under the TE cover as a single entity.

The commands described in this TS may be observed on the link between the TE and the TA. However, most of the commands retrieve information about the ME, not about the TA.

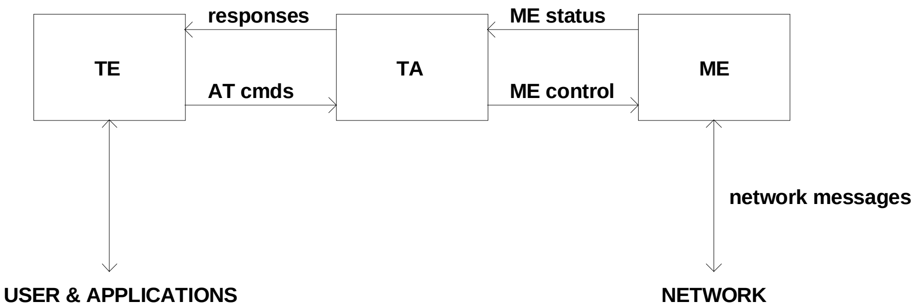

Figure 1: Setup

Interface between TE and TA is intended to operate over existing serial (ITU-T Recommendation V.24) cables, infrared link, and all link types with similar behaviour. For correct operation many of the defined commands require eight bit data and therefore it is recommended that TE-TA link is set to eight bits/ byte mode. (For infrared operation implementation refer informative references IrDA. For embedding AT commands and data during on-line data state refer TIA-617/ITU-T V.80.) Interface between TA and ME is dependent on the interface in the ME.

2 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.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

~~• For this Release 1998 document, references to GSM documents are for Release 1998 versions (version 7.x.y).~~

[1] 3G TS~~GSM~~ 2~~0~~2.002: "~~Digital cellular telecommunication system (Phase 2+);~~ Bearer Services (BS) supported by a GSM Public Land Mobile Network (PLMN)".

[2] ~~GSM~~ 3G TS 2~~0~~2.003: "~~Digital cellular telecommunication system (Phase 2+);~~ Teleservices supported by a GSM Public Land Mobile Network (PLMN)".

[3] 3G TS~~GSM~~ 2~~0~~2.081: "~~Digital cellular telecommunication system (Phase 2+);~~ Line identification supplementary services - Stage 1".

[4] 3G TS~~GSM~~ ~~0~~22.082: "~~Digital cellular telecommunication system (Phase 2+);~~ Call Forwarding (CF) supplementary services - Stage 1".

[5] 3G TS~~GSM~~ 2~~0~~2.083: "~~Digital cellular telecommunication system (Phase 2+);~~ Call Waiting (CW) and Call Hold (HOLD) supplementary services - Stage 1".

[6] 3G TS~~GSM~~ 2~~0~~2.088: "~~Digital cellular telecommunication system (Phase 2+);~~ Call Barring (CB) supplementary services - Stage 1".

[7] 3G TS~~GSM~~ 2~~0~~3.003: "~~Digital cellular telecommunication system (Phase 2+);~~ Numbering, addressing and identification".

[8] GSM 04.08: "Digital cellular telecommunication system (Phase 2+); Mobile radio interface layer 3 specification".

[9] GSM MoU SE.13, GSM MoU Permanent Reference Document SE.13: "GSM Mobile Network Codes and Names".

[10] ITU-T Recommendation E.212: "Identification plan for land mobile stations".

[11] ITU-T Recommendation T.31: "Asynchronous facsimile DCE control, service class 1".

[12] ITU-T Recommendation T.32: "Asynchronous facsimile DCE control, service class 2".

[13] ITU-T Recommendation T.50: "International Reference Alphabet (IRA) (Formerly International Alphabet No. 5 or IA5) - Information technology - 7-bit coded character set for information exchange".

[14] ITU-T Draft new Recommendation V.25ter: "Serial asynchronous automatic dialling and control".

[15] Telecommunications Industry Association TIA IS-99: "Data Services Option Standard for Wideband Spread Spectrum Digital Cellular System".

[16] Telecommunications Industry Association TIA IS-135: "800 MHz Cellular Systems, TDMA Services, Async Data and Fax".

[17] Portable Computer and Communications Association PCCA STD-101 Data Transmission Systems and Equipment: "Serial Asynchronous Automatic Dialling and Control for Character Mode DCE on Wireless Data Services".

[18] 3G TS~~GSM~~ 2~~0~~4.022: "~~Digital cellular telecommunication system (Phase 2+);~~ Radio Link Protocol (RLP) for data and telematic services on the Mobile Station - Base Station System (MS - BSS) interface and the Base Station System - Mobile-services Switching Centre (BSS - MSC) interface".

[19] 3G TS~~GSM~~ 2~~0~~2.030: "~~Digital cellular telecommunication system (Phase 2+);~~ Man Machine Interface (MMI) of the Mobile Station (MS)".

[20] GSM 05.08: "Digital cellular telecommunication system (Phase 2+); Radio subsystem link control".

[21] 3G TS~~GSM~~ 2~~0~~2.085: "~~Digital cellular telecommunication system (Phase 2+);~~ Closed User Group (CUG) supplementary services - Stage 1".

[22] 3G TS~~GSM~~ 2~~0~~2.084: "~~Digital cellular telecommunication system (Phase 2+);~~ MultiParty (MPTY) supplementary services - Stage 1".

[23] 3G TS~~GSM~~ 2~~0~~2.090: "~~Digital cellular telecommunication system (Phase 2+); Stage 1 description of~~ Unstructured Supplementary Service Data (USSD) - Stage 1".

[24] 3G TS~~GSM~~ 2~~0~~7.005: "~~Digital cellular telecommunication system (Phase 2+);~~ Use of Data Terminal Equipment - Data Circuit terminating Equipment (DTE - DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)".

[25] 3G TS~~GSM~~ 2~~0~~3.038: "~~Digital cellular telecommunication system (Phase 2+);~~ Alphabet and language specific information".

[26] 3G TS~~GSM~~ 2~~0~~2.024: "~~Digital cellular telecommunication system (Phase 2+);~~ Description of Charge Advice Information (CAI)".

[27] 3G TS~~GSM~~ 2~~0~~2.086: "~~Digital cellular telecommunication system (Phase 2+);~~ Advice of Charge (AoC) supplementary services - Stage 1".

[28] GSM 11.11: "Digital cellular telecommunication system (Phase 2+); Specification of the Subscriber Identity Module - Mobile Equipment (SIM-ME) interface".

[29] 3G TS~~GSM~~ 2~~0~~2.034: "~~Digital cellular telecommunication system (Phase 2+);~~ High Speed Circuit Switched Data (HSCSD) - Stage 1".

[30] 3G TS~~GSM~~ 2~~0~~2.091: "~~Digital cellular telecommunication system (Phase 2+);~~ Explicit Call Transfer (ECT) supplementary service - Stage 1".

[31] 3G TS~~GSM~~ 2~~0~~2.072: "~~Digital cellular telecommunication system (Phase 2+);~~ Call Deflection (CD) supplementary service - Stage 1".

[32] ISO/IEC10646: "Universal Multiple-Octet Coded Character Set (UCS)"; UCS2, 16 bit coding.

[33] 3G TS~~GSM~~ 2~~0~~2.022: "~~Digital cellular telecommunication system (Phase 2+);~~ Personalisation of GSM Mobile Equipment (ME) Mobile functionality specification".

[34] 3G TS~~GSM~~ 2~~0~~7.060: "~~Digital cellular telecommunication system (Phase 2+);~~ General requirements on Mobile Stations (MS) supporting General Packet Radio Bearer Service (GPRS)".

[35] CCITT Recommendation V.110: "Support of data terminal equipments (DTEs) with V-Series interfaces by an integrated services digital network".

[36] CCITT Recommendation V.120: "Support by an ISDN of data terminal equipment with V-Series type interfaces with provision for statistical multiplexing".

[37] ITU-T Recommendation X.31: "Support of packet mode terminal equipment by an ISDN".

[38] GSM 05.05: "Digital cellular telecommunication system (Phase 2+); Radio transmission and reception".

[39] 3G TS~~GSM~~ 2~~0~~9.061: "~~Digital cellular telecommunication system (Phase 2+);~~ General Packet Radio Service (GPRS); Interworking between the Public Land Mobile Network (PLMN) supporting GPRS and Packet Data Networks (PDN)".

[40] 3G TS 23.081: "3rd Generation Partnership Project; Technical Specification Group Core Network; Line identification supplementary services - Stage 2".

[41] 3G TS 27.001: "3rd Generation Partnership Project; Technical Specification Group Core Network; General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".

[42] 3G TS 29.007: "3rd Generation Partnership Project; Technical Specification Group Core Network; General requirements on interworking between the Public Land Mobile Network (PLMN) and the Integrated Services Digital Network (ISDN) or Public Switched Telephone Network (PSTN)".

[43] Infrared Data Association; Specification of Ir Mobile Communications (IrMC) version 1.1, March 01,1999

[44] IrDA Object Exchange Protocol version 1.2, March 18, 1999

[45] 3G TS 27.010: "Terminal Equipment to User Equipment (TE-UE) multiplexer protocol User Equipment (UE)"

[46] 3G TS 23.107: "Quality of Service, Concept and Architecture".

[47] 3G TS 23.060: "General Packet Radio Service (GPRS) Service description; Stage 2".

3 Abbreviations and definitions

3.1 Abbreviations

For the purposes of this TS, the following abbreviations apply:

AT	ATtention; this two-character abbreviation is always used to start a command line to be sent from TE to TA
BCD	Binary Coded Decimal
ETSI	European Telecommunications Standards Institute
FTM	Frame Tunnelling Mode (refer 3G TS 27.001 [41] and 3G TS 29.007[42])
HSCSD	High Speed Circuit Switched Data
IHOSS	Internet Hosted Octet Stream Service
IMEI	International Mobile station Equipment Identity
IRA	International Reference Alphabet (ITU-T T.50 [13])
IrDA	Infrared Data Association
ISO	International Standards Organisation
ITU-T	International Telecommunication Union - Telecommunications Standardization Sector
ME	Mobile Equipment, e.g. a GSM phone (equal to MS; Mobile Station)
MoU	Memorandum of Understanding (GSM operator joint)
OSP	Octet Stream Protocol
OSP:IHOSS	Octet Stream Protocol for Internet Hosted Octet Stream Service
PCCA	Portable Computer and Communications Association
RDI	Restricted Digital Information
RLP	Radio Link Protocol
SIM	Subscriber Identity Module
TA	Terminal Adaptor, e.g. a GSM data card (equal to DCE; Data Circuit terminating Equipment)
TE	Terminal Equipment, e.g. a computer (equal to DTE; Data Terminal Equipment)
TIA	Telecommunications Industry Association
UDI	Unrestricted Digital Information

3.2 Definitions

For the purposes of this TS, the following syntactical definitions apply (refer also clause 4):

<CR> Carriage return character, which value is specified with command S3.

<LF> Linefeed character, which value is specified with command S4.

<...> Name enclosed in angle brackets is a syntactical element. Brackets themselves do not appear in the command line.

`[...]`	Optional subparameter of a command or an optional part of TA information response is enclosed in square brackets. Brackets themselves do not appear in the command line. When subparameter is not given in *parameter type* commands, new value equals to its previous value. In *action type* commands, action should be done on the basis of the recommended default setting of the subparameter.
underline	Underlined defined subparameter value is the recommended default setting of this subparameter. In *parameter type* commands, this value should be used in factory settings which are configured by V.25ter [14] command `&F0`. In *action type* commands, this value should be used when subparameter is not given.

4 AT command syntax

This clause summarizes general aspects on AT commands and issues related to them. For further information refer ITU-T Recommendation V.25ter [14].

4.1 Command line

See figure 2 for general structure of a command line. Standardized *basic* commands are found only in V.25ter [14]. ~~GSM~~GSM/UMTS commands use syntax rules of *extended* commands. Every extended command has a *test command* (trailing `=?`) to test the existence of the command and to give information about the type of its subparameters. *Parameter type* commands also have a *read command* (trailing `?`) to check the current values of subparameters. *Action type* commands do not store the values of any of their possible subparameters, and therefore do not have a read command.

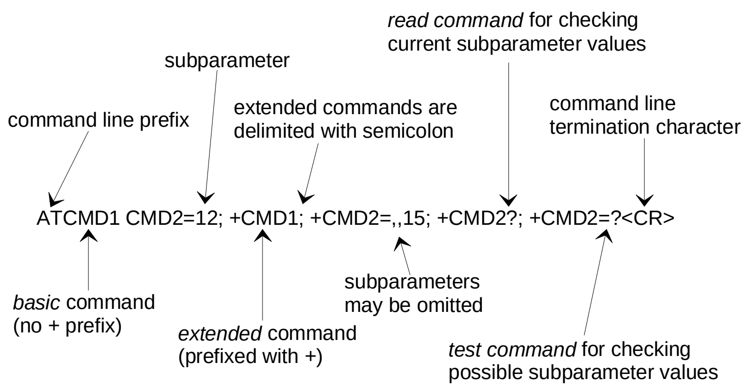

Figure 2: Basic structure of a command line

If verbose responses are enabled with command `V1` and all commands in a command line has been performed successfully, result code `<CR><LF>OK<CR><LF>` is sent from the TA to the TE. If numeric responses are enabled with command `V0`, result code `0<CR>` is sent instead.

If verbose responses are enabled with command `V1` and subparameter values of a command are not accepted by the TA (or command itself is invalid, or command cannot be performed for some reason), result code `<CR><LF>ERROR<CR><LF>` is sent to the TE and no subsequent commands in the command line are processed. If numeric responses are enabled with command `V0`, result code `4<CR>` is sent instead. `ERROR` (or `4`) response may be replaced by `+CME ERROR: <err>` (refer clause 9) when command was not processed due to an error related to ME operation.

4.2 Information responses and result codes

The TA response for the example command line of figure 2 could be as shown in figure 3. Here, verbose response format is enabled with command `V1`. If numeric format `V0` would have been used, `<CR><LF>` headers of *information responses* would have been left out and *final result code* changed to `0<CR>`.

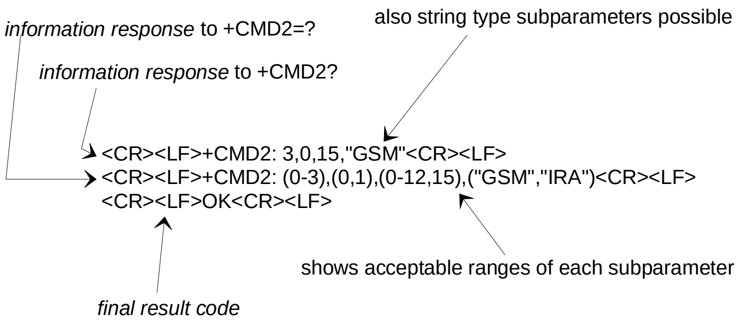

Figure 3: Response to a command line

So called *intermediate result codes* inform about progress of TA operation (e.g. connection establishment `CONNECT`), and so called *unsolicited result codes* indicate occurrence of an event not directly associated with issuance of a command from TE (e.g. ring indication `RING`).

4.3 ITU-T V.25ter [14] TE-TA interface commands

Table 1 summarizes V.25ter [14] commands relating to command line and response formatting, and TA-TE interface operation. All are applicable to ~~GSM~~GSM/UMTS terminals.

Table 1: V.25ter commands relating to TE-TA interface

Command	Section	Impl.	Use in ~~GSM~~GSM/UMTS
S3=[<value>]	6.2.1	mand.	command line termination character (mandatory default setting IRA 13)
S4=[<value>]	6.2.2	mand.	response formatting character (recommended default IRA 10)
S5=[<value>]	6.2.3	mand.	command line editing character (recommended default IRA 8)
E[<value>]	6.2.4	mand.	command echo (recommended default 1 i.e. TA echoes commands back)
Q[<value>]	6.2.5	mand.	result code suppression (recommended default 0 i.e. TA transmits result codes)
V[<value>]	6.2.6	mand.	TA response format (recommended default 1 i.e. verbose format)
X[<value>]	6.2.7	mand.	defines CONNECT result code format; values manufacturer specific
&C[<value>]	6.2.8	mand.	determines how ITU-T V.24 circuit 109 (or equivalent) relates to the detection of received line signal from remote end (recommended default 1 i.e. 109 operation relates to detection of received signal)
&D[<value>]	6.2.9	mand.	determines how TA responds when ITU-T V.24 circuit 108/2 (or equivalent) is changed from ON to OFF condition during online data state
+IPR=[<value>]	6.2.10	opt.	fixed TE data rate (recommended default 0 i.e. automatic detection)
+ICF=[<format>[,<parity>]]	6.2.11	opt.	TE-TA character framing (recommended default 3,3 i.e. eight data bits, no parity, 1 stop bit)
+IFC=[<by_te>[,<by_ta>]]	6.2.12	opt.	TE-TA local flow control (recommended default 2,2 i.e. TE uses ITU-T V.24 circuit 133 (or equivalent), and TA circuit 106 (or equivalent))
+ILRR=[<value>]	6.2.13	opt.	determines whether the used local TE-TA data rate is informed using intermediate result code +ILRR: <rate> before going online data state after call answering or originating

5 General commands

ITU-T Recommendation V.25ter [14] includes "Generic DCE Control" commands with the prefix +G. These commands are for the identification of the TA. Four of those commands are adapted here to be the identification commands of the ME. Syntax is otherwise similar but the prefix is +CG. TIA IS-99 [15] uses same commands for base station identification.

5.1 Request manufacturer identification +CGMI

Table 2: +CGMI action command syntax

Command	Possible response(s)
+CGMI	<manufacturer> *+CME ERROR: <err>*
+CGMI=?	

Description

Execution command causes the TA to return one or more lines of information text <manufacturer>, determined by the ME manufacturer, which is intended to permit the user of the TA to identify the manufacturer of the ME to which it is connected to. Typically, the text will consist of a single line containing the name of the manufacturer, but manufacturers may choose to provide more information if desired. Refer subclause 9.2 for possible <err> values.

Defined values

<manufacturer>: the total number of characters, including line terminators, in the information text shall not exceed 2048 characters.

Text shall not contain the sequence 0<CR> or OK<CR>

Implementation

Optional.

5.2 Request model identification +CGMM

Table 3: +CGMM action command syntax

Command	Possible response(s)
+CGMM	<model> *+CME ERROR: <err>*
+CGMM=?	

Description

Execution command causes the TA to return one or more lines of information text <model>, determined by the ME manufacturer, which is intended to permit the user of the TA to identify the specific model of the ME to which it is connected to. Typically, the text will consist of a single line containing the name of the product, but manufacturers may choose to provide more information if desired. Refer to subclause 9.2 for possible <err> values.

Defined values

<model>: the total number of characters, including line terminators, in the information text shall not exceed 2048 characters.

Text shall not contain the sequence 0<CR> or OK<CR>

Implementation

Optional.

5.3 Request revision identification +CGMR

Table 4: +CGMR action command syntax

Command	Possible response(s)
+CGMR	<revision> *+CME ERROR: <err>*
+CGMR=?	

Description

Execution command causes the TA to return one or more lines of information text <revision>, determined by the ME manufacturer, which is intended to permit the user of the TA to identify the version, revision level or date, or other pertinent information of the ME to which it is connected to. Typically, the text will consist of a single line containing the version of the product, but manufacturers may choose to provide more information if desired. Refer subclause 9.2 for possible <err> values.

Defined values

<revision>: the total number of characters, including line terminators, in the information text shall not exceed 2048 characters.

Text shall not contain the sequence 0<CR> or OK<CR>

Implementation

Optional.

5.4 Request product serial number identification +CGSN

Table 5: +CGSN action command syntax

Command	Possible response(s)
+CGSN	<sn> *+CME ERROR: <err>*
+CGSN=?	

Description

Execution command causes the TA to return one or more lines of information text <sn>, determined by the ME manufacturer, which is intended to permit the user of the TA to identify the individual ME to which it is connected to. Typically, the text will consist of a single line containing the IMEI (International Mobile station Equipment Identity; refer ~~GSM 03.03~~3G TS 23.003 [7]) number of the ME, but manufacturers may choose to provide more information if desired. Refer subclause 9.2 for possible <err> values.

Defined values

<sn>: the total number of characters, including line terminators, in the information text shall not exceed 2048 characters.

Text shall not contain the sequence 0<CR> or OK<CR>

Implementation

Optional.

5.5 Select TE character set +CSCS

Table 6: +CSCS parameter command syntax

Command	Possible response(s)
+CSCS=[<chset>]	
+CSCS?	+CSCS: <chset>
+CSCS=?	+CSCS: (list of supported <chset>s)

Description

Set command informs TA which character set <chset> is used by the TE. TA is then able to convert character strings correctly between TE and ME character sets.

When TA-TE interface is set to 8-bit operation and used TE alphabet is 7-bit, the highest bit shall be set to zero.

NOTE: It is manufacturer specific how the internal alphabet of ME is converted to/from the TE alphabet.

Read command shows current setting and test command displays conversion schemes implemented in the TA.

Defined values

<chset> (conversion schemes not listed here can be defined by manufacturers):

"GSM" GSM 7 bit default alphabet (3G TS~~GSM~~ 2~~0~~3.038 ~~subclause 6.2.1~~); this setting causes easily software flow control (XON/XOFF) problems

"HEX" character strings consist only of hexadecimal numbers from 00 to FF; e.g. "032FE6" equals three 8-bit characters with decimal values 3, 47 and 230; no conversions to the original ME character set shall be done.

NOTE: If ME is using ~~GSM default alphabet~~GSM 7 bit default alphabet, its characters shall be padded with 8th bit (zero) before converting them to hexadecimal numbers (i.e. no SMS-style packing of 7-bit alphabet).

"IRA" international reference alphabet (ITU-T T.50 [13])

"PCCP*xxx*" PC character set Code Page *xxx*

"PCDN" PC Danish/Norwegian character set

"UCS2" 16-bit universal multiple-octet coded character set (ISO/IEC10646 [32]); UCS2 character strings are converted to hexadecimal numbers from 0000 to FFFF; e.g. "004100620063" equals three 16-bit characters with decimal values 65, 98 and 99~~, $(AT R97)$~~

"8859-*n*" ISO 8859 Latin *n* (1-6) character set

"8859-C" ISO 8859 Latin/Cyrillic character set

"8859-A" ISO 8859 Latin/Arabic character set

"8859-G" ISO 8859 Latin/Greek character set

"8859-H" ISO 8859 Latin/Hebrew character set

Implementation

Mandatory when a command using the setting of this command is implemented.

5.6 Request international mobile subscriber identity +CIMI

Table 7: +CIMI action command syntax

Command	Possible response(s)
+CIMI	<IMSI> *+CME ERROR: <err>*
+CIMI=?	

Description

Execution command causes the TA to return <IMSI>, which is intended to permit the TE to identify the individual SIM which is attached to ME. Refer subclause 9.2 for possible <err> values.

Defined values

<IMSI>: International Mobile Subscriber Identity (string without double quotes)

Implementation

Optional.

5.7 Multiplexing mode +CMUX ~~$(MUX MS-TE)$~~

Table 8: +CMUX parameter command syntax

Command	Possible response(s)
+CMUX=<mode>[,<subset>[,<port_speed>[,<N1>[,<T1>[,<N2>[,<T2>[,<T3>[,<k>]]]]]]]]	*+CME ERROR: <err>*
+CMUX?	+CMUX: <mode>,[<subset>],<port_speed>,<N1>,<T1>, <N2>,<T2>,<T3>[,<k>] *+CME ERROR: <err>*
+CMUX=?	+CMUX: (list of supported <mode>s),(list of supported <subset>s),(list of supported <port_speed>s),(list of supported <N1>s),(list of supported <T1>s),(list of supported <N2>s),(list of supported <T2>s),(list of supported <T3>s),(list of supported <k>s)

Description

This command is used to enable/disable the ~~GSM~~3G TS ~~0~~27.010 [45] multiplexing protocol control channel. Refer to subclause 9.2 for possible `<err>` values. The AT command sets parameters for the Control Channel. If the parameters are left out, the default value is used.

Read command returns the current mode and the settings.

Test command returns the supported modes and parameters.

It is recommended that the ME/TA/TE should autobaud to the `+CMUX` command up to and including an interface speed of 9600 bits/s.

The `OK` or `+CME ERROR: <err>` response is returned at the speed of the `+CMUX` command prior to entering `<mode>`.

It is recommended that whenever the multiplexer control channel is released the ME/TA/TE should assume an interface rate of up to and including 9600 bits/s for auto bauding purposes irrespective of any previous higher speed having been selected.

If a `+CMUX` command is issued whilst in any multiplexer mode then that `+CMUX` command shall be ignored and the ME/TA shall return an `+CME ERROR: <err>` response.

Defined values

<operation> (multiplexer Transparency Mechanism)

0 Basic option

1 Advanced option

`<subset>`:

This parameter defines the way in which the multiplexer **control channel** is set up. A virtual channel may subsequently be set up differently but in the absence of any negotiation for the settings of a virtual channel, the virtual channel shall be set up according to the control channel `<subset>` setting.

0 UIH frames used only

1 UI frames used only

2 I frames used only

Default value: 0

`<port_speed>` (transmission rate):

1 9 600 bit/s

2 19 200 bit/s

3 38 400 bit/s

4 57 600 bit/s

5 115 200 bit/s

6 230 400 bits/s

`<N1>` (maximum frame size):

1- 32768

default Value : 31 (64 if Advanced option is used)

`<T1>` (acknowledgement timer in units of ten milliseconds):

1-255, where 10 is default (100 ms)

<N2> (maximum number of re-transmissions):

0-100, where 3 is default

<T2> (response timer for the multiplexer control channel in units of ten milliseconds):

2-255, where 30 is default (300 ms)

NOTE: T2 must be longer than T1.

<T3> (wake up response timer in seconds):

1-255, where 10 is default

<k> (window size, for Advanced operation with Error Recovery options):

1-7, where 2 is default

Implementation

Mandatory, if 3G TS ~~GSM~~ 2~~0~~7.010 [45] supported in the ME/TA.

5.8 ITU-T V.25ter [14] generic TA control commands

Table 9: V.25ter generic TA control commands

Command	Section	Impl.	Use in ~~GSM~~GSM/UMTS
Z[<value>]	6.1.1	mand.	TA sets all parameters to their defaults as specified by a user memory profile or by the manufacturer, and resets TA
&F[<value>]	6.1.2	mand.	TA sets all parameters to their defaults as specified by the manufacturer
I[<value>]	6.1.3	opt.	request manufacturer specific information about the TA (software cannot use this command to determine the capabilities of a TA)
+GMI	6.1.4	mand.	request TA manufacturer identification (may equal to +CGMI)
+GMM	6.1.5	mand.	request TA model identification (may equal to +CGMM)
+GMR	6.1.6	mand.	request TA revision identification (may equal to +CGMR)
+GSN	6.1.7	opt.	request TA serial number identification (may equal to +CGSN)
+GOI	6.1.8	opt.	request ISO system global object identification of the TA (general format defined in ITU-T Recommendation X.208; encoding rules in ITU-T Recommendation X.209)
+GCAP	6.1.9	mand.	request overall capabilities of TA; the response code for a TA building on this document shall be +CGSM
+GCI=<T.35>	6.1.10	opt.	selects the country of installation for the TA using ITU-T Recommendation T.35 Annex A country codes

5.9 PCCA STD-101 [17] select wireless network +WS46

PCCA STD-101 [17] includes a command to select the cellular network (Wireless Data Service; WDS) to operate with the TA. PCCA calls this as WDS-Side Stack Selection. This command may be used when TA is asked to indicate the networks in which it can operate.

Table 10: +WS46 parameter command syntax

Command	Possible response(s)
+WS46=[<n>]	
+WS46?	<n>
+WS46=?	(list of supported <n>s)

Description

Set command selects to WDS side stack `<n>` to be used by the TA. Read command shows current setting and test command displays side stacks implemented in the TA.

Defined values

`<n>`:

12 GSM digital cellular

refer PCCA STD-101 [17] for other values

Implementation

Mandatory in PCCA STD-101, but optional for ~~GSM~~GSM/UMTS.

5.10 Informative examples

When beginning to build a communication link, a general TE application controlling a TA needs to determine the TA and the ME to which it is connected. V.25ter [14] has seven commands for TA identification from which four are mandatory to be implemented in a TA. An example of this command sequence requesting manufacturer (`+GMI`), model (`+GMM`), revision (`+GMR`) and serial number (`+GSN`) information would be:

```
AT+GMI
Manufacturer ABC
OK
AT+GMM
GSM Ultimate Data Device
OK
AT+GMR
1.00
OK
AT+GSN
987612345-123
OK
```

The maximum lengths of the information responses are defined to be 2048 characters, but it is recommended that they are kept as simple as in the example. The serial number command is defined as optional. Another optional command is Global Object Identification command (`+GOI`) which should return the object identifiers of ITU-T Recommendation X.208 as numeric strings delimited by periods. The Complete Capabilities List command (`+GCAP`) should indicate the major capability areas of the TA. The support of different areas is presented in the response of `+GCAP` command. Each area may be presented by the selection command name of a specific capability area (e.g. `+FCLASS` for fax support) or some other predefined response. For instance, a GSM TA with fax capabilities could respond as follows:

```
AT+GCAP
+GCAP: +CGSM,+FCLASS,+W
OK
```

The first supported area in the response is presented with `+CGSM`. It is the response text to show that some or all GSM commands of this TS are supported. Second response text (`+FCLASS`) informs that some fax or voice capabilities are present, and the third text (`+W`) about the presence of wireless commands as specified by PCCA STD-101 [17]. Command `+FCLASS=?` (refer e.g. ITU-T T.31 [11] and T.32 [12]) should be used to query the supported fax capabilities and `+WS46=?` to query the wireless data services available:

```
AT+FCLASS=?;+WS46=?
0,1,2,2.0
(12)
OK
```

The TA of this example supports GSM data services, and fax service class 1 (TIA-578-A), 2 (manufacturer specific) and 2.0 (ITU-T T.32 [12]/ TIA-592).

This TS defines commands for ME identification which are similar to those for TA identification in V.25ter [14], for an example:

```
AT+CGMI
Mobile Manufacturer XYZ
OK
AT+CGMM
GSM Phone 1234
OK
```

```
AT+CGMR
1.00
OK
AT+CGSN
123456121234561
OK
```

Manufacturer, model and version commands work similarly as for TA, except that the serial number query returns the International Mobile Station Equipment Identity (IMEI) number. IMEI is fifteen digits long and consists of a type approval code, a final assembly code, a serial number and a spare digit (refer ~~GSM 03.03~~3G TS 23.003 [7]). When the TA is implemented inside ME, the responses for both TA and ME queries will most likely follow the responses of ME identification.

6 Call control commands and methods

This clause describes the control of GSM/UMTS calls. Normal data and fax call control is done as in ITU-T Recommendations V.25ter [14], T.31 [11] and T.32 [12]. For voice call originating, refer subclause "ITU-T V.25ter dial command D".

6.1 Select type of address +CSTA

Table 11: +CSTA parameter command syntax

Command	Possible response(s)
`+CSTA=[<type>]`	
`+CSTA?`	`+CSTA: <type>`
`+CSTA=?`	`+CSTA:` (list of supported `<type>`s)

Description

Set command selects the type of number for further dialling commands (`D`) according to GSM/UMTS specifications. Test command returns values supported by the TA as a compound value.

Defined values

`<type>`: type of address octet in integer format (refer GSM 04.08 [8] subclause 10.5.4.7); default 145 when dialling string includes international access code character "+", otherwise 129

Implementation

Mandatory when other than default value allowed.

6.2 ITU-T V.25ter [14] dial command D

V.25ter [14] dial command `D` lists characters that may be used in a dialling string for making a call or controlling supplementary services in accordance with ~~GSM 02.30~~3G TS 22.030 [19]. Their use in GSM/UMTS is listed in this subclause, as well as new dial modifiers applicable only to GSM/UMTS are introduced. For a ME supporting AT commands only, it is mandatory to support the control of supplementary services in accordance with ~~GSM 02.30~~3G TS 22.030 [19] through the dial command or through the specific supplementary service commands (`+CCFC`, `+CLCK`, etc.), where ~~GSM 02.30~~3G TS 22.030 [19] identifies the supplementary services as mandatory.

V.25ter dialling digits

`1 2 3 4 5 6 7 8 9 0 * # + A B C` (implementation of these characters is mandatory for GSM/UMTS)

`D` (implementation of this character is optional for GSM/UMTS, and it is ignored)

V.25ter modifier characters

`,` (implementation of this character is mandatory for GSM/UMTS, but it may be ignored)

`T P` (implementation of these characters is mandatory for GSM/UMTS, but they are ignored)

! W @ (implementation of these characters is optional for GSM/UMTS, and they are ignored)

V.25ter semicolon character

In GSM/UMTS, when semicolon character is given after dialling digits (or modifiers), a voice call originated to the given address. TA returns to command state immediately (or after possible +COLP result code; refer subclause "Connected line identification presentation +COLP"). Refer Annex G for a detailed example.

~~GSM~~GSM/UMTS modifier characters

> (refer subclause "Direct dialling from phonebooks")

I or i (override the CLIR supplementary service subscription default value for this call; I = invocation (restrict CLI presentation) and i = suppression (allow CLI presentation); refer subclause "Calling line identification restriction +CLIR")

G or g (control the CUG supplementary service information for this call; uses index and info values set with command +CCUG; refer subclause "Closed user group +CCUG")

6.3 Direct dialling from phonebooks

~~GSM~~GSM/UMTS ME and SIM can contain phonebooks which have a phone number and an alphanumeric field for each phonebook entry location. The use of V.25ter [14] dialling command ensures that direct dialling from ME and SIM phonebook is possible through ordinary communications software which just gives the phone number field to be filled and then use the D command to originate the call. Available memories may be queried with Select Phonebook Storage test command +CPBS=?, and location range for example with Read Phonebook Entries test command +CPBR=?.

Execute commands

1. D><str>[I][G][;]	originate call to phone number which corresponding alphanumeric field is <str> (if possible, all available memories should be searched for the correct entry)
2. D>*mem*<n>[I][G][;]	originate call to phone number in memory *mem* entry location <n> (available memories may be queried with Select Phonebook Storage test command +CPBS=?; *mem* could be e.g. ME)
3. D><n>[I][G][;]	originate call to phone number in entry location <n> (it is manufacturer specific which memory storage of ME, SIM and TA is used; command Select Phonebook Memory Storage +CPBS setting is recommended to be used)

Semicolon character shall be added when voice call is originated. CLIR and CUG per call base modifiers may also be present.

Responses

Possible error responses include +CME ERROR: <err> when error is related to ME functionality. Refer subclause 9.2 for possible error values. Otherwise TA responses can have values defined by V.25ter [14] and commands Service Reporting Control +CR and Connected Line Identification Presentation +COLP. Detailed error report of an unsuccessful originated call failed in a ~~GSM~~GSM/UMTS network error can be obtained with command Extended Error Report +CEER (if implemented).

Defined values

<str>: string type value, which should equal to an alphanumeric field in at least one phonebook entry in the searched memories; used character set should be the one selected with Select TE Character Set +CSCS

<n>: integer type memory location should be in the range of locations available in the memory used

Implementation

Mandatory when direct dialling is implemented. Also phonebook commands implementation is required.

6.4 Call mode +CMOD

Table 12: +CMOD parameter command syntax

Command	Possible response(s)
+CMOD=[<mode>]	
+CMOD?	+CMOD: <mode>
+CMOD=?	+CMOD: (list of supported <mode>s)

Description

Set command selects the call mode of further dialling commands (D) or for next answering command (A). Mode can be either single or alternating (in this TS, terms "alternating mode" and "alternating call" refer to all ~~GSM~~GSM/UMTS bearer and teleservices that incorporate more than one basic service (voice, data, fax) within one call). When single mode is selected the call originating and hangup procedures are similar to procedures specified in ITU-T Recommendations V.25ter [14], T.31 [11] and T.32 [12]. In ~~GSM~~GSM/UMTS there can be voice followed by data (refer ~~GSM 02.02~~3G TS 22.002 [1]), alternating voice/data (refer ~~GSM 02.02~~3G TS 22.002 [1]) and alternating voice/fax calls (refer ~~GSM 02.03~~3G TS 22.003 [2]). Refer next two subclauses for alternating call control methods.

Test command returns values supported by the TA as a compound value.

NOTE: +CMOD shall be set to zero after a successfully completed alternating mode call. It shall be set to zero also after a failed answering. The power-up, factory (&F) and user resets (Z) shall also set the value to zero. This reduces the possibility that alternating mode calls are originated or answered accidentally.

Defined values

<mode>:

0 single mode

1 alternating voice/fax (teleservice 61)

2 alternating voice/data (bearer service 61)

3 voice followed by data (bearer service 81)

also all other values below 128 are reserved by this TS

Implementation

Mandatory when alternating mode calls are implemented in the TA.

6.5 Hangup call +CHUP

Table 13: +CHUP action command syntax

Command	Possible response(s)
+CHUP	
+CHUP=?	

Description

Execution command causes the TA to hangup the current ~~GSM~~GSM/UMTS call of the ME.

NOTE**:** The purpose of this command is not to replace the V.25ter [14] command H, but to give an assured procedure to terminate an alternating mode call. Refer next subclause.

Implementation

Mandatory when alternating mode calls implemented in the TA.

6.6 Alternating mode call control method

This subclause describes the procedure to handle alternating mode calls with AT commands. Procedures are mandatory when alternating mode calls are implemented in the TA.

NOTE: ATH and drop DTR will not necessarily cause a hangup from voice mode. If the +CVHU ~~$(AT R97)$~~ is implemented the behaviour shall be controlled by its setting.

Voice followed by data call (bearer service 81)

Figure 4 shows commands to start the call, to switch from voice to data (In-Call Modification) and to hang up the call. `+CMOD` and `+FCLASS` commands indicate the current settings before dialling or answering command, not that they shall be given just before `D` or `A` command. Refer subclause "Cellular result codes +CRC" for possible `+CRING` result code values. Refer Annex F for a detailed example.

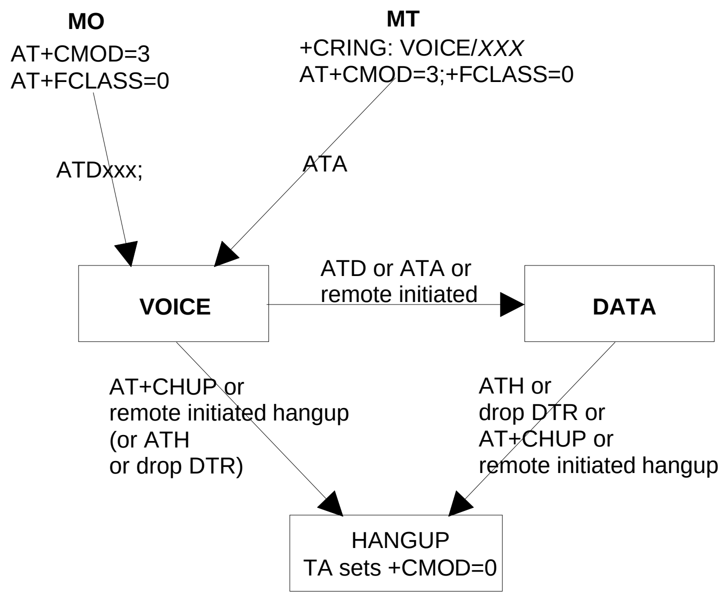

Figure 4: Voice followed by data call

Voice/ data call (bearer service number 61)

Figure 5 shows the commands to start the call, to switch between modes (In-Call Modification) and to hang up the call. `+CMOD` and `+FCLASS` commands indicate the current settings before dialling or answering command, not that they shall be given just before `D` or `A` command. Refer subclause "Cellular result codes +CRC" for possible `+CRING` result code values. Refer Annex E for a detailed example.

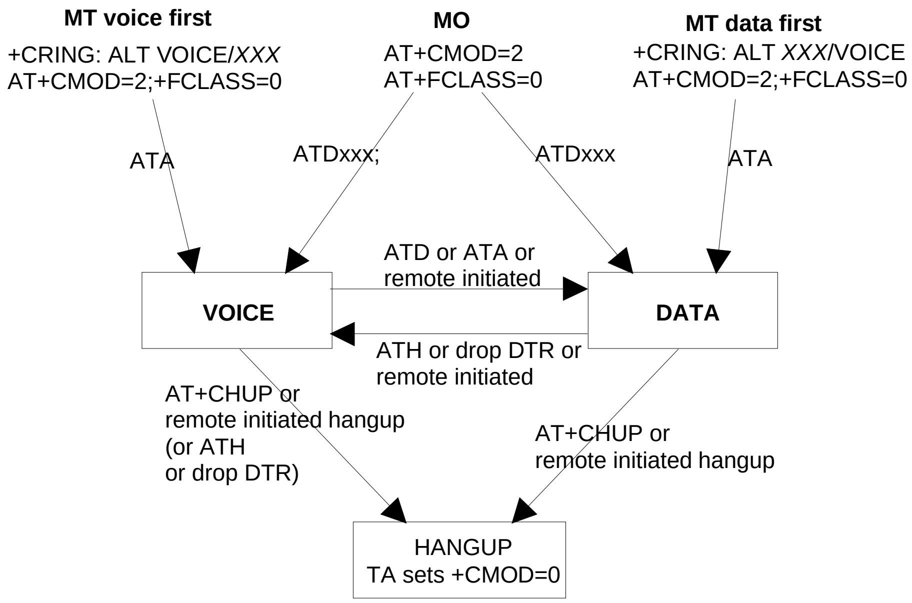

Figure 5: Alternating voice and data call

Voice/ fax call (teleservice number 61)

Figure 6 shows the commands to start the call, to switch between modes (In-Call Modification) and to hang up the call. `+CMOD` and `+FCLASS` commands indicate the current settings before dialling or answering command, not that they shall be given just before `D` or `A` command. The parameter "x" of `+FCLASS` command can be 1, 1.0, 2 or 2.0.

NOTE: The transition from fax mode to voice mode is for further study.

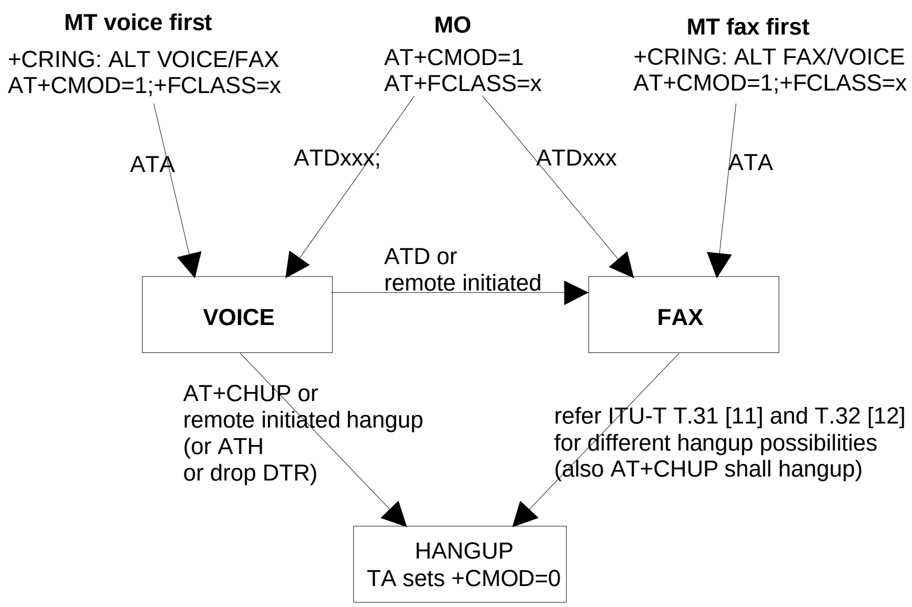

Figure 6: Alternating voice and fax call

6.7 Select bearer service type +CBST

Table 14: +CBST parameter command syntax

Command	Possible response(s)
`+CBST=[<speed>[,<name>[,<ce>]]]`	
`+CBST?`	`+CBST: <speed>,<name>,<ce>`

+CBST=?	+CBST: (list of supported <speed>s),(list of supported <name>s),(list of supported <ce>s)

Description

Set command selects the bearer service <name> with data rate <speed>, and the connection element <ce> to be used when data calls are originated (refer ~~GSM 02.02~~3G TS 22.002 [1]). Values may also be used during mobile terminated data call setup, especially in case of single numbering scheme calls (refer +CSNS).

Test command returns values supported by the TA as compound values.

Defined values

NOTE: The default values of the subparameters are manufacturer specific since they depend on the purpose of the device and data services provided by it. Not all combinations of these subparameters are supported by ~~GSM~~GSM/UMTS (refer ~~GSM 02.02~~3G TS 22.002 [1]).

<speed>:

0	autobauding (automatic selection of the speed; this setting is possible in case of 3.1 kHz modem and non-transparent service)
1	300 bps (V.21)
2	1200 bps (V.22)
3	1200/75 bps (V.23)
4	2400 bps (V.22bis)
5	2400 bps (V.26ter)
6	4800 bps (V.32)
7	9600 bps (V.32)
12	9600 bps (V.34)
14	14400 bps (V.34)
15	19200 bps (V.34)
16	28800 bps (V.34)
17	33600 bps (V.34)
34	1200 bps (V.120)
36	2400 bps (V.120)
38	4800 bps (V.120)
39	9600 bps (V.120)
43	14400 bps (V.120)
47	19200 bps (V.120)
48	28800 bps (V.120)
49	38400 bps (V.120)
50	48000 bps (V.120)
51	56000 bps (V.120)
65	300 bps (V.110)
66	1200 bps (V.110)
68	2400 bps (V.110 or X.31 flag stuffing)
70	4800 bps (V.110 or X.31 flag stuffing)
71	9600 bps (V.110 or X.31 flag stuffing)
75	14400 bps (V.110 or X.31 flag stuffing)
79	19200 bps (V.110 or X.31 flag stuffing)
80	28800 bps (V.110 or X.31 flag stuffing)
81	38400 bps (V.110 or X.31 flag stuffing)
82	48000 bps (V.110 or X.31 flag stuffing)
83	56000 bps (V.110 or X.31 flag stuffing; this setting can be used in conjunction with asynchronous non-transparent UDI or RDI service in order to get FTM)
84	64000 bps (X.31 flag stuffing; this setting can be used in conjunction with asynchronous non-transparent UDI service in order to get FTM)
115	56000 bps (bit transparent)
116	64000 bps (bit transparent)
120	32000 bps (PIAFS32k)
121	64000 bps (PIAFS64k)

also all other values below 128 are reserved by this TS

<name>:

0	data circuit asynchronous (UDI or 3.1 kHz modem)
1	data circuit synchronous (UDI or 3.1 kHz modem)
2	PAD Access (asynchronous) (UDI)
3	Packet Access (synchronous) (UDI)
4	data circuit asynchronous (RDI)
5	data circuit synchronous (RDI)
6	PAD Access (asynchronous) (RDI)
7	Packet Access (synchronous) (RDI)

also all other values below 128 are reserved by this TS

<ce>:

0	transparent
1	non-transparent
2	both, transparent preferred
3	both, non-transparent preferred

Implementation

Mandatory when data calls implemented.

6.8 Radio link protocol +CRLP

Table 15: +CRLP parameter command syntax

Command	Possible response(s)
+CRLP=[<iws>[,<mws>[,<T1> [,<N2>[,<ver>[,<T4>]]]]]]	
+CRLP?	+CRLP: <iws>,<mws>,<T1>,<N2>[,<ver1>[,<T4>]] [<CR><LF>+CRLP: <iws>,<mws>,<T1>,<N2>[,<ver2>[,<T4>]] [...]]
+CRLP=?	+CRLP: (list of supported <iws>s),(list of supported <mws>s), (list of supported <T1>s),(list of supported <N2>s)[,<ver1> [,(list of supported <T4>s)]] [<CR><LF>+CRLP: (list of supported <iws>s),(list of supported <mws>s),(list of supported <T1>s),(list of supported <N2>s) [,<ver1>[,(list of supported <T4>s)]] [...]]

Description

Radio link protocol (RLP) parameters used when non-transparent data calls are originated may be altered with set command. Available command subparameters depend on the RLP versions implemented by the device (e.g. <ver> may not be available if device supports only versions 0 and 1).

NOTE: If radio link protocol is not used, but some other error correcting protocol (for transparent data calls), V.25ter [14] Error Control Selection test command +ES=? may be used to indicate the presence of the protocol.

Read command returns current settings for each supported RLP version <ver*x*>. Only RLP parameters applicable to the corresponding <ver*x*> are returned.

Test command returns values supported by the TA as a compound value. If ME/TA supports several RLP versions <ver*x*>, the RLP parameter value ranges for each <ver*x*> are returned in a separate line.

Defined values

<ver>, <ver*x*>: RLP version number in integer format; when version indication is not present it shall equal 0

NOTE: Versions 0 and 1 share the same parameter set. Read and test commands shall return only one line for this set (where `<verx>` is not present).

`<iws>`, `<mws>`, `<T1>`, `<N2>`, `<T4>`: IWF to MS window size, MS to IWF window size, acknowledgement timer T1, retransmission attempts N2, re-sequencing period T4 in integer format (default values and value ranges depend on RLP version; refer ~~GSM 04.22~~3G TS 24.022 [18]): T1 and T4 are in units of 10 ms.

Implementation

Mandatory when RLP implemented.

6.9 Service reporting control +CR

Table 16: +CR parameter command syntax

Command	Possible response(s)
`+CR=[<mode>]`	
`+CR?`	`+CR: <mode>`
`+CR=?`	`+CR:` (list of supported `<mode>`s)

Description

Set command controls whether or not intermediate result code `+CR: <serv>` is returned from the TA to the TE. If enabled, the intermediate result code is transmitted at the point during connect negotiation at which the TA has determined which speed and quality of service will be used, before any error control or data compression reports are transmitted, and before the intermediate result code `CONNECT` is transmitted.

NOTE: This command replaces V.25ter [14] command Modulation Reporting Control `+MR`, which is not appropriate for use in the ~~GSM~~GSM/UMTS network. Possible error control (other than radio link protocol) and data compression reporting can be enabled with V.25ter commands Error Control Reporting `+ER` and Data Compression Reporting `+DR`.

Test command returns values supported by the TA as a compound value.

Defined values

`<mode>`:

0 disables reporting

1 enables reporting

`<serv>`:

`ASYNC` asynchronous transparent

`SYNC` synchronous transparent

`REL ASYNC` asynchronous non-transparent

`REL SYNC` synchronous non-transparent

`GPRS [<L2P>]` GPRS

The optional <L2P> proposes a layer 2 protocol to use between the MT and the TE. It is defined in the Enter GPRS Data Mode (+CGDATA) command.

Implementation

Mandatory when data calls implemented.

6.10 Extended error report +CEER

Table 17: +CEER action command syntax

Command	Possible response(s)
+CEER	+CEER: <report>
+CEER=?	

Description

Execution command causes the TA to return one or more lines of information text <report>, determined by the ME manufacturer, which should offer the user of the TA an extended report of the reason for

- the failure in the last unsuccessful call setup (originating or answering) or in-call modification,
- the last call release,
- the last unsuccessful GPRS attach or unsuccessful PDP context activation,
- the last GPRS detach or PDP context deactivation.

Typically, the text will consist of a single line containing the cause information given by ~~GSM~~GSM/UMTS network in textual format.

Defined values

<report>: the total number of characters, including line terminators, in the information text shall not exceed 2041 characters.

Text shall not contain the sequence 0<CR> or OK<CR>

Implementation

Optional.

6.11 Cellular result codes +CRC

Table 18: +CRC parameter command syntax

Command	Possible response(s)
+CRC=[<mode>]	
+CRC?	+CRC: <mode>
+CRC=?	+CRC: (list of supported <mode>s)

Description

Set command controls whether or not the extended format of incoming call indication or GPRS network request for PDP context activation is used. When enabled, an incoming call is indicated to the TE with unsolicited result code +CRING: <type> instead of the normal RING.

Test command returns values supported by the TA as a compound value.

NOTE: Similar command may be found in TIA IS-99 [15] and TIA IS-135 [16].

Defined values

<mode>:

0 disables extended format

1 enables extended format

<type>:

ASYNC asynchronous transparent

SYNC synchronous transparent

REL ASYNC asynchronous non-transparent

REL SYNC synchronous non-transparent

FAX facsimile (TS 62)

VOICE normal voice (TS 11)

VOICE/*XXX* voice followed by data (BS 81) (*XXX* is ASYNC, SYNC, REL ASYNC or REL SYNC)

ALT VOICE/*XXX* alternating voice/data, voice first (BS 61)

ALT *XXX*/VOICE alternating voice/data, data first (BS 61)

ALT VOICE/FAX alternating voice/fax, voice first (TS 61)

ALT FAX/VOICE alternating voice/fax, fax first (TS 61)

GPRS <PDP_type>, <PDP_addr>[, <L2P>] GPRS network request for PDP context activation

<PDP_type> and <PDP_addr> are as defined in the Define PDP Context (+CGDCONT) command. The optional <L2P> proposes a layer 2 protocol to use between the MT and the TE. It is defined in the Enter GPRS Data Mode (+CGDATA) command. If the MT is unable to announce to the TE the network's request (for example it is in V.25ter online data state) the MT shall reject the request. No corresponding unsolicited result code shall be issued when the MT returns to a command state.

Implementation

Mandatory when data or fax circuit mode calls implemented.

6.12 HSCSD device parameters +CHSD

Table 19: +CHSD action command syntax

Command	Possible response(s)
+CHSD	+CHSD: <mclass>,<maxRx>,<maxTx>,<sum>,<codings> *+CME ERROR: <err>*
+CHSD=?	

Description

Execution command returns information about HSCSD features (refer ~~GSM 02.34~~3G TS 22.034 [29]) supported by the ME/TA. Refer subclause 9.2 for possible <err> values.

Defined values

<mclass>: integer type; multislot class

<maxRx>: integer type; maximum number of receive timeslots that ME can use

<maxTx>: integer type; maximum number of transmit timeslots that ME can use

<sum>: integer type; total number of receive and transmit timeslots that ME can use at the same time (per TDMA frame). The following applies in a HSCSD call: 1 ≤ (receive slots) + (transmit slots) ≤ <sum>

<codings> is a sum of integers each representing a supported channel coding (e.g. value 5 indicates that 4.8k and 9.6k channel codings are supported):

1 4.8k full rate data traffic channel

4 9.6k full rate data traffic channel

8 14.4k full rate data traffic channel

16 28.8k full rate data traffic channel (only possible when 14.4k is supported)

32 32.0k full rate data traffic channel (only possible in a two-timeslot configuration)

64 43.2k full rate data traffic channel (only possible when 14.4k is supported)

Implementation

Mandatory when HSCSD implemented.

6.13 HSCSD transparent call configuration +CHST

Table 20: +CHST parameter command syntax

Command	Possible response(s)
+CHST=[<wRx>[,<codings>]]	
+CHST?	+CHST: <wRx>,<codings>
+CHST=?	

Description

Set command controls parameters for transparent HSCSD calls. Changing them during a call does not affect the current call.

Defined values

<wRx>: integer type; wanted amount of receive timeslots. Default value 0 indicates that TA shall calculate a proper value from currently selected fixed network user rate (<speed> subparameter from +CBST command) and <codings>

<codings>: a sum of integers each representing a channel coding that is accepted for transparent HSCSD calls. Default value 0 indicates that all supported codings are accepted (refer +CHSD command for other values)

Implementation

Mandatory when transparent HSCSD implemented.

6.14 HSCSD non-transparent call configuration +CHSN

Table 21: +CHSN parameter command syntax

Command	Possible response(s)
+CHSN=[<wAiur>[,<wRx>[,<topRx>[,<codings>]]]]	
+CHSN?	+CHSN: <wAiur>,<wRx>,<topRx>,<codings>
+CHSN=?	+CHSN: (list of supported <wAiur>s), (list of supported <wRx>s),(list of supported <topRx>,(list of supported <codings>s)

Description

Set command controls parameters for non-transparent HSCSD calls. Changing <topRx> or <codings> value during a call does not affect the current call. Changing of <wAiur> or <wRx> affects the current call only if <topRx> was non-zero when call was established.

Defined values

<wAiur>: integer type; wanted air interface user rate. Default value 0 indicates that TA shall calculate a proper value from currently selected fixed network user rate (<speed> subparameter from +CBST command), <codings>, and <wRx> (or <maxRx> from +CHSD command if <wRx>=0). Other values:

1 9600 bps

2 14400 bps

3 19200 bps

4 28800 bps

5 38400 bps

6 43200 bps

7 57600 bps

`<wRx>`: integer type; wanted amount of receive timeslots. Default value 0 indicates that TA shall calculate a proper value from currently selected `<wAiur>` and `<codings>`

`<topRx>`: integer type; top value for `<wRx>` that user is going to request during the next established non-transparent HSCSD call. Default value 0 indicates that user is not going to change `<wAiur>`/`<wRx>` during the next call

`<codings>`: a sum of integers each representing a channel coding that is accepted for non-transparent HSCSD calls. Default value 0 indicates that all supported codings are accepted (refer `+CHSD` command for other values)

Implementation

Mandatory when non-transparent HSCSD implemented.

6.15 HSCSD current call parameters +CHSC

Table 22: +CHSC action command syntax

Command	Possible response(s)
`+CHSC`	`+CHSC: <rx>,<tx>,<aiur>,<coding>`
`+CHSC=?`	

Description

Execution command returns information about current HSCSD call. If no HSCSD call is active, all parameters returned shall equal zero. (It is manufacturer specific whether non-zero information is returned in case of an active normal single-slot data call.)

Defined values

`<rx>`: integer type; number of receive timeslots currently in use

`<tx>`: integer type; number of transmit timeslots currently in use

`<aiur>`: integer type; current air interface user rate (in case of transparent service this equals fixed network user rate) (refer `+CHSN` command for possible values). For the two-timeslot ECSD bit transparent configuration the following additional values apply:

8 56000 bps

9 64000 bps

`<coding>`: current channel coding (refer `+CHSD` command for possible values)

Implementation

Optional.

6.16 HSCSD parameters report +CHSR~~$(AT R98)$~~

Table 23: +CHSR action command syntax

Command	Possible response(s)
+CHSR=[<mode>]	
+CHSR?	+CHSR: <mode>
+CHSR=?	+CHSR: (list of supported <mode>s)

Description

Enabled command returns intermediate result code `+CHSR: <type>` from the TA to the TE when an HSCSD call is being set up. The result code represents the current (negotiated or renegotiated) HSCSD parameters. If enabled, the intermediate result code is transmitted at the point of the call setup negotiation where the TA has determined what type of an HSCSD connection will be used. Result code transmission is done after possible service (`+CR`), error control (`+ER`), and/or compression (`+DR`) reporting but before possible TE-TA rate (`+ILRR`) reporting and before the intermediate result code CONNECT is transmitted. The format of the intermediate result code is:

`+CHSR: <rx>,<tx>,<aiur>,<coding>`

For the value definitions, refer to `+CHSN` and `+CHSC` commands. For instance, for a non-transparent HSCSD call, result code '`+CHSR: 2,2,4,8`' means that the call has two timeslots in both up- and downlink, the air interface user rate is 28800 bps, and the used channel coding TCH/F14.4.

Defined values

<mode>:

0 disables reporting

1 enables reporting

Implementation

Mandatory when HSCSD implemented

6.17 HSCSD automatic user initiated upgrading +CHSU~~$(AT R98)$~~

Table 24: +CHSU parameter command syntax

Command	Possible response(s)
+CHSU=<mode>	
+CHSU?	+CHSU: <mode>
+CHSU=?	+CHSU: (list of supported <mode>s)

Description

Set command controls whether or not automatic user initiated service level upgrading shall be used for non-transparent HSCSD calls. "Automatic" means that, if enabled, the ME/TA shall use the UP bit in the received RLP frames to determine when to initiate user initiated service level upgrading (i.e. when to modify the +CHSN parameters <wAiur> and/or <wRx> for the current call). Refer to 3G TS~~GSM~~ 2~~0~~7.001 for details on the interpretation of the UP bit(s).

NOTE: The validity of the UP bit in the RLP frames depends on the result of the RLP negotiations. The UP bit shall only be used if the result of the RLP negotiations were successful with respect to the UP bit.

Defined values

<mode>:

0 disables use of UP bit for upgrading

1 enables use of UP bit for upgrading

Implementation

Optional

6.18 HSCSD non-transparent asymmetry configuration +CHSA

Table 25: +CHSA parameter command syntax

Command	Possible response(s)
+CHSA=<mode>	
+CHSA?	+CHSA: <mode>
+CHSA=?	+CHSA: (list of supported <mode>s)

Description

Set command controls the preferred asymmetry bias for non-transparent ECSD calls. Downlink biased asymmetry means that 8-PSK modulation is preferred downlink and GMSK modulation uplink. Uplink based asymmetry means that 8-PSK modulation is preferred uplink and GMSK downlink. Changing of <mode> affects the current call only if <topRx> (refer +CHSN) was non-zero when call was established.

Test command returns values supported by the ME/TA as compound values. The <mode> subparameter range indirectly indicates the MS Type; range (0-1) indicates MS Type A and range (0-2) indicates MS Type B.

NOTE: ECSD is also controlled by +CHSD, +CHSN and +CHST.

Defined values

<mode>:

0 No preference

1 Downlink biased asymmetry

2 Uplink biased asymmetry

Implementation

Mandatory when non-transparent ECSD is implemented.

6.19 Single numbering scheme +CSNS

Table 26: +CSNS parameter command syntax

Command	Possible response(s)
+CSNS=[<mode>]	
+CSNS?	+CSNS: <mode>
+CSNS=?	+CSNS: (list of supported <mode>s)

Description

Set command selects the bearer or teleservice to be used when mobile terminated single numbering scheme call is established. Parameter values set with +CBST command shall be used when <mode> equals to a data service. If +CBST parameter is set to a value that is not applicable to single numbering calls, ME/TA shall map the value to the closest valid one. E.g. if user has set <speed>=71, <name>=2 and <ce>=1 (non-transparent asynchronous 9600 bps V.110 ISDN connection) for mobile originated calls, ME/TA shall map the values into non-transparent asynchronous 9600 bps V.32 modem connection when single numbering scheme call is answered.

Test command returns values supported by the TA as compound values.

Defined values

<mode>:

0 voice

1 alternating voice/fax, voice first (TS 61)

2 fax (TS 62)

3 alternating voice/data, voice first (BS 61)

4 data

5 alternating voice/fax, fax first (TS 61)

6 alternating voice/data, data first (BS 61)

7 voice followed by data (BS 81)

Implementation

Optional.

6.20 Voice Hangup Control +CVHU ~~$(AT R97)$~~

Table 27: +CVHU parameter command syntax

Command	Possible response(s)
+CVHU=[<mode>]	
+CVHU?	+CVHU:<mode>
+CVHU=?	+CVHU:(list of supported <mode>s)

Description

Set command selects whether ATH or “drop DTR” shall cause a voice connection to be disconnected or not. By voice connection is also meant alternating mode calls that are currently in voice mode. (See section 6.6).

NOTE: When <mode> = 2, this command must be seen in conjunction with the V.25ter [14] command &D. Else &D shall be ignored.

Defined values

<mode>:

0 “Drop DTR” ignored but OK response given. ATH disconnects.

1 “Drop DTR” and ATH ignored but OK response given.

2 “Drop DTR” behaviour according to &D setting. ATH disconnects.

Implementation

Optional

6.21 V.120 rate adaption protocol +CV120

Table 28: +CV120 parameter command syntax

Command	Possible response(s)
+CV120=[<rah>[,<mfm>[,<mode>[,<llineg>[,<assign>[,<negtype>]]]]]]	

+CV120?	+CV120: <rah>,<mfm>,<mode>,<llineg>, <assign>,<negtype>
+CV120=?	+CV120: (list of supported <rah>s),(list of supported <mfm>s),(list of supported <mode>s),(list of supported <llineg>s),(list of supported <assign>s),(list of supported <negtype>s)

Description

Set command sets the values of the V.120 protocol parameters (defined in CCITT V.120) that are carried in the GSM BC and/or LLC information elements.

Read command returns current settings for the V.120 parameters.

Test command returns values supported by the TA as a compound value.

Defined values

<rah>

0 rate adaption header not included

1 rate adaption header included (mandatory for protocol sensitive modes).

<mfm>

0 multiple frame establishment not supported, only UI frames allowed

1 multiple frame establishment supported, both I and UI frames allowed.

<mode>

0 bit transparent mode of operation

1 protocol sensitive mode of operation.

<llineg>

0 no negotiation, LLI = 256 only

1 negotiation allowed. Note - <negtype> indicates the connection over which the negotiation is performed.

<assign>

0 message originator is "default assignee"

1 message originator is "assignor only".

<negtype>

0 negotiation is done using logical link zero

1 negotiation is done with USER INFORMATION messages on a temporary signalling connection.

~~GSM~~GSM/UMTS does not support all the possible modes of V.120 operation. However, in order to accommodate possible future additions, the complete set of parameters is included in the command.

The permitted values are: 1, 1 or 0, 1, 0, 0, 0.

A recommended set of default values is: 1, 1, 1, 0, 0, 0.

Implementation

Mandatory, if the ME supports V.120 interworking.

6.22 Settings date format +CSDF

Table 29: +CSDF parameter command syntax

Command	Possible response(s)
+CSDF=[<mode>]	*+CME ERROR: <err>*
+CSDF?	+CSDF:<mode> *+CME ERROR: <err>*
+CSDF=?	+CSDF:(list of supported <mode>s) *+CME ERROR: <err>*

Description

This command sets the date format of the date information presented to the user.

Defined values

<mode>:

NOTE: It is manufacturer specific which modes that are supported.

1 DD-MMM-YYYY

NOTE: Presentation of MMM is language dependent.

2 DD-MM-YY

3 MM/DD/YY

4 DD/MM/YY

5 DD.MM.YY

6 YYMMDD

7 YY-MM-DD

8-255 Manufacturer specific

Implementation

Optional

6.23 Silence Command +CSIL

Table 30: +CSIL parameter command syntax

Command	Possible response(s)
+CSIL=[<mode>]	*+CME ERROR: <err>*
+CSIL?	+CSIL:<mode> *+CME ERROR: <err>*
+CSIL=?	+CSIL:(list of supported <mode>s) *+CME ERROR: <err>*

Description

Set command enables/disables the silent mode. When the phone is in silent mode, all sounds from MS are suppressed except voice.

Read command reads the current setting.

Test command lists the supported modes.

Defined values

<mode>:

0 Silent mode off

1 Silent mode on

Implementation

Optional

6.24 Settings time format +CSTF

Table 31: +CSTF parameter command syntax

Command	Possible response(s)
+CSTF=[<mode>]	*+CME ERROR: <err>*
+CSTF?	+CSTF:<mode> *+CME ERROR: <err>*
+CSTF=?	+CSTF:(list of supported <mode>s) *+CME ERROR: <err>*

Description

Set command sets the time format of the time information presented to the user.

Read commands reads the current setting.

Test commands reads the supported <modes>s.

Defined values

<mode>:

1 HH:MM (24 hour clock)

2 HH:MM a.m./p.m.

3-7 Manufacturer specific

Implementation

Optional

6.25 ITU-T V.25ter [14] call control commands

Table 32: V.25ter call control commands

Command	Section	Impl.	Use in ~~GSM~~GSM/UMTS
D[<dial_string>][;]	6.3.1	mand.	originates a call
T	6.3.2	mand.	ignored (select tone dialling)
P	6.3.3	mand.	ignored (select pulse dialling)
A	6.3.5	mand.	answer a call
H[<value>]	6.3.6	mand.	hang-up a single mode call; for alternate mode call refer subclause "Hangup call +CHUP" (only value equal to zero needed)
O[<value>]	6.3.7	mand.	returns TA to online data state from online command mode (only value equal to zero needed)
S0=[<value>]	6.3.8	mand.	sets the number of call indications (rings) before automatically answering the call; value equalling zero disables automatic answering and is the default
S6=[<value>]	6.3.9	mand.	ignored (pause before blind dialling)
S7=[<value>]	6.3.10	mand.	sets number of seconds to wait for completion of call answering or originating procedure before giving up and disconnecting
S8=[<value>]	6.3.11	mand.	sets number of seconds to wait when comma dial modifier encountered in dial string of D command (default is 2 seconds)
S10=[<value>]	6.3.12	mand.	sets number of tenths of seconds to wait before disconnecting after TA has indicated the absence of received line signal
L[<value>]	6.3.13	mand.	ignored (monitor speaker loudness)
M[<value>]	6.3.14	mand.	ignored (monitor speaker mode)

6.26 ITU-T V.25ter [14] data compression commands

Table 33: V.25ter data compression commands

Command	Section	Impl.	Use in ~~GSM~~GSM/UMTS
+DS=[<dir>[,<neg>[,<P1>[,<P2>]]]]	6.6.1	mand. when V.42bis	controls ITU-T Recommendation V.42bis data compression functions; for subparameter defaults in ~~GSM~~GSM/UMTS refer ~~GSM 04.22~~3G TS 24.022 [18]
+DR=[<value>]	6.6.2	mand. when V.42bis	determines whether the use of V.42bis is informed using intermediate result code +DR: <type> before going online data state after call answering or originating

6.27 Informative examples

The alternating mode call handling (voice and fax, or voice and data) and the data call setup commands are defined such that the dialling command of V.25ter [14] (D) still always originates a call. The purpose is to support all current TE applications using the dialling command as default. Fax calls are controlled following the rules of ITU-T T.31 [11] and T.32 [12] standards.

An example where a voice call is originated:

```
ATD+1 812 555673I;  (type of address defaults to 145, CLI presentation is restricted for this call)
OK                  (call setup was successful)
```

An example where a voice call is attempted from a phonebook:

```
ATD>"Doe Joe"G;   (enable CUG control for this call)
+CME ERROR: 22    (entry "Doe Joe" is not found)
```

Also supplementary services may be controlled using dial command according to ~~GSM 02.30~~3G TS 22.030 [19]. An example of call forwarding on no reply for telephony with the adjustment of the no reply condition timer on 25 seconds:

```
ATD**61*+1812555673*11*25#
OK                  (modification was successful)
```

Two new commands are created for controlling the alternating mode calls. First one, Call Mode (+CMOD), selects between single and alternating mode. Because this is a crucial command, it is defined that the value is set back to zero (single mode) after every successfully originated alternating mode call. Also on power-up and factory or user resets, the value is set to zero. The second new command, Hangup Call (+CHUP), is not a replacement of V.25ter [14] command H, but a command which reliably disconnects the call in ~~GSM~~GSM/UMTS network. This is defined because the H command is used to switch from fax or data mode to voice mode.

The setting of ~~GSM~~GSM/UMTS bearer service (data circuit duplex asynchronous and synchronous, PAD access circuit asynchronous, or data packet duplex synchronous), is done with Select Bearer Service Type (+CBST). It chooses one of the four mentioned bearer services, the data rate of the service (or actually the modulation when modem IWFs are used), and enables or disables RLP. Command Radio Link Protocol (+CRLP) is used to set the RLP parameters in the radio path.

Service Reporting Control command (+CR) is defined similarly as the reporting of modulation, V.18, error control, and data compression which are V.25ter [14] features used to show information about the type of the established connection before the CONNECT intermediate result code. +CR command has one subparameter which specifies whether the intermediate result code +CR: <serv> is returned or not. The result code should be returned before any V.25ter [14] reporting result codes. An example of setting up an asynchronous 9600 bit/s modem connection with service reporting:

```
AT+CBST=7,0,1       (asynchronous modem 9600 bit/s and RLP)
OK
AT+CR=1             (enable reporting)
OK
ATD1234567890
+CR: REL ASYNC
CONNECT 9600
```

As ~~GSM~~GSM/UMTS network offers more information about the reason of the failure in call originating and answering than normal PSTN, it is useful to add an extra command to return this information to the TE. This information should not be returned always after unsuccessful call originating or answering, because many TE applications look for just the regular NO CARRIER, BUSY, NO ANSWER and CONNECT messages. Action command Extended Error Report (+CEER) does not have any subparameters, and it returns the cause of the latest call setup failure. This information may be the textual presentation of the ~~GSM~~GSM/UMTS network failure code (refer GSM specification 04.08 [8] Annex H), or some other information defined by the TA manufacturer.

7 Network service related commands

This clause describes ~~GSM~~GSM/UMTS network related commands, which are not covered in call control clause of this TS. Commands include ~~GSM~~GSM/UMTS supplementary service handling, MSISDN query, ME and network facility locking, and network registration information query.

7.1 Subscriber number +CNUM

Table 34: +CNUM action command syntax

Command	Possible response(s)
+CNUM	+CNUM: [<alpha1>],<number1>,<type1>[,<speed>,<service>[,<itc>]] [<CR><LF>+CNUM: [<alpha2>],<number2>,<type2>[,<speed>,<service> [,<itc>]] [...]] *+CME ERROR: <err>*
+CNUM=?	

Description

Action command returns the MSISDNs related to the subscriber (this information can be stored in the SIM or in the ME). If subscriber has different MSISDN for different services, each MSISDN is returned in a separate line. Refer subclause 9.2 for possible `<err>` values.

Defined values

`<alphax>`: optional alphanumeric string associated with `<numberx>`; used character set should be the one selected with command Select TE Character Set `+CSCS`

`<numberx>`: string type phone number of format specified by `<typex>`

`<typex>`: type of address octet in integer format (refer GSM 04.08 [8] subclause 10.5.4.7)

`<speed>`: as defined in subclause 6.7

`<service>` (service related to the phone number):

0 asynchronous modem

1 synchronous modem

2 PAD Access (asynchronous)

3 Packet Access (synchronous)

4 voice

5 fax

also all other values below 128 are reserved by this TS

`<itc>` (information transfer capability):

0 3.1 kHz

1 UDI

Implementation

Optional.

7.2 Network registration +CREG

Table 35: +CREG parameter command syntax

Command	Possible response(s)
`+CREG=[<n>]`	
`+CREG?`	`+CREG: <n>,<stat>[,<lac>,<ci>]` *`+CME ERROR: <err>`*
`+CREG=?`	`+CREG: (`list of supported `<n>`s`)`

Description

Set command controls the presentation of an unsolicited result code `+CREG: <stat>` when `<n>`=1 and there is a change in the ME network registration status, or code `+CREG: <stat>[,<lac>,<ci>]` when `<n>`=2 and there is a change of the network cell.

Read command returns the status of result code presentation and an integer `<stat>` which shows whether the network has currently indicated the registration of the ME. Location information elements `<lac>` and `<ci>` are returned only when `<n>`=2 and ME is registered in the network. Refer subclause 9.2 for possible `<err>` values.

Defined values

<n>:

0 disable network registration unsolicited result code

1 enable network registration unsolicited result code +CREG: <stat>

2 enable network registration and location information unsolicited result code +CREG: <stat>[,<lac>,<ci>]

<stat>:

0 not registered, ME is not currently searching a new operator to register to

1 registered, home network

2 not registered, but ME is currently searching a new operator to register to

3 registration denied

4 unknown

5 registered, roaming

<lac>: string type; two byte location area code in hexadecimal format (e.g. "00C3" equals 195 in decimal)

<ci>: string type; two byte cell ID in hexadecimal format

Implementation

Optional.

7.3 Operator selection +COPS

Table 36: +COPS parameter command syntax

Command	Possible response(s)
+COPS=[<mode>[,<format>[,<oper>]]]	*+CME ERROR: <err>*
+COPS?	+COPS: <mode>[,<format>,<oper>] *+CME ERROR: <err>*
+COPS=?	+COPS: [list of supported (<stat>,long alphanumeric <oper>,short alphanumeric <oper>,numeric <oper>)s][,,(list of supported <mode>s),(list of supported <format>s)] *+CME ERROR: <err>*

Description

Set command forces an attempt to select and register the ~~GSM~~GSM/UMTS network operator. <mode> is used to select whether the selection is done automatically by the ME or is forced by this command to operator <oper> (it shall be given in format <format>). If the selected operator is not available, no other operator shall be selected (except <mode>=4). The selected operator name format shall apply to further read commands (+COPS?) also. <mode>=2 forces an attempt to deregister from the network. The selected mode affects to all further network registration (e.g. after <mode>=2, ME shall be unregistered until <mode>=0 or 1 is selected). Refer subclause 9.2 for possible <err> values. This command should be abortable when registration/deregistration attempt is made.

Read command returns the current mode and the currently selected operator. If no operator is selected, <format> and <oper> are omitted.

Test command returns a list of quadruplets, each representing an operator present in the network. Quadruplet consists of an integer indicating the availability of the operator <stat>, long and short alphanumeric format of the name of the operator, and numeric format representation of the operator. Any of the formats may be unavailable and should then be an empty field. The list of operators shall be in order: home network, networks referenced in SIM, and other networks.

It is recommended (although optional) that after the operator list TA returns lists of supported `<mode>`s and `<format>`s. These lists shall be delimited from the operator list by two commas.

Defined values

`<mode>`:

0 automatic (`<oper>` field is ignored)

1 manual (`<oper>` field shall be present)

2 deregister from network

3 set only `<format>` (for read command `+COPS?`), do not attempt registration/deregistration (`<oper>` field is ignored); this value is not applicable in read command response

4 manual/automatic (`<oper>` field shall be present); if manual selection fails, automatic mode (`<mode>`=0) is entered

`<format>`:

0 long format alphanumeric `<oper>`

1 short format alphanumeric `<oper>`

2 numeric `<oper>`

`<oper>`: string type; `<format>` indicates if the format is alphanumeric or numeric; long alphanumeric format can be upto 16 characters long and short format up to 8 characters (refer GSM MoU SE.13 [9]); numeric format is the GSM Location Area Identification number (refer GSM 04.08 [8] subclause 10.5.1.3) which consists of a three BCD digit country code coded as in ITU-T E.212 Annex A [10], plus a two BCD digit network code, which is administration specific; returned `<oper>` shall not be in BCD format, but in IRA characters converted from BCD; hence the number has structure: (country code digit 3)(country code digit 2)(country code digit 1)(network code digit 2)(network code digit 1)

`<stat>`:

0 unknown

1 available

2 current

3 forbidden

Implementation

Optional.

7.4 Facility lock +CLCK

Table 37: +CLCK action command syntax

Command	Possible response(s)
`+CLCK=<fac>,<mode>[,<passwd>[,<class>]]`	*`+CME ERROR: <err>`* **when `<mode>`=2 and command successful:** `+CLCK: <status>[,<class1>` `[<CR><LF>+CLCK: <status>,<class2>` `[...]]`
`+CLCK=?`	`+CLCK:` (list of supported `<fac>`s) *`+CME ERROR: <err>`*

Description

Execute command is used to lock, unlock or interrogate a ME or a network facility `<fac>`. Password is normally needed to do such actions. When querying the status of a network service (`<mode>`=2) the response line for 'not active' case (`<status>`=0) should be returned only if service is not active for any `<class>`. Refer subclause 9.2 for possible `<err>` values. This command should be abortable when network facilities are set or interrogated.

Call barring facilities are based on ~~GSM~~GSM/UMTS supplementary services (refer ~~GSM 02.88~~3G TS 22.088 [6]). The interaction of these with other commands based on other ~~GSM~~GSM/UMTS supplementary services is described in the ~~GSM~~GSM/UMTS standard.

Test command returns facility values supported by the TA as a compound value.

Defined values

`<fac>` values reserved by this TS:

"CS" CNTRL (lock CoNTRoL surface (e.g. phone keyboard))

"PS" PH-SIM (lock PHone to SIM card) (ME asks password when other than current SIM card inserted; ME may remember certain amount of previously used cards thus not requiring password when they are inserted)

"PF" lock Phone to the very First inserted SIM card (also referred in this TS as PH-FSIM) (ME asks password when other than the first SIM card is inserted)

"SC" SIM (lock SIM card) (SIM asks password in ME power-up and when this lock command issued)

"AO" BAOC (Barr All Outgoing Calls) (refer ~~GSM 02.88~~3G TS 22.088 [6] clause 1)

"OI" BOIC (Barr Outgoing International Calls) (refer ~~GSM 02.88~~3G TS 22.088 [6] clause 1)

"OX" BOIC-exHC (Barr Outgoing International Calls except to Home Country) (refer ~~GSM 02.88~~3G TS 22.088 [6] clause 1)

"AI" BAIC (Barr All Incoming Calls) (refer ~~GSM 02.88~~3G TS 22.088 [6] clause 2)

"IR" BIC-Roam (Barr Incoming Calls when Roaming outside the home country) (refer ~~GSM 02.88~~3G TS 22.088 [6] clause 2)

"NT" barr incoming calls from numbers Not stored to TA memory

"NM" barr incoming calls from numbers Not stored to ME memory

"NS" barr incoming calls from numbers Not stored to SIM memory

"NA" barr incoming calls from numbers Not stored in Any memory

"AB" All Barring services (refer ~~GSM 02.30~~3G TS 22.030 [19]) (applicable only for `<mode>`=0)

"AG" All outGoing barring services (refer ~~GSM 02.30~~3G TS 22.030 [19]) (applicable only for `<mode>`=0)

"AC" All inComing barring services (refer ~~GSM 02.30~~3G TS 22.030 [19]) (applicable only for `<mode>`=0)

"FD" SIM fixed dialling memory feature (if PIN2 authentication has not been done during the current session, PIN2 is required as `<passwd>`)

"PN" Network Personalisation (refer ~~GSM 02.22~~3G TS 22.022 [33])

"PU" network sUbset Personalisation (refer ~~GSM 02.22~~3G TS 22.022 [33])

"PP" service Provider Personalisation (refer ~~GSM 02.22~~3G TS 22.022 [33])

"PC" Corporate Personalisation (refer ~~GSM 02.22~~3G TS 22.022 [33])

`<mode>`:

0 unlock

1 lock

2 query status

<status>:

0 not active

1 active

<passwd>: string type; shall be the same as password specified for the facility from the ME user interface or with command Change Password +CPWD

<classx> is a sum of integers each representing a class of information (default 7):

1 voice (telephony)

2 data (refers to all bearer services; with <mode>=2 this may refer only to some bearer service if TA does not support values 16, 32, 64 and 128)

4 fax (facsimile services)

8 short message service

16 data circuit sync

32 data circuit async

64 dedicated packet access

128 dedicated PAD access

Implementation

The call barring supplementary service control is mandatory for ME supporting AT commands only and not supporting the control through dial command D.

7.5 Change password +CPWD

Table 38: +CPWD action command syntax

Command	Possible response(s)
+CPWD=<fac>,<oldpwd>,<newpwd>	*+CME ERROR: <err>*
+CPWD=?	+CPWD: list of supported (<fac>,<pwdlength>)s *+CME ERROR: <err>*

Description

Action command sets a new password for the facility lock function defined by command Facility Lock +CLCK. Refer subclause 9.2 for possible <err> values.

Test command returns a list of pairs which present the available facilities and the maximum length of their password.

Defined values

<fac>:

"P2" SIM PIN2

refer Facility Lock +CLCK for other values

<oldpwd>, <newpwd>: string type; <oldpwd> shall be the same as password specified for the facility from the ME user interface or with command Change Password +CPWD and <newpwd> is the new password; maximum length of password can be determined with <pwdlength>

<pwdlength>: integer type maximum length of the password for the facility

Implementation

Optional.

7.6 Calling line identification presentation +CLIP

Table 39: +CLIP parameter command syntax

Command	Possible response(s)
+CLIP=[<n>]	
+CLIP?	+CLIP: <n>,<m>
+CLIP=?	+CLIP: (list of supported <n>s)

Description

This command refers to the ~~GSM~~GSM/UMTS supplementary service CLIP (Calling Line Identification Presentation) that enables a called subscriber to get the calling line identity (CLI) of the calling party when receiving a mobile terminated call. Set command enables or disables the presentation of the CLI at the TE. It has no effect on the execution of the supplementary service CLIP in the network.

When the presentation of the CLI at the TE is enabled (and calling subscriber allows), +CLIP: <number>,<type>[,<subaddr>,<satype>[,[<alpha>][,<CLI validity>]]] response is returned after every RING (or +CRING: <type>; refer subclause "Cellular result codes +CRC") result code sent from TA to TE. It is manufacturer specific if this response is used when normal voice call is answered.

Read command gives the status of <n>, and also triggers an interrogation of the provision status of the CLIP service according ~~GSM 02.81~~3G TS 22.081 [3] (given in <m>).Test command returns values supported by the TA as a compound value.

Defined values

<n> (parameter sets/shows the result code presentation status in the TA):

0 disable

1 enable

<m> (parameter shows the subscriber CLIP service status in the network):

0 CLIP not provisioned

1 CLIP provisioned

2 unknown (e.g. no network, etc.)

<number>: string type phone number of format specified by <type>

<type>: type of address octet in integer format (refer GSM 04.08 [8] subclause 10.5.4.7)

<subaddr>: string type subaddress of format specified by <satype>

<satype>: type of subaddress octet in integer format (refer GSM 04.08 [8] subclause 10.5.4.8)

<alpha>: optional string type alphanumeric representation of <number> corresponding to the entry found in phonebook; used character set should be the one selected with command Select TE Character Set +CSCS

<CLI validity>:

0 CLI valid

1 CLI has been withheld by the originator.

2 CLI is not available due to interworking problems or limitations of originating network.

When CLI is not available (<CLI validity>=2), <number> shall be an empty string (“”) and <type> value will not be significant. Nevertheless, TA may return the recommended value **128** for <type> ((TON/NPI unknown in accordance with GSM 04.08 [8] subclause 10.5.4.7).

When CLI has been withheld by the originator, (<CLI validity>=1) and the CLIP is provisioned with the “override category” option (refer ~~GSM 02.81~~3G TS 22.081[3] and 3G TS 23.081[40]), <number> and <type> is provided. Otherwise, TA shall return the same setting for <number> and <type> as if the CLI was not available.

Implementation

Optional.

7.7 Calling line identification restriction +CLIR

Table 40: +CLIR parameter command syntax

Command	Possible response(s)
+CLIR=[<n>]	
+CLIR?	+CLIR: <n>,<m>
+CLIR=?	+CLIR: (list of supported <n>s)

Description

This command refers to CLIR-service according to ~~GSM 02.81~~3G TS 22.081 [3] that allows a calling subscriber to enable or disable the presentation of the CLI to the called party when originating a call.

Set command overrides the CLIR subscription (default is restricted or allowed) when temporary mode is provisioned as a default adjustment for all following outgoing calls. This adjustment can be revoked by using the opposite command.. If this command is used by a subscriber without provision of CLIR in permanent mode the network will act according ~~GSM 02.81~~3G TS 22.081 [3].

Read command gives the default adjustment for all outgoing calls (given in <n>), and also triggers an interrogation of the provision status of the CLIR service (given in <m>). Test command returns values supported by the TA as a compound value.

NOTE: On a per call base CLIR functionality is explained in subclause "ITU-T V.25ter [14] dial command".

Defined values

<n> (parameter sets the adjustment for outgoing calls):

0 presentation indicator is used according to the subscription of the CLIR service

1 CLIR invocation

2 CLIR suppression

<m> (parameter shows the subscriber CLIR service status in the network):

0 CLIR not provisioned

1 CLIR provisioned in permanent mode

2 unknown (e.g. no network, etc.)

3 CLIR temporary mode presentation restricted

4 CLIR temporary mode presentation allowed

Implementation

Optional.

7.8 Connected line identification presentation +COLP

Table 41: +COLP parameter command syntax

Command	Possible response(s)
+COLP=[<n>]	
+COLP?	+COLP: <n>,<m>
+COLP=?	+COLP: (list of supported <n>s)

Description

This command refers to the ~~GSM~~GSM/UMTS supplementary service COLP (Connected Line Identification Presentation) that enables a calling subscriber to get the connected line identity (COL) of the called party after setting up a mobile originated call. The command enables or disables the presentation of the COL at the TE. It has no effect on the execution of the supplementary service COLR in the network.

When enabled (and called subscriber allows), +COLP: <number>,<type>[,<subaddr>,<satype> [,<alpha>]] intermediate result code is returned from TA to TE before any +CR or V.25ter [14] responses. It is manufacturer specific if this response is used when normal voice call is established.

Read command gives the status of <n>, and also triggers an interrogation of the provision status of the COLP service according ~~GSM 02.81~~3G TS 22.081 [3] (given in <m>).

Test command returns values supported by the TA as a compound value.

Defined values

<n> (parameter sets/shows the result code presentation status in the TA):

0 disable

1 enable

<m> (parameter shows the subscriber COLP service status in the network):

0 COLP not provisioned

1 COLP provisioned

2 unknown (e.g. no network, etc.)

<number>, <type>, <subaddr>, <satype>, <alpha>: refer +CLIP

Implementation

Optional.

7.9 Called line identification presentation +CDIP

Table 42: +CDIP parameter command syntax

Command	Possible response(s)
+CDIP=[<n>]	
+CDIP?	+CDIP: <n>,<m>
+CDIP=?	+CDIP: (list of supported <n>s)

Description

This command related to a network service that provides “multiple called numbers (called line identifications) service” to an MT. This command enables a called subscriber to get the called line identification of the called party when receiving a mobile terminated call. Set command enables or disables the presentation of the called line identifications at the TE.

When the presentation of the called line identification at the TE is enabled, `+CDIP:<number>,<type>[,<subaddr>,<satype>]` response is returned after every `RING` (or `+CRING: <type>`; refer subclause "Cellular result codes +CRC") result code sent from TA to TE. It is manufacturer specific if this response is used when normal voice call is answered.

Read command gives the status of `<n>`, and also triggers an interrogation of the provision status of the “multiple called numbers” service. Test command returns values supported by the TA as a compound value.

Defined values

`<n>` (parameter sets/shows the result code presentation status in the TA):

0 disable

1 enable

`<m>` (parameter shows the subscriber “multiple called numbers” service status in the network):

0 “multiple called numbers service” is not provisioned

1 “multiple called numbers service” is provisioned

2 unknown (e.g. no network, etc.)

`<number>`: string type phone number of format specified by `<type>`

`<type>`: type of address octet in integer format (refer GSM 04.08 [8] subclause 10.5.4.7)

`<subaddr>`: string type subaddress of format specified by `<satype>`

`<satype>`: type of subaddress octet in integer format (refer GSM 04.08 [8] subclause 10.5.4.8)

Implementation

Optional.

7.10 Closed user group +CCUG

Table 43: +CCUG parameter command syntax

Command	Possible response(s)
`+CCUG=[<n>[,<index>[,<info>]]]`	
`+CCUG?`	`+CCUG: <n>,<index>,<info>`
`+CCUG=?`	

Description

This command allows control of the Closed User Group supplementary service (refer ~~GSM 02.85~~3G TS 22.085 [21]). Set command enables the served subscriber to select a CUG index, to suppress the Outgoing Access (OA), and to suppress the preferential CUG.

Set command with `<n>`=1 enables to control the CUG information on the air interface as a default adjustment for all following outgoing calls. The interaction of this command with other commands based on other ~~GSM~~GSM/UMTS supplementary services is described in the ~~GSM~~GSM/UMTS standard.

NOTE: On a per call base CUG functionality is explained in subclause "ITU-T V.25ter [14] dial command".

Defined values

`<n>`:

0 disable CUG temporary mode

1 enable CUG temporary mode

<index>:

0...9 CUG index

10 no index (preferred CUG taken from subscriber data)

<info>:

0 no information

1 suppress OA

2 suppress preferential CUG

3 suppress OA and preferential CUG

Implementation

Optional.

7.11 Call forwarding number and conditions +CCFC

Table 44: +CCFC action command syntax

Command	Possible response(s)
+CCFC=<reason>,<mode> [,<number>[,<type> [,<class> [,<subaddr>[,<satype> [,<time>]]]]]]	*+CME ERROR: <err>* **when <mode>=2 and command successful:** +CCFC: <status>,<class1>[,<number>,<type> [,<subaddr>,<satype>[,<time>]]][<CR><LF>+CCFC: <status>,<class2>[,<number>,<type> [,<subaddr>,<satype>[,<time>]]] [...]]
+CCFC=?	+CCFC: (list of supported <reason>s)

Description

This command allows control of the call forwarding supplementary service according to ~~GSM 02.82~~3G TS 22.082 [4]. Registration, erasure, activation, deactivation, and status query are supported. When querying the status of a network service (<mode>=2) the response line for 'not active' case (<status>=0) should be returned only if service is not active for any <class>.

Test command returns reason values supported by the TA as a compound value.

Defined values

<reason>:

0 unconditional

1 mobile busy

2 no reply

3 not reachable

4 all call forwarding (refer ~~GSM 02.30~~3G TS 22.030 [19])

5 all conditional call forwarding (refer ~~GSM 02.30~~3G TS 22.030 [19])

<mode>:

0 disable

1 enable

2 query status

3 registration

4 erasure

<number>: string type phone number of forwarding address in format specified by <type>

<type>: type of address octet in integer format (refer GSM 04.08 [8] subclause 10.5.4.7); default 145 when dialling string includes international access code character "+", otherwise 129

<subaddr>: string type subaddress of format specified by <satype>

<satype>: type of subaddress octet in integer format (refer GSM 04.08 [8] subclause 10.5.4.8); default 128

<class*x*> is a sum of integers each representing a class of information (default 7):

1 voice (telephony)

2 data (refers to all bearer services; with <mode>=2 this may refer only to some bearer service if TA does not support values 16, 32, 64 and 128)

4 fax (facsimile services)

8 short message service

16 data circuit sync

32 data circuit async

64 dedicated packet access

128 dedicated PAD access

<time>:

1...30 when "no reply" is enabled or queried, this gives the time in seconds to wait before call is forwarded, default value 20

<status>:

0 not active

1 active

Implementation

Mandatory for ME supporting AT commands only and not supporting the control through dial command D.

7.12 Call waiting +CCWA

Table 45: +CCWA parameter command syntax

Command	Possible response(s)
+CCWA=[<n>[,<mode>[,<class>]]]	*+CME ERROR: <err>* **when <mode>=2 and command successful** +CCWA: <status>,<class1> [<CR><LF>+CCWA: <status>,<class2> [...]]
+CCWA?	+CCWA: <n>
+CCWA=?	+CCWA: (list of supported <n>s)

Description

This command allows control of the Call Waiting supplementary service according to ~~GSM 02.83~~3G TS 22.083 [5]. Activation, deactivation and status query are supported. When querying the status of a network service (`<mode>`=2) the response line for 'not active' case (`<status>`=0) should be returned only if service is not active for any `<class>`. Parameter `<n>` is used to disable/enable the presentation of an unsolicited result code `+CCWA: <number>,<type>,<class>,[<alpha>][,<CLI validity>]` to the TE when call waiting service is enabled. Command should be abortable when network is interrogated.

The interaction of this command with other commands based on other ~~GSM~~GSM/UMTS supplementary services is described in the ~~GSM~~GSM/UMTS standard.

Test command returns values supported by the TA as a compound value.

Defined values

`<n>` (sets/shows the result code presentation status in the TA):

0 disable

1 enable

`<mode>` (when `<mode>` parameter is not given, network is not interrogated):

0 disable

1 enable

2 query status

`<classx>` is a sum of integers each representing a class of information (default 7):

1 voice (telephony)

2 data (refers to all bearer services; with `<mode>`=2 this may refer only to some bearer service if TA does not support values 16, 32, 64 and 128)

4 fax (facsimile services)

8 short message service

16 data circuit sync

32 data circuit async

64 dedicated packet access

128 dedicated PAD access

`<status>`:

0 not active

1 active

`<number>`: string type phone number of calling address in format specified by `<type>`

`<type>`: type of address octet in integer format (refer GSM 04.08 [8] subclause 10.5.4.7)

`<alpha>`: optional string type alphanumeric representation of `<number>` corresponding to the entry found in phonebook; used character set should be the one selected with command Select TE Character Set `+CSCS`

`<CLI validity>`:

0 CLI valid

1 CLI has been withheld by the originator.

2 CLI is not available due to interworking problems or limitations of originating network.

When CLI is not available (`<CLI validity>`=2), `<number>` shall be an empty string (“”) and `<type>` value will not be significant. Nevertheless, TA may return the recommended value **128** for <type> ((TON/NPI unknown in accordance with GSM 04.08 [8] subclause 10.5.4.7).

When CLI has been withheld by the originator, (`<CLI validity>`=1) and the CLIP is provisioned with the “override category” option (refer ~~GSM 02.81~~3G TS 22.081[3] and 3G TS 23.081[40]), <number> and <type> is provided. Otherwise, TA shall return the same setting for <number> and <type> as if the CLI was not available.

Implementation

Optional.

7.13 Call related supplementary services +CHLD

Table 46: +CHLD action command syntax

Command	Possible response(s)
`+CHLD=[<n>]`	*+CME ERROR: <err>*
`+CHLD=?`	`[+CHLD: (`list of supported `<n>`s`)]`

Description

This command allows the control of the following call related services:

- a call can be temporarily disconnected from the ME but the connection is retained by the network
- multiparty conversation (conference calls)
- the served subscriber who has two calls (one held and the other either active or alerting) can connect the other parties and release the served subscriber’s own connection

Calls can be put on hold, recovered, released, added to conversation, and transferred similarly as defined in ~~GSM 02.30~~3G TS 22.030 [19]. Refer subclause 9.2 for possible `<err>` values.

This is based on the ~~GSM~~GSM/UMTS supplementary services HOLD (Call Hold; refer ~~GSM 02.83~~3G TS 22.083 [5] clause 2), MPTY (MultiParty; refer ~~GSM 02.84~~3G TS 22.084 [22]) and ECT (Explicit Call Transfer; refer ~~GSM 02.91~~3G TS 22.091 [29]). The interaction of this command with other commands based on other ~~GSM~~GSM/UMTS supplementary services is described in the ~~GSM~~GSM/UMTS standard.

NOTE: Call Hold, MultiParty and Explicit Call Transfer are only applicable to teleservice 11.

It is recommended (although optional) that test command returns a list of operations which are supported. The call number required by some operations shall be denoted by "x" (e.g. `+CHLD: (0,1,1x,2,2x,3)`).

Defined values

`<n>`: integer type; equals to numbers entered before SEND button in ~~GSM 02.30~~3G TS 22.030 [19] subclause 4.5.5.1

NOTE: The "directory number" case shall be handled with dial command `D`, and the END case with hangup command `H` (or `+CHUP`). The 4*“directory number” case is handled with `+CTFR` command.

Implementation

Optional.

7.14 Call deflection +CTFR

Table 47: +CTFR action command syntax

Command	Possible response(s)
+CTFR=<number>[,<type>[,<subaddr>[,<satype>]]]	*+CME ERROR: <err>*
+CTFR=?	

Description

This refers to a service that causes an incoming alerting call to be forwarded to a specified number. Action command does this. Refer subclause 9.2 for possible <err> values.

This is based on the ~~GSM~~GSM/UMTS supplementary service CD (Call Deflection; refer ~~GSM 02.72~~3G TS 22.072 [30]). The interaction of this command with other commands based on other ~~GSM~~GSM/UMTS supplementary services is described in the ~~GSM~~GSM/UMTS standard.

NOTE: Call Deflection is only applicable to teleservice 11.

Defined values

<number>: string type phone number of format specified by <type>

<type>: type of address octet in integer format (refer GSM 04.08 [8] subclause 10.5.4.7); default 145 when dialling string includes international access code character "+", otherwise 129

<subaddr>: string type subaddress of format specified by <satype>

<satype>: type of subaddress octet in integer format (refer GSM 04.08 [8] subclause 10.5.4.8); default 128

Implementation

Optional.

7.15 Unstructured supplementary service data +CUSD

Table 48: +CUSD parameter command syntax

Command	Possible response(s)
+CUSD=[<n>[,<str>[,<dcs>]]]	*+CME ERROR: <err>*
+CUSD?	+CUSD: <n>
+CUSD=?	+CUSD: (list of supported <n>s)

Description

This command allows control of the Unstuctured Supplementary Service Data (USSD) according to ~~GSM 02.90~~3G TS 22.090 [23]. Both network and mobile initiated operations are supported. Parameter <n> is used to disable/enable the presentation of an unsolicited result code (USSD response from the network, or network initiated operation) +CUSD: <m>[,<str>,<dcs>] to the TE. In addition, value <n>=2 is used to cancel an ongoing USSD session.

When <str> is given, a mobile initiated USSD-string or a response USSD-string to a network initiated operation is sent to the network. The response USSD-string from the network is returned in a subsequent unsolicited +CUSD result code.

NOTE: In case of successful mobile initiated operation, TA implemented according to a version prior to 6 of this standard, waits the USSD response from the network and sends it to the TE before the final result code. This will block the AT command interface for the period of the operation. Such TA does not support <n> value 2.

The interaction of this command with other commands based on other ~~GSM~~GSM/UMTS supplementary services is described in the ~~GSM~~GSM/UMTS standard.

Test command returns values supported by the TA as a compound value.

Defined values

<n>:

0 disable the result code presentation in the TA

1 enable the result code presentation in the TA

2 cancel session (not applicable to read command response)

<str>: string type USSD-string (when <str> parameter is not given, network is not interrogated):

- if <dcs> indicates that ~~GSM 03.38~~3G TS 23.038 [25] 7 bit default alphabet is used:
  - if TE character set other than "HEX" (refer command Select TE Character Set +CSCS): ME/TA converts GSM alphabet into current TE character set according to rules of ~~GSM 07.05~~3G TS 27.005 [24] Annex A
  - if TE character set is "HEX": ME/TA converts each 7-bit character of GSM alphabet into two IRA character long hexadecimal number (e.g. character Π (GSM 23) is presented as 17 (IRA 49 and 55))
- if <dcs> indicates that 8-bit data coding scheme is used: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number (e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65))

<dcs>: ~~GSM 03.38~~3G TS 23.038 [25] Cell Broadcast Data Coding Scheme in integer format (default 0)

<m>:

0 no further user action required (network initiated USSD-Notify, or no further information needed after mobile initiated operation)

1 further user action required (network initiated USSD-Request, or further information needed after mobile initiated operation)

2 USSD terminated by network

3 other local client has responded

4 operation not supported

5 network time out

Implementation

Optional.

7.16 Advice of Charge +CAOC

Table 49: +CAOC parameter command syntax

Command	Possible response(s)
+CAOC[=<mode>]	[+CAOC: <ccm>] *+CME ERROR: <err>*
+CAOC?	+CAOC: <mode>
+CAOC=?	[+CAOC: (list of supported <mode>s]

Description

This refers to Advice of Charge supplementary service (~~GSM 02.24~~3G TS 22.024 [26] and ~~GSM 02.86~~3G TS 22.086 [27]) that enables subscriber to get information about the cost of calls. With <mode>=0, the execute command returns the current call meter value from the ME.

~~If $(AT R97)$ is supported, t~~The command also includes the possibility to enable an unsolicited event reporting of the CCM information. The unsolicited result code `+CCCM: <ccm>` is sent when the CCM value changes, but not more that every 10 seconds. Deactivation of the unsolicited event reporting is made with the same command.

Refer subclause 9.2 for possible `<err>` values.

NOTE: Advice of Charge values stored in the SIM (ACM, ACMmax, PUCT) can be accessed with generic or restricted SIM access command (`+CSIM` or `+CRSM`)).~~ If $(AT R97)$ is supported t~~Those values can be more readily accessed with commands `+CACM`, `+CAMM` and +`CPUC`.

~~If $(AT R97)$ is supported, t~~The Read command indicates whether the unsolicited reporting is activated or not. Read command is available when the unsolicited result code is supported.

It is recommended (although optional) that the test command returns the supported mode values.

Defined values

`<mode>`: ~~$(AT R97)$~~

`0` query CCM value

`1` deactivate the unsolicited reporting of CCM value

`2` activate the unsolicited reporting of CCM value

`<ccm>`: string type; three bytes of the current call meter value in hexadecimal format (e.g. "00001E" indicates decimal value 30); value is in home units and bytes are similarly coded as ACMmax value in the SIM

Implementation

Optional.

7.17 Supplementary service notifications +CSSN

Table 50: +CSSN parameter command syntax

Command	Possible response(s)
`+CSSN=[<n>[,<m>]]`	
`+CSSN?`	`+CSSN: <n>,<m>`
`+CSSN=?`	`+CSSN:` (list of supported `<n>`s),(list of supported `<m>`s)

Description

This command refers to supplementary service related network initiated notifications. The set command enables/disables the presentation of notification result codes from TA to TE.

When `<n>`=1 and a supplementary service notification is received after a mobile originated call setup, intermediate result code `+CSSI: <code1>[,<index>]` is sent to TE before any other MO call setup result codes presented in this TS or in V.25ter [14]. When several different `<code1>`s are received from the network, each of them shall have its own `+CSSI` result code.

When `<m>`=1 and a supplementary service notification is received during a mobile terminated call setup or during a call, or when a forward check supplementary service notification is received, unsolicited result code `+CSSU: <code2>[,<index>[,<number>,<type>[,<subaddr>,<satype>]]]` is sent to TE. In case of MT call setup, result code is sent after every `+CLIP` result code (refer command "Calling line identification presentation +CLIP") and when several different `<code2>`s are received from the network, each of them shall have its own `+CSSU` result code.

Test command returns values supported by the TA as a compound value.

Defined values

`<n>` (parameter sets/shows the `+CSSI` result code presentation status in the TA):

0 disable

1 enable

`<m>` (parameter sets/shows the `+CSSU` result code presentation status in the TA):

0 disable

1 enable

`<code1>` (it is manufacturer specific, which of these codes are supported):

0 unconditional call forwarding is active

1 some of the conditional call forwardings are active

2 call has been forwarded

3 call is waiting

4 this is a CUG call (also `<index>` present)

5 outgoing calls are barred

6 incoming calls are barred

7 CLIR suppression rejected

8 call has been deflected

`<index>`: refer "Closed user group +CCUG"

`<code2>` (it is manufacturer specific, which of these codes are supported):

0 this is a forwarded call (MT call setup)

1 this is a CUG call (also `<index>` present) (MT call setup)

2 call has been put on hold (during a voice call)

3 call has been retrieved (during a voice call)

4 multiparty call entered (during a voice call)

5 call on hold has been released (this is not a SS notification) (during a voice call)

6 forward check SS message received (can be received whenever)

7 call is being connected (alerting) with the remote party in alerting state in explicit call transfer operation (during a voice call)

8 call has been connected with the other remote party in explicit call transfer operation (also number and subaddress parameters may be present) (during a voice call or MT call setup)

9 this is a deflected call (MT call setup)

10 sdditional incoming call forwarded

`<number>`: string type phone number of format specified by `<type>`

`<type>`: type of address octet in integer format (refer GSM 04.08 [8] subclause 10.5.4.7)

`<subaddr>`: string type subaddress of format specified by `<satype>`

`<satype>`: type of subaddress octet in integer format (refer GSM 04.08 [8] subclause 10.5.4.8)

Implementation

Optional.

7.18 List current calls +CLCC

Table 51:+CLCC action command syntax

Command	Possible response(s)
+CLCC	[+CLCC: <id1>,<dir>,<stat>,<mode>,<mpty>[, <number>,<type>[,<alpha>]] [<CR><LF>+CLCC: <id2>,<dir>,<stat>,<mode>,<mpty>[, <number>,<type>[,<alpha>]] [...]]] *+CME ERROR: <err>*
+CLCC=?	

Description

Returns list of current calls of ME. If command succeeds but no calls are available, no information response is sent to TE. Refer subclause 9.2 for possible <err> values.

Defined values

<id*x*>: integer type; call identification number as described in ~~GSM 02.30~~3G TS 22.030 [19] subclause 4.5.5.1; this number can be used in +CHLD command operations

<dir>:

0 mobile originated (MO) call

1 mobile terminated (MT) call

<stat> (state of the call):

0 active

1 held

2 dialing (MO call)

3 alerting (MO call)

4 incoming (MT call)

5 waiting (MT call)

<mode> (bearer/teleservice):

0 voice

1 data

2 fax

3 voice followed by data, voice mode

4 alternating voice/data, voice mode

5 alternating voice/fax, voice mode

6 voice followed by data, data mode

7 alternating voice/data, data mode

8 alternating voice/fax, fax mode

9 unknown

<mpty>:

0 call is not one of multiparty (conference) call parties

1 call is one of multiparty (conference) call parties

<number>: string type phone number in format specified by <type>

<type>: type of address octet in integer format (refer GSM 04.08 [8] subclause 10.5.4.7)

<alpha>: string type alphanumeric representation of <number> corresponding to the entry found in phonebook; used character set should be the one selected with command Select TE Character Set +CSCS

Implementation

Optional. Recommended when +CHLD command is implemented.

7.19 Preferred operator list +CPOL ~~$(AT R97)$~~

Table 52:+CPOL parameter command syntax

Command	Possible response(s)
+CPOL=[<index>][,<format>[,<oper>]]	*+CME ERROR: <err>*
+CPOL?	+CPOL: <index1>,<format>,<oper1> [<CR><LF>+CPOL: <index2>,<format>,<oper2> [...]] *+CME ERROR: <err>*
+CPOL=?	+CPOL: (list of supported <index>s),(list of supported <format>s)*+CME ERROR: <err>*

Description

This command is used to edit the SIM preferred list of networks. Execute command writes an entry in the SIM list of preferred operators ($EF_{PLMNsel}$). If <index> is given but <oper> is left out, entry is deleted. If <oper> is given but <index> is left out, <oper> is put in the next free location. If only <format> is given, the format of the <oper> in the read command is changed. Refer subclause 9.2 for possible <err> values.

NOTE: ME may also update this list automatically when new networks are selected.

Read command returns all used entries from the SIM list of preferred operators.

Test command returns the whole index range supported by the SIM.

Defined values

<index*n*>: integer type; the order number of operator in the SIM preferred operator list

<format>:

0 long format alphanumeric <oper>

1 short format alphanumeric <oper>

2 numeric <oper>

<oper*n*>: string type; <format> indicates if the format is alphanumeric or numeric (see +COPS)

Implementation

Optional.

7.20 Read operator names +COPN ~~$(AT R97)$~~

Table 53:+COPN action command syntax

Command	Possible response(s)
+COPN	+COPN: <numeric1>,<alpha1> [<CR><LF>+COPN: <numeric2>,<alpha2> [...]] *+CME ERROR: <err>*
+COPN=?	

Description

Execute command returns the list of operator names from the ME. Each operator code `<numeric`*n*`>` that has an alphanumeric equivalent `<alpha`*n*`>` in the ME memory shall be returned. Refer subclause 9.2 for possible `<err>` values.

Defined values

`<numeric`*n*`>`: string type; operator in numeric format (see `+COPS`)

`<alpha`*n*`>`: string type; operator in long alphanumeric format (see `+COPS`)

Implementation

Optional.

7.21 Informative examples

This subclause includes all the ~~GSM~~GSM/UMTS supplementary service related commands, additional commands to lock ME and SIM capabilities, and commands to check the network registration status.

An example where MSISDNs of a ME are queried, calls are forwarded to different numbers when mobile is busy (CFB) or when it does not answer (CFNRy). The status of CFNRy is read:

```
AT+CNUM
+CNUM: ,"+358501234567",145,,4        (voice number)
OK
AT+CCFC=1,1,"931123456"               (enable CFB)
OK
AT+CCFC=2,1,"921654321"               (enable CFNRy)
OK
AT+CCFC=1,2                           (query CFNRy)
+CCFC: 1,7,"+35821654321",145,,,20    (forward after 20 seconds)
OK
```

An example of Call Waiting (`+CCWA`), Call Related Supplementary Services (`+CHLD`), and Connected Line Identification Presentation (`+COLP`) usage:

```
AT+CCWA=1,1;+COLP=1            (enable call waiting and COLP result codes)
OK
ATD9311234567;                 (originate a voice call)
+COLP: "+358311234567",145
OK
...conversation...
+CCWA: "+358317654321",145     (another call is waiting)
AT+CHLD=2                      (put first call on hold and answer the second one)
OK
...conversation...
AT+CHLD=1                      (release the second (active) call and recover the first (held) call)
OK
ATH                            (release the first call)
OK
```

Call barring supplementary services are combined in one command, Facility Lock (`+CLCK`), which is also used to restrict ME and SIM functionality Some of the facilities require a password when enabled or disabled. An additional command, Change Password (`+CPWD`), is defined for changing the password of different barring and restriction facilities. An example where locking status of outgoing international calls is interrogated and then barred, and the password of the SIM card lock (Personal Identity Number, PIN) is changed:

```
AT+CLCK="OI",2
+CLCK: 0,7
OK
AT+CLCK="OI",1,"1234"
OK
AT+CPWD="SC","4321","1234"
OK
```

Operator Selection (+COPS) command is used for querying the status of all ~~GSM~~GSM/UMTS operators detected in the area, and switching between operators.

Following example illustrates a network selection sequence in Finland. Two operators are found, the status of Tele is unknown and Radiolinja is currently selected. Read command shows that automatic selection mode is on and that Radiolinja is selected. Then an attempt is made to access Tele, but it is denied (shown by +CME ERROR).

```
AT+COPS=?
+COPS: (2,"RADIOLINJA","RL","24405"),(0,"TELE","TELE","24491")
OK
AT+COPS?
+COPS: 0,0,"RADIOLINJA"
OK
AT+COPS=1,0,"TELE"
+CME ERROR: 3
```

When a terminal wanders between countries (i.e. networks), an application may follow this e.g. with the following scenario:

```
AT+CREG=1                       (enable +CREG: <stat> unsolicited result code)
OK
AT+CREG?
+CREG: 1,1                      (ME is registered in home PLMN)
OK
AT+COPS=3,2;+COPS?;+COPS=3,0;+COPS?
+COPS: 0,2,"24405"              (get the country...
+COPS: 0,0,"RADIOLINJA"          ...and operator name)
OK
...user wanders to another PLMN...
+CREG: 2                        (deregistered, roaming ongoing)
+CREG: 5                        (registered again, not home PLMN)
AT+COPS=3,2;+COPS?;+COPS=3,0;+COPS?
+COPS: 0,2,"24001"              (get the country...
+COPS: 0,0,"TELIA MOBITEL"       ...and operator name)
OK
...user loses connection, no other PLMNs around...
+CREG: 0
```

8 Mobile Equipment control and status commands

This clause includes commands for ME power, keypad, display and indicator handling. Also commands for selecting, reading and writing of phonebooks, and setting real-time clock facilities are specified. Two commands are specified for accessing SIM database records in a general way.

Figure 7 illustrates the effect of these commands. Command Phone Activity Status +CPAS indicates the current general activity status of the ME. Command Set Phone Functionality +CFUN is used to set the ME to different power consumption states. Command Enter PIN +CPIN is used to enter ME passwords which are needed before any other functionality of the ME can be used (e.g. SIM PIN, PUK). Commands Generic SIM Access +CSIM and Restricted SIM Access +CRSM can be used to access all data in SIM. Commands Battery Charge +CBC and Signal Quality +CSQ are same as in TIA IS-135 [16] and they are used to query the battery charge of the ME and the current RSSI of the ME. Command Mobile Equipment Control Mode +CMEC is used to select the controlling unit of ME keypad, display and indicators. Controlling commands for the TE are Keypad Emulation +CKPD, Display Control +CDIS and Indicator Control +CIND. If corresponding event reporting is enabled with command Mobile Equipment Event Reporting +CMER, +CKEV is the result code of a keypad event, +CDEV is the result code of a display event, and +CIEV is the result code of an indicator event. Phonebook commands are Select Phonebook Memory Storage +CPBS, Read Phonebook Entries +CPBR, Find Phonebook Entries +CPBF and Write Phonebook Entry +CPBW. Additional command

Clock +CCLK can be used to control the real-time clock of the ME if available. Command Alarm +CALA sets possible alarm clock facilities of the ME.

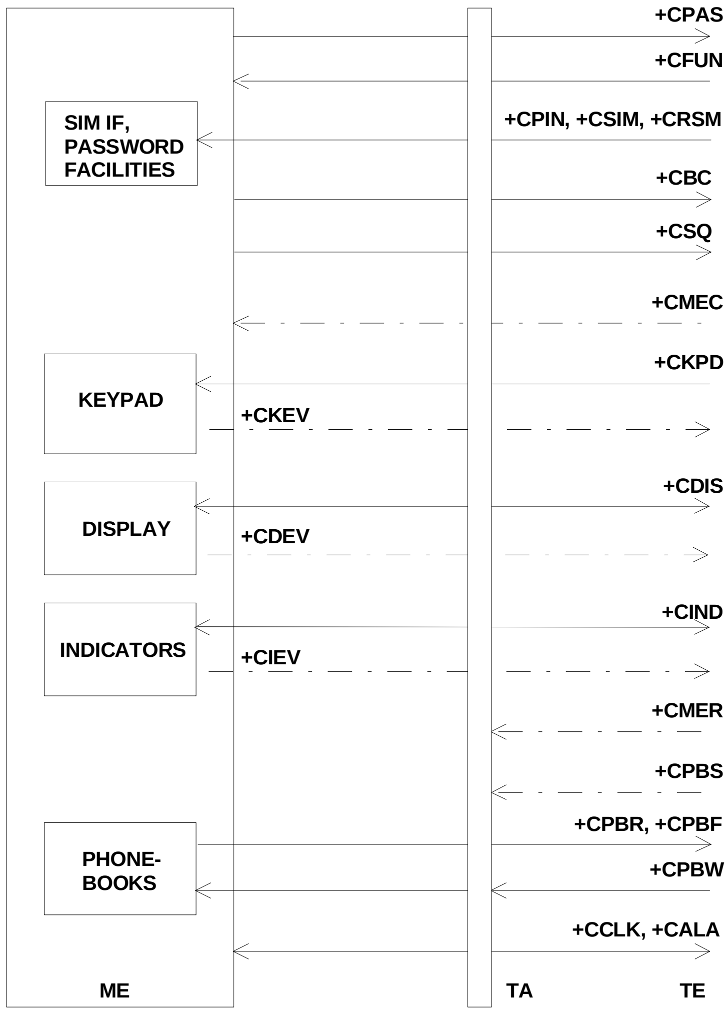

Figure 7: Mobile equipment control and status commands

8.1 Phone activity status +CPAS

Table 54: +CPAS action command syntax

Command	Possible response(s)
+CPAS	+CPAS: <pas> *+CME ERROR: <err>*
+CPAS=?	+CPAS: (list of supported <pas>s) *+CME ERROR: <err>*

Description

Execution command returns the activity status <pas> of the ME. It can be used to interrogate the ME before requesting action from the phone. Refer subclause 9.2 for possible <err> values.

Test command returns values supported by the ME as a compound value.

Defined values

<pas>:

0 ready (ME allows commands from TA/TE)

1 unavailable (ME does not allow commands from TA/TE)

2 unknown (ME is not guaranteed to respond to instructions)

3 ringing (ME is ready for commands from TA/TE, but the ringer is active)

4 call in progress (ME is ready for commands from TA/TE, but a call is in progress)

5 asleep (ME is unable to process commands from TA/TE because it is in a low functionality state)

also all other values below 128 are reserved by this TS

Implementation

Mandatory when ME can be operated from TE (refer subclause "Mobile Equipment control mode +CMEC").

8.2 Set phone functionality +CFUN

Table 55: +CFUN parameter command syntax

Command	Possible response(s)
`+CFUN=[<fun>[,<rst>]]`	*+CME ERROR: <err>*
`+CFUN?`	`+CFUN: <fun>` *+CME ERROR: <err>*
`+CFUN=?`	`+CFUN:` (list of supported `<fun>`s), (list of supported `<rst>`s) *+CME ERROR: <err>*

Description

Set command selects the level of functionality `<fun>` in the ME. Level "full functionality" is where the highest level of power is drawn. "Minimum functionality" is where minimum power is drawn. Level of functionality between these may also be specified by manufacturers. When supported by manufacturers, ME resetting with `<rst>` parameter may be utilized. Refer subclause 9.2 for possible `<err>` values.

NOTE: It is manufacturer specific does this command affect network registration. Command Operator Selection `+COPS` is used to force registration/deregistration.

Test command returns values supported by the ME as a compound value.

Defined values

`<fun>`:

0 minimum functionality

1 full functionality

2 disable phone transmit RF circuits only

3 disable phone receive RF circuits only

4 disable phone both transmit and receive RF circuits

5...127 reserved for manufacturers as intermediate states between full and minimum functionality

`<rst>`:

0 do not reset the ME before setting it to `<fun>` power level

NOTE: This shall be always default when `<rst>` is not given.

1 reset the ME before setting it to `<fun>` power level

Implementation

Optional.

8.3 Enter PIN +CPIN

Table 56: +CPIN parameter command syntax

Command	Possible response(s)
`+CPIN=<pin>[,<newpin>]`	*`+CME ERROR: <err>`*
`+CPIN?`	`+CPIN: <code>` *`+CME ERROR: <err>`*
`+CPIN=?`	

Description

Set command sends to the ME a password which is necessary before it can be operated (SIM PIN, SIM PUK, PH-SIM PIN, etc.). If the PIN is to be entered twice, the TA shall automatically repeat the PIN. If no PIN request is pending, no action is taken towards ME and an error message, `+CME ERROR`, is returned to TE. Refer subclause 9.2 for possible `<err>` values.

If the PIN required is SIM PUK or SIM PUK2, the second pin is required. This second pin, `<newpin>`, is used to replace the old pin in the SIM.

NOTE: Commands which interact with ME that are accepted when ME is pending SIM PIN, SIM PUK, or PH-SIM are: `+CGMI`, `+CGMM`, `+CGMR`, `+CGSN`, `D112;` (emergency call), `+CPAS`, `+CFUN`, `+CPIN`, `+CDIS` (read and test command only), and `+CIND` (read and test command only).

Read command returns an alphanumeric string indicating whether some password is required or not.

Defined values

`<pin>`, `<newpin>`: string type values

`<code>` values reserved by this TS:

`READY` ME is not pending for any password

`SIM PIN` ME is waiting SIM PIN to be given

`SIM PUK` ME is waiting SIM PUK to be given

`PH-SIM PIN` ME is waiting phone-to-SIM card password to be given

`PH-FSIM PIN` ME is waiting phone-to-very first SIM card password to be given

`PH-FSIM PUK` ME is waiting phone-to-very first SIM card unblocking password to be given

`SIM PIN2` ME is waiting SIM PIN2 to be given (this `<code>` is recommended to be returned only when the last executed command resulted in PIN2 authentication failure (i.e. `+CME ERROR: 17`); if PIN2 is not entered right after the failure, it is recommended that ME does not block its operation)

`SIM PUK2` ME is waiting SIM PUK2 to be given (this `<code>` is recommended to be returned only when the last executed command resulted in PUK2 authentication failure (i.e. `+CME ERROR: 18`); if PUK2 and new PIN2 are not entered right after the failure, it is recommended that ME does not block its operation)

`PH-NET PIN` ME is waiting network personalisation password to be given

`PH-NET PUK` ME is waiting network personalisation unblocking password to be given

`PH-NETSUB PIN` ME is waiting network subset personalisation password to be given

`PH-NETSUB PUK` ME is waiting network subset personalisation unblocking password to be given

`PH-SP PIN` ME is waiting service provider personalisation password to be given

PH-SP PUK ME is waiting service provider personalisation unblocking password to be given

PH-CORP PIN ME is waiting corporate personalisation password to be given

PH-CORP PUK ME is waiting corporate personalisation unblocking password to be given

Implementation

Mandatory for ME not supporting the +CKPD command and supporting AT commands only.

8.4 Battery charge +CBC

Table 57: +CBC action command syntax

Command	Possible response(s)
+CBC	+CBC: <bcs>,<bcl> *+CME ERROR: <err>*
+CBC=?	+CBC: (list of supported <bcs>s),(list of supported <bcl>s)

Description

Execution command returns battery connection status <bcs> and battery charge level <bcl> of the ME. Refer subclause 9.2 for possible <err> values.

Test command returns values supported by the TA as compound values.

Defined values

<bcs>:

0 ME is powered by the battery

1 ME has a battery connected, but is not powered by it

2 ME does not have a battery connected

3 Recognized power fault, calls inhibited

<bcl>:

0 battery is exhausted, or ME does not have a battery connected

1...100 battery has 1-100 percent of capacity remaining

Implementation

Optional.

8.5 Signal quality +CSQ

Table 58: +CSQ action command syntax

Command	Possible response(s)
+CSQ	+CSQ: <rssi>,<ber> *+CME ERROR: <err>*
+CSQ=?	+CSQ: (list of supported <rssi>s),(list of supported <ber>s)

Description

Execution command returns received signal strength indication <rssi> and channel bit error rate <ber> from the ME. Refer subclause 9.2 for possible <err> values.

Test command returns values supported by the TA as compound values.

Defined values

<rssi>:

0 -113 dBm or less

1 -111 dBm

2...30 -109... -53 dBm

31 -51 dBm or greater

99 not known or not detectable

<ber> (in percent):

0...7 as RXQUAL values in the table in GSM 05.08 [20] subclause 8.2.4

99 not known or not detectable

Implementation

Optional.

8.6 Mobile Equipment control mode +CMEC

Table 59: +CMEC parameter command syntax

Command	Possible response(s)
`+CMEC=[<keyp>[,<disp>[,<ind>]]]`	*+CME ERROR: <err>*
`+CMEC?`	`+CMEC: <keyp>,<disp>,<ind>`
`+CMEC=?`	+CMEC: (list of supported <keyp>s),(list of supported <disp>s),(list of supported <ind>s)

Description

Set command selects the equipment, which operates ME keypad, writes to ME display and sets ME indicators. If operation mode is not allowed by the ME, +CME ERROR: <err> is returned. Refer subclause 9.2 for <err> values.

Test command returns the modes supported by the TA as compound values.

Defined values

<keyp>:

<u>0</u> ME can be operated only through its keypad (execute command of +CKPD cannot be used)

1 ME can be operated only from TE (with command +CKPD)

2 ME can be operated from both ME keypad and TE

<disp>:

<u>0</u> only ME can write to its display (command +CDIS can only be used to read the display)

1 only TE can write to ME display (with command +CDIS)

2 ME display can be written by both ME and TE

<ind>:

<u>0</u> only ME can set the status of its indicators (command +CIND can only be used to read the indicators)

1 only TE can set the status of ME indicators (with command +CIND)

2 ME indicators can be set by both ME and TE

Implementation

Mandatory when any of keypad, display or indicator commands is implemented.

8.7 Keypad control +CKPD

Table 60: +CKPD action command syntax

Command	Possible response(s)
`+CKPD=<keys>[,<time>[,<pause>]]`	*+CME ERROR: <err>*
`+CKPD=?`	

Description

Execution command emulates ME keypad by giving each keystroke as a character in a string <keys>. <time>*0.1 seconds is the time to stroke each key and <pause>*0.1 seconds is the length of pause between two strokes. If emulating fails in an ME error, +CME ERROR: <err> is returned. Refer subclause 9.2 for <err> values. This command should be accepted (OK returned) before actually starting to press the keys. Thus unsolicited result codes of key pressings and display events can be returned (refer subclause "Mobile Equipment event reporting +CMER").

Defined values

<keys>: string of characters representing keys as listed in the following table (based on PCCA STD-101 Annex table I-3). Colon character (IRA 58) followed by one character can be used to indicate a manufacturer specific key not listed here. All characters from a semicolon character (IRA 59) to the next single semicolon character are treated as alpha entries and are not converted to key equivalents. All semicolon characters inside alpha entries should be duplicated in the TE and stripped to one before entering to the ME. Pause character (IRA 87 or 119) can be used to pause between key pressings for a time specified by <pause>. All IRA values not listed here are reserved.

Table 61: Character codes

Char	IRA (dec)	Comment (+ some known key symbols)
#	35	hash (number sign)
%	37	percent sign (P)
*	42	star (*)
0... 9	48... 57	number keys
:	58	escape character for manufacturer specific keys
;	59	escape character for string entering
<	60	left arrow
>	62	right arrow
@	64	alpha key (α/ABC)
A/a	65/97	channel A (A)
B/b	66/98	channel B (B)
C/c	67/99	clear display (C/CLR)
D/d	68/100	volume down
E/e	69/101	connection end (END)
F/f	70/102	function (FCN)
L/l	76/108	phone lock (LOCK)
M/m	77/109	menu (MENU)
P/p	80/112	power (PWR)
Q/q	81/113	quiet/mute (MUTE)
R/r	82/114	recall last number (R/RCL/MR)
S/s	83/115	connection start (SEND)
T/t	84/116	store/ memory (STO/M/M+)
U/u	85/117	volume up
V/v	86/118	down arrow
W/w	87/119	pause character
X/x	88/120	auxiliary (AUX)
Y/y	89/121	delete last character (C)
[	91	soft key 1
]	93	soft key 2
^	94	up arrow

`<time>`, `<pause>`:

0...255 0... 25.5 seconds (default values are manufacturer specific, but should be so long that a normal ME can handle keystrokes correctly)

Implementation

Mandatory for ME not supporting the `+CPIN` command and supporting AT commands only.

8.8 Display control +CDIS

Table 62: +CDIS parameter command syntax

Command	Possible response(s)
`+CDIS=[<text>[,<text>[,...]]]`	*+CME ERROR: <err>*
`+CDIS?`	`+CDIS: <text>[,<text>[,...]]` *+CME ERROR: <err>*
`+CDIS=?`	`+CDIS: <length>[,<length>[,...]]` *+CME ERROR: <err>*

Description

Set command is used to write the contents of ME text type display elements. An element can consist of one character or several characters. The order of element parameters `<text>` should follow the rule: first is the element in upper left corner, second is the next element to the right and so on. The last element is the element in lower right corner. The number of elements is ME specific. If ME does not allow writing to its display or ME is not currently reachable, `+CME ERROR: <err>` is returned. Refer subclause 9.2 for `<err>` values. If certain element is not writable, setting of it should be ignored. If element parameter is empty field, element shall remain in the previous value.

NOTE: This command cannot be used to write to a display which sum of element lengths exceed the length of the command line buffer of the TA.

Read command returns the contents of ME display elements. If `<text>` field is empty (not empty string), ME does not allow the reading of corresponding element. If ME is not currently reachable, `+CME ERROR: <err>` is returned. Refer subclause 9.2 for `<err>` values.

Test command returns maximum length of each display element. If ME does not offer the length of elements, `<length>` fields should be empty. If ME is not currently reachable, `+CME ERROR: <err>` is returned. Refer subclause 9.2 for `<err>` values.

NOTE: ME manufacturer should offer the order and maximum length of elements.

Defined values

`<text>`: string type parameter using character set specified by command Select TE Character Set `+CSCS`

`<length>`: integer type parameter giving the maximum length of corresponding `<text>` parameter

Implementation

Optional.

8.9 Indicator control +CIND

Table 63: +CIND parameter command syntax

Command	Possible response(s)
+CIND=[<ind>[,<ind>[,...]]]	*+CME ERROR: <err>*
+CIND?	+CIND: <ind>[,<ind>[,...]] *+CME ERROR: <err>*
+CIND=?	+CIND: (<descr>,(list of supported <ind>s)) [,(<descr>,(list of supported <ind>s))[,...]] *+CME ERROR: <err>*

Description

Set command is used to set the values of ME indicators. `<ind>` value 0 means that the indicator is off (or in state which can be identified as "off"-state), 1 means that indicator is on (or in a state which is more substantial than "off"-state), 2 is more substantial than 1, and so on. If the indicator is a simple on/off style element, it has values 0 and 1. The number of elements is ME specific. If ME does not allow setting of indicators or ME is not currently reachable, `+CME ERROR: <err>` is returned. Refer subclause 9.2 for `<err>` values. If certain indicator is not writable, setting of it should be ignored. If parameter is empty field, indicator shall remain in the previous value.

Read command returns the status of ME indicators. If ME is not currently reachable, `+CME ERROR: <err>` is returned. Refer subclause 9.2 for `<err>` values.

Test command returns pairs, where string value `<descr>` is a maximum 16 character description of the indicator and compound value is the allowed values for the indicator. If ME is not currently reachable, `+CME ERROR: <err>` is returned. Refer subclause 9.2 for `<err>` values.

NOTE: ME manufacturer should offer the description of supported indicators not listed here and their value ranges and default values.

Defined values

`<ind>`: integer type value, which shall be in range of corresponding `<descr>`

<descr> values reserved by this TS and their <ind> ranges:

"battchg" battery charge level (0-5)

"signal" signal quality (0-5)

"service" service availability (0-1)

"sounder" sounder activity (0-1)

"message" message received (0-1)

"call" call in progress (0-1)

"vox" transmit activated by voice activity (0-1)

"roam" roaming indicator (0-1)

"smsfull" a short message memory storage in the MT has become full (1), or memory locations are available (0); i.e. the range is (0-1)

Implementation

Optional.

8.10 Mobile Equipment event reporting +CMER

Table 64: +CMER parameter command syntax

Command	Possible response(s)
+CMER=[<mode>[,<keyp>[,<disp>[,<ind>[,<bfr>]]]]]	*+CME ERROR: <err>*
+CMER?	+CMER: <mode>,<keyp>,<disp>,<ind>,<bfr>
+CMER=?	+CMER: (list of supported <mode>s),(list of supported <keyp>s),(list of supported <disp>s),(list of supported <ind>s),(list of supported <bfr>s)

Description

Set command enables or disables sending of unsolicited result codes from TA to TE in the case of key pressings, display changes, and indicator state changes. <mode> controls the processing of unsolicited result codes specified within this command. <bfr> controls the effect on buffered codes when <mode> 1, 2 or 3 is entered. If setting is not supported by the ME, +CME ERROR: <err> is returned. Refer subclause 9.2 for <err> values.

Test command returns the modes supported by the TA as compound values.

Defined values

<mode>:

<u>0</u> buffer unsolicited result codes in the TA; if TA result code buffer is full, codes can be buffered in some other place or the oldest ones can be discarded

1 discard unsolicited result codes when TA-TE link is reserved (e.g. in on-line data mode); otherwise forward them directly to the TE

2 buffer unsolicited result codes in the TA when TA-TE link is reserved (e.g. in on-line data mode) and flush them to the TE after reservation; otherwise forward them directly to the TE

3 forward unsolicited result codes directly to the TE; TA-TE link specific inband technique used to embed result codes and data when TA is in on-line data mode

<keyp>:

0 no keypad event reporting

1 keypad event reporting using result code +CKEV: <key>,<press>. <key> indicates the key (refer IRA values defined in table in subclause "Keypad control +CKPD") and <press> if the key is pressed or released (1 for pressing and 0 for releasing). Only those key pressings, which are not caused by +CKPD shall be indicated by the TA to the TE.

NOTE: When this mode is enabled, corresponding result codes of all keys currently pressed should be flushed to the TA regardless of <bfr> setting.

2 keypad event reporting using result code +CKEV: <key>,<press>. All key pressings shall be directed from TA to TE.

NOTE: When this mode is enabled, corresponding result codes of all keys currently pressed should be flushed to the TA regardless of <bfr> setting.

<disp>:

0 no display event reporting

1 display event reporting using result code +CDEV: <elem>,<text>. <elem> indicates the element order number (as specified for +CDIS) and <text> is the new value of text element. Only those display events, which are not caused by +CDIS shall be indicated by the TA to the TE. Character set used in <text> is as specified by command Select TE Character Set +CSCS

2 display event reporting using result code +CDEV: <elem>,<text>. All display events shall be directed from TA to TE. Character set used in <text> is as specified by command Select TE Character Set +CSCS

<ind>:

0 no indicator event reporting

1 indicator event reporting using result code +CIEV: <ind>,<value>. <ind> indicates the indicator order number (as specified for +CIND) and <value> is the new value of indicator. Only those indicator events, which are not caused by +CIND shall be indicated by the TA to the TE

2 indicator event reporting using result code +CIEV: <ind>,<value>. All indicator events shall be directed from TA to TE

<bfr>:

0 TA buffer of unsolicited result codes defined within this command is cleared when <mode> 1...3 is entered

1 TA buffer of unsolicited result codes defined within this command is flushed to the TE when <mode> 1...3 is entered (OK response shall be given before flushing the codes)

Implementation

Mandatory when any of the keypad, display, or indicator result codes is implemented.

8.11 Select phonebook memory storage +CPBS

Table 65: +CPBS parameter command syntax

Command	Possible response(s)
+CPBS=<storage>[,<password>]	*+CME ERROR: <err>*
+CPBS?	+CPBS: <storage>[,<used>,<total>] *+CME ERROR: <err>*
+CPBS=?	+CPBS: (list of supported <storage>s)

Description

Set command selects phonebook memory storage `<storage>`, which is used by other phonebook commands. If setting fails in an ME error, `+CME ERROR: <err>` is returned. Refer subclause 9.2 for `<err>` values.

Read command returns currently selected memory, and when supported by manufacturer, number of used locations and total number of locations in the memory.

Test command returns supported storages as compound value.

Defined values

`<storage>` values reserved by this TS:

`"DC"` ME dialled calls list (`+CPBW` may not be applicable for this storage) ~~$(AT R97)$~~

`"EN"` SIM (or ME) emergency number (`+CPBW` is not be applicable for this storage) ~~$(AT R97)$~~

`"FD"` SIM fixdialling-phonebook

`"LD"` SIM last-dialling-phonebook

`"MC"` ME missed (unanswered received) calls list (`+CPBW` may not be applicable for this storage)

`"ME"` ME phonebook

`"MT"` combined ME and SIM phonebook

`"ON"` SIM (or ME) own numbers (MSISDNs) list (reading of this storage may be available through `+CNUM` also) ~~$(AT R97)$~~

`"RC"` ME received calls list (`+CPBW` may not be applicable for this storage) ~~$(AT R97)$~~

`"SM"` SIM phonebook

`"TA"` TA phonebook

`<password>`: string type value representing the PIN2-code required when selecting PIN2-code locked `<storage>`s above, e.g. “FD”.

`<used>`: integer type value indicating the number of used locations in selected memory

`<total>`: integer type value indicating the total number of locations in selected memory

Implementation

Mandatory when phonebook read, find or write command, or direct dialling (refer subclause "Direct dialling from phonebooks") is implemented.

8.12 Read phonebook entries +CPBR

Table 66: +CPBR action command syntax

Command	Possible response(s)
`+CPBR=<index1>[,<index2>]`	`[+CPBR: <index1>,<number>,<type>,<text>[[...]<CR><LF>+CPBR: <index2>,<number>,<type>,<text>]]` *`+CME ERROR: <err>`*
`+CPBR=?`	`+CPBR: (`list of supported `<index>`s`),[<nlength>],[<tlength>]` *`+CME ERROR: <err>`*

Description

Execution command returns phonebook entries in location number range `<index1>`... `<index2>` from the current phonebook memory storage selected with `+CPBS`. If `<index2>` is left out, only location `<index1>` is returned. Entry fields returned are location number `<index`*`n`*`>`, phone number stored there `<number>` (of format `<type>`) and text

<text> associated with the number. If all queried locations are empty (but available), no information text lines may be returnedIf listing fails in an ME error, +CME ERROR: <err> is returned. Refer subclause 9.2 for <err> values.

Test command returns location range supported by the current storage as a compound value and the maximum lengths of <number> and <text> fields. In case of SIM storage, the lengths may not be available. If ME is not currently reachable, +CME ERROR: <err> is returned. Refer subclause 9.2 for <err> values.

Defined values

<index1>, <index2>, <index>: integer type values in the range of location numbers of phonebook memory

<number>: string type phone number of format <type>

<type>: type of address octet in integer format (refer GSM 04.08 [8] subclause 10.5.4.7)

<text>: string type field of maximum length <tlength>; character set as specified by command Select TE Character Set +CSCS

<nlength>: integer type value indicating the maximum length of field <number>

<tlength>: integer type value indicating the maximum length of field <text>

Implementation

Optional.

8.13 Find phonebook entries +CPBF

Table 67: +CPBF action command syntax

Command	Possible response(s)
+CPBF=<findtext>	[+CPBF: <index1>,<number>,<type>,<text>[[...] <CR><LF>+CBPF: <index2>,<number>,<type>,<text>]] *+CME ERROR: <err>*
+CPBF=?	+CPBF: [<nlength>],[<tlength>] *+CME ERROR: <err>*

Description

Execution command returns phonebook entries (from the current phonebook memory storage selected with +CPBS) which alphanumeric field start with string <findtext>. Entry fields returned are location number <index*n*>, phone number stored there <number> (of format <type>) and text <text> associated with the number. If listing fails in an ME error, +CME ERROR: <err> is returned. Refer subclause 9.2 for <err> values.

Test command returns the maximum lengths of <number> and <text> fields. In case of SIM storage, the lengths may not be available. If ME is not currently reachable, +CME ERROR: <err> is returned. Refer subclause 9.2 for <err> values.

Defined values

<index1>, <index2>: integer type values in the range of location numbers of phonebook memory

<number>: string type phone number of format <type>

<type>: type of address octet in integer format (refer GSM 04.08 [8] subclause 10.5.4.7)

<findtext>, <text>: string type field of maximum length <tlength>; character set as specified by command Select TE Character Set +CSCS

<nlength>: integer type value indicating the maximum length of field <number>

<tlength>: integer type value indicating the maximum length of field <text>

Implementation

Optional.

8.14 Write phonebook entry +CPBW

Table 68: +CPBW action command syntax

Command	Possible response(s)
+CPBW=[<index>][,<number>[,<type>[,<text>]]]	*+CME ERROR: <err>*
+CPBW=?	+CPBW: (list of supported <index>s),[<nlength>],(list of supported <type>s),[<tlength>] *+CME ERROR: <err>*

Description

Execution command writes phonebook entry in location number <index> in the current phonebook memory storage selected with +CPBS. Entry fields written are phone number <number> (in the format <type>) and text <text> associated with the number. If those fields are omitted, phonebook entry is deleted. If <index> is left out, but <number> is given, entry is written to the first free location in the phonebook (the implementation of this feature is manufacturer specific). If writing fails in an ME error, +CME ERROR: <err> is returned. Refer subclause 9.2 for <err> values.

Test command returns location range supported by the current storage as a compound value, the maximum length of <number> field, supported number formats of the storage, and the maximum length of <text> field. In case of SIM storage, the lengths may not be available. If ME is not currently reachable, +CME ERROR: <err> is returned. Refer subclause 9.2 for <err> values. If storage does not offer format information, the format list should be empty parenthesis

Defined values

<index>: integer type values in the range of location numbers of phonebook memory

<number>: string type phone number of format <type>

<type>: type of address octet in integer format (refer GSM 04.08 [8] subclause 10.5.4.7) ; default 145 when dialling string includes international access code character "+", otherwise 129

<text>: string type field of maximum length <tlength>; character set as specified by command Select TE Character Set +CSCS

<nlength>: integer type value indicating the maximum length of field <number>

<tlength>: integer type value indicating the maximum length of field <text>

Implementation

Optional.

8.15 Clock +CCLK

Table 69: +CCLK parameter command syntax

Command	Possible response(s)
+CCLK=<time>	*+CME ERROR: <err>*
+CCLK?	+CCLK: <time> *+CME ERROR: <err>*
+CCLK=?	

Description

Set command sets the real-time clock of the ME. If setting fails in an ME error, `+CME ERROR: <err>` is returned. Refer subclause 9.2 for `<err>` values.

Read command returns the current setting of the clock.

Defined values

`<time>`: string type value; format is "yy/MM/dd,hh:mm:ss±zz", where characters indicate year (two last digits), month, day, hour, minutes, seconds and time zone (indicates the difference, expressed in quarters of an hour, between the local time and GMT; range -47...+48). E.g. 6th of May 1994, 22:10:00 GMT+2 hours equals to "94/05/06,22:10:00+08"

NOTE: If ME does not support time zone information then the three last characters of <time> are not returned by +CCLK?.

Implementation

Optional.

8.16 Alarm +CALA

Table 70: +CALA parameter command syntax

Command	Possible response(s)
`+CALA=<time>[,<n>[,<type>[,<text>[,<recurr>[,<silent>]]]]]`	*`+CME ERROR: <err>`*
`+CALA?`	`[+CALA: <time>,<n1>,<type>,[<text>],[<recurr>],<silent>` `[<CR><LF>+CALA: <time>,<n2>,<type>,[<text>],[<recurr>],<silent>` `[...]]]` *`+CME ERROR: <err>`*
`+CALA=?`	`+CALA: (`list of supported `<n>`s`),(`list of supported `<type>`s`),<tlength>,<rlength>,(`list of supported `<silent>`s`)` *`+CME ERROR: <err>`*

Description

Set command sets an alarm time in the ME. There can be an array of different types of alarms, and each alarm may cause different text to be displayed in the ME display. If setting fails in an ME error, `+CME ERROR: <err>` is returned. Refer subclause 9.2 for `<err>` values.

To set up a recurrent alarm for one or more days in the week, the `<recurr>`-parameter may be used.

When an alarm is timed out and executed, the unsolicited result code `+CALV: <n>` is always returned, even if the alarm is set up to be silent.

Read command returns the list of current active alarm settings in the ME.

Test command returns supported array index values, alarm types, and maximum length of the text to be displayed.

Defined values

`<time>`: refer `+CCLK`

NOTE: If the `<recurr>`-parameter is used, the `<time>`-parameter must not contain a date.

`<n>, <n1>, <n2>`: integer type value indicating the index of the alarm; default is manufacturer specific

`<type>`: integer type value indicating the type of the alarm (e.g. sound, volume, LED); values and default are manufacturer specific

`<text>`: string type value indicating the text to be displayed when alarm time is reached; maximum length `<tlength>`

`<tlength>`: integer type value indicating the maximum length of `<text>`

`<recurr>`: string type value indicating day of week for the alarm in one of the following formats:

"<1..7>[,<1..7>[…]]" – Sets a recurrent alarm for one or more days in the week. The digits 1 to 7 corresponds to the days in the week, Monday (1), …, Sunday (7).
Example: The string "1,2,3,4,5" may be used to set an alarm for all weekdays.

"0" – Sets a recurrent alarm for all days in the week.

`<rlength>`: integer type value indicating the maximum length of `<recurr>`

`<silent>`: Integer type value indicating if the alarm is silent or not. If set to 1 the alarm will be silent and the only result from the alarm is the unsolicited result code `+CALV`. If set to 0 the alarm will not be silent.

Implementation

Optional.

8.17 Generic SIM access +CSIM

Table 71: +CSIM action command syntax

Command	Possible response(s)
`+CSIM=<length>,<command>`	`+CSIM: <length>,<response>` *+CME ERROR: <err>*
`+CSIM=?`	

Description

Set command transmits to the ME the `<command>` it then shall send as it is to the SIM. In the same manner the SIM `<response>` shall be sent back by the ME to the TA as it is. Refer subclause 9.2 for `<err>` values.

This command allows a direct control of the SIM by an distant application on the TE. The TE shall then take care of processing SIM information within the frame specified by ~~GSM~~GSM/UMTS.

NOTE: Compared to Restricted SIM Access command `+CRSM`, the definition of `+CSIM` allows TE to take more control over the SIM-ME interface. The locking and unlocking of the interface may be done by a special `<command>` value or automatically by TA/ME (by interpreting `<command>` parameter). In case that TE application does not use the unlock command (or does not send a `<command>` causing automatic unlock) in a certain timeout value, ME may release the locking.

Defined values

`<length>` : integer type; length of the characters that are sent to TE in `<command>` or `<response>` (two times the actual length of the command or response)

`<command>` : command passed on by the ME to the SIM in the format as described in GSM 11.11 [28] (hexadecimal character format; refer `+CSCS`)

`<response>` : response to the command passed on by the SIM to the ME in the format as described in GSM 11.11 [28] (hexadecimal character format; refer `+CSCS`)

Implementation

Optional.

8.18 Restricted SIM access +CRSM

Table 72: +CRSM action command syntax

Command	Possible response(s)
+CRSM=<command>[,<fileid> [,<P1>,<P2>,<P3>[,<data>]]]	+CRSM: <sw1>,<sw2>[,<response>] *+CME ERROR: <err>*
+CRSM=?	

Description

By using this command instead of Generic SIM Access +CSIM TE application has easier but more limited access to the SIM database. Set command transmits to the ME the SIM <command> and its required parameters. ME handles internally all SIM-ME interface locking and file selection routines. As response to the command, ME sends the actual SIM information parameters and response data. ME error result code +CME ERROR may be returned when the command cannot be passed to the SIM, but failure in the execution of the command in the SIM is reported in <sw1> and <sw2> parameters. Refer to subclause 9.2 for <err> values.

Coordination of command requests to SIM and the ones issued by ~~GSM~~GSM/UMTS application inside the ME is implementation dependent. However the TE should be aware of the precedence of the ~~GSM~~GSM/UMTS application commands to the TE commands.

Defined values

<command> (command passed on by the ME to the SIM; refer GSM 11.11 [28]):

176 READ BINARY

178 READ RECORD

192 GET RESPONSE

214 UPDATE BINARY

220 UPDATE RECORD

242 STATUS

all other values are reserved

NOTE: The ME internally executes all commands necessary for selecting the desired file, before performing the actual command.

<fileid>: integer type; this is the identifier of a elementary datafile on SIM. Mandatory for every command except STATUS

NOTE: The range of valid file identifiers depends on the actual SIM and is defined in GSM 11.11 [28]. Optional files may not be present at all.

<P1>, <P2>, <P3>: integer type; parameters passed on by the ME to the SIM. These parameters are mandatory for every command, except GET RESPONSE and STATUS. The values are described in GSM 11.11 [28]

<data>: information which shall be written to the SIM (hexadecimal character format; refer +CSCS)

<sw1>, <sw2>: integer type; information from the SIM about the execution of the actual command. These parameters are delivered to the TE in both cases, on successful or failed execution of the command

<response>: response of a successful completion of the command previously issued (hexadecimal character format; refer +CSCS). STATUS and GET RESPONSE return data, which gives information about the current elementary datafield. This information includes the type of file and its size (refer GSM 11.11 [28]). After READ BINARY or READ RECORD command the requested data will be returned. <response> is not returned after a successful UPDATE BINARY or UPDATE RECORD command

Implementation

Optional.

8.19 Secure control command +CSCC

Table 73: +CSCC parameter command syntax

Command	Possible response(s)
+CSCC=<mode>[,<cmd_set>[,<token>]]	+CSCC: <challenge> *+CME ERROR: <err>*
+CSCC?	+CSCC: <mode>,<cmd_set1> [<CR><LF>+CSCC: <mode>,<cmd_set2> [...]] *+CME ERROR: <err>*
+CSCC=?	+CSCC: (list of supported <mode>s),(list of supported <cmd_set>s)

Description

This command is used to enable/disable access to commands protected by security mechanism. This enables/disables access to command sets designated as "secure" such as programming of ME. Refer subclause 9.2 for possible <err> values.

The TE asks for a <challenge> with <mode>=1 and one specific command set (<cmd_set>), the ME replies with the <challenge>, which should be inserted into the identification algorithm in both entities (TE and ME). The algorithm output <token> is sent to the ME with <mode>=2 to enable the specified command set. <mode>=3 is used to disable the command set.

The read command returns the status (<mode> 2 or 3) of each supported command set.

Defined values

<mode>:

1 request challenge token to enable access to specified command set

2 enable access to specified command set (<token> required)

3 disable access to specified command set

<cmd_set>, <cmd_set1>, <cmd_set2>:

0 MS code re-programming command set.

other values below 128 are reserved by this TS

<token>: string type; a variable length bit string represented with IRA characters 0 - 9 and A - F, each character representing a nibble; e.g. bit string "0110 1100 1001 1010" is represented by the IRA string "6C9A". The length of the required bit string varies depending on the value of <cmd_set>.

<challenge>: same format as token

Implementation

Optional.

8.20 Alert sound mode +CALM~~$(AT R97)$~~

Table 74: +CALM parameter command syntax

Command	Possible response(s)
+CALM=<mode>	*+CME ERROR: <err>*

+CALM?	+CALM: <mode> *+CME ERROR: <err>*
+CALM=?	+CALM: (list of supported <mode>s) *+CME ERROR: <err>*

Description

This command is used to select the general alert sound mode of the ME. Refer subclause 9.2 for possible <err> values.

Test command returns supported values as compound value.

Defined values

<mode>:

0 normal mode

1 silent mode (all sounds from ME are prevented)

2… manufacturer specific

Implementation

Optional.

8.21 Ringer sound level +CRSL ~~$(AT R97)$~~

Table 75: +CRSL parameter command syntax

Command	Possible response(s)
+CRSL=<level>	*+CME ERROR: <err>*
+CRSL?	+CRSL: <level> *+CME ERROR: <err>*
+CRSL=?	+CRSL: (list of supported <level>s) *+CME ERROR: <err>*

Description

This command is used to select the incoming call ringer sound level of the ME. Refer subclause 9.2 for possible <err> values.

Test command returns supported values as compound value.

Defined values

<level>: integer type value with manufacturer specific range (smallest value represents the lowest sound level)

Implementation

Optional.

8.22 Vibrator mode +CVIB ~~$(AT R97)$~~

Table 76: +CVIB parameter command syntax

Command	Possible response(s)
+CVIB=<mode>	*+CME ERROR: <err>*
+CVIB?	+CVIB: <mode> *+CME ERROR: <err>*
+CVIB=?	+CVIB: (list of supported <mode>s) *+CME ERROR: <err>*

Description

This command is used to enable and disable the vibrator alert feature of the ME. It is manufacturer specific how this interacts with +CALM command. Refer subclause 9.2 for possible `<err>` values.

Test command returns supported values as compound value.

Defined values

`<mode>`:

0 disable

1 enable

...15 reserved by this TS

16… manufacturer specific

Implementation

Optional.

8.23 Loudspeaker volume level +CLVL ~~$(AT R97)$~~

Table 77: +CLVL parameter command syntax

Command	Possible response(s)
+CLVL=<level>	*+CME ERROR: <err>*
+CLVL?	+CLVL: <level> *+CME ERROR: <err>*
+CLVL=?	+CLVL: (list of supported <level>s) *+CME ERROR: <err>*

Description

This command is used to select the volume of the internal loudspeaker of the ME. Refer subclause 9.2 for possible `<err>` values.

Test command returns supported values as compound value.

Defined values

`<level>`: integer type value with manufacturer specific range (smallest value represents the lowest sound level)

Implementation

Optional.

8.24 Mute control +CMUT ~~$(AT R97)$~~

Table 78: +CMUT parameter command syntax

Command	Possible response(s)
+CMUT=<n>	*+CME ERROR: <err>*
+CMUT?	+CMUT: <n> *+CME ERROR: <err>*
+CMUT=?	+CMUT: (list of supported <n>s)

Description

This command is used to enable and disable the uplink voice muting during a voice call. Refer subclause 9.2 for possible `<err>` values.

Test command returns supported values as compound value.

Defined values

<n>:

0 mute off

1 mute on

Implementation

Optional.

8.25 Accumulated call meter +CACM ~~$(AT R97)$~~

Table 79: +CACM parameter command syntax

Command	Possible response(s)
+CACM=[<passwd>]	*+CME ERROR: <err>*
+CACM?	+CACM: <acm> *+CME ERROR: <err>*
+CACM=?	

Description

Set command resets the Advice of Charge related accumulated call meter value in SIM file EF_{ACM}. ACM contains the total number of home units for both the current and preceding calls. SIM PIN2 is usually required to reset the value. If setting fails in an ME error, `+CME ERROR: <err>` is returned. Refer subclause 9.2 for `<err>` values.

Read command returns the current value of ACM.

Defined values

`<passwd>`: string type; SIM PIN2

`<acm>`: string type; accumulated call meter value similarly coded as `<ccm>` under `+CAOC`

Implementation

Optional.

8.26 Accumulated call meter maximum +CAMM ~~$(AT R97)$~~

Table 80: +CAMM parameter command syntax

Command	Possible response(s)
+CAMM=[<acmmax>[,<passwd>]]	*+CME ERROR: <err>*
+CAMM?	+CAMM: <acmmax> *+CME ERROR: <err>*
+CAMM=?	

Description

Set command sets the Advice of Charge related accumulated call meter maximum value in SIM file EF_{ACMmax}. ACMmax contains the maximum number of home units allowed to be consumed by the subscriber. When ACM (refer `+CACM`) reaches ACMmax calls are prohibited (see also ~~GSM 02.24~~3G TS 22.024 [26]). SIM PIN2 is usually required to set the value. If setting fails in an ME error, `+CME ERROR: <err>` is returned. Refer subclause 9.2 for `<err>` values.

Read command returns the current value of ACMmax.

Defined values

`<acmmax>`: string type; accumulated call meter maximum value similarly coded as `<ccm>` under `+CAOC`; value zero disables ACMmax feature

`<passwd>`: string type; SIM PIN2

Implementation

Optional.

8.27 Price per unit and currency table +CPUC ~~$(AT R97)$~~

Table 81: +CPUC parameter command syntax

Command	Possible response(s)
+CPUC=<currency>,<ppu>[,<passwd>]	*+CME ERROR: <err>*
+CPUC?	+CPUC: <currency>,<ppu> *+CME ERROR: <err>*
+CPUC=?	

Description

Set command sets the parameters of Advice of Charge related price per unit and currency table in SIM file EF_{PUCT}. PUCT information can be used to convert the home units (as used in +CAOC, +CACM and +CAMM) into currency units. SIM PIN2 is usually required to set the parameters. If setting fails in an ME error, +CME ERROR: <err> is returned. Refer subclause 9.2 for <err> values.

Read command returns the current parameters of PUCT.

Defined values

<currency>: string type; three-character currency code (e.g. “GBP”, “DEM”); character set as specified by command Select TE Character Set +CSCS

<ppu>: string type; price per unit; dot is used as a decimal separator (e.g. “2.66”)

<passwd>: string type; SIM PIN2

Implementation

Optional.

8.28 Call Meter maximum event +CCWE ~~$(AT R98)$~~

Table 82: +CCWE parameter command syntax

Command	Possible response(s)
+CCWE=<mode>	*+CME ERROR: <err>*
+CCWE?	+CCWE: <mode> *+CME ERROR: <err>*
+CCWE=?	+CCWE: (list of supported <mode>s) *+CME ERROR: <err>*

Description

Shortly before the ACM (Accumulated Call Meter) maximum value is reached, an unsolicited result code +CCWV will be sent, if enabled by this command. The warning is issued approximately when 30 seconds call time remains. It is also issued when starting a call if less than 30 s call time remains. If setting fails in an ME error, +CME ERROR: <err> is returned. Refer subclause 9.2 for <err> values.

Read command returns the current setting.

Test command returns supported settings.

Defined values

<mode>:

<u>0</u> Disable the call meter warning event

1 Enable the call meter warning event

Implementation

Optional.

8.29 Power class +CPWC~~$(AT R98)$~~

Table 83: +CPWC parameter command syntax

Command	Possible response(s)
+CPWC=[<class>[,<band>]]	*+CME ERROR: <err>*
+CPWC?	+CPWC: <curr_class1>,<def_class1>,<band1>[,<curr_class2>,<def_class2>,<band2>[...]] *+CME ERROR: <err>*
+CPWC=?	+CPWC: list of supported (<band>,(list of <class>s)) pairs *+CME ERROR: <err>*

Description

This command is used to set the preferred ME power class for each GSM frequency band supported. The interaction of this setting with the selected bearer service (+CBST and HSCSD commands) is manufacturer specific (for example, selecting a multislot operation might reduce the power class automatically). If setting fails in an ME error, +CME ERROR: <err> is returned. Refer subclause 9.2 for <err> values.

Read command returns the currently selected output power class and default output power class for each supported frequency band (as defined by ME manufacturer). Parameter <band1> and its associated power class parameters refer to the currently used frequency band. For example, +CPWC: 2,1,1,5,4,0 in case of a dual-band ME currently using band GSM1800, for which the power class is currently set to 2, the default being class 1, and for which the currently set power class value for GSM900 is class 5 the default being class 4.

Test command returns supported bands and their power classes. For example,

+CPWC: (0,(0,4,5)),(1,(0-2)) in case of a dual-band handheld ME.

Defined values

<class>, <curr_class*n*>s, <def_class*n*>s:

<u>0</u> default (not applicable to <curr_class>s or <def_class*n*>s)

1… MS output power class as in GSM 05.05 [38]

<band>, <band*n*>s:

<u>0</u> GSM900

1 GSM1800

2 reserved for GSM1900

3 GSM 400

Implementation

Optional.

8.30 Set Language +CLAN~~$(AT R98)$~~

Table 84: +CLAN parameter command syntax

Command	Possible response(s)
`+CLAN=<code>`	*+CME ERROR: <err>*
`+CLAN?`	`+CLAN: <code>` *+CME ERROR: <err>*
`+CLAN=?`	`+CLAN:(list of supported <code>s)` *+CME ERROR: <err>*

Description

This command sets the language in the ME. The set-command must confirm the selected language with the MMI-module in the ME. If setting fails, a ME error, +CME ERROR: <err> is returned. Refer subclause 9.2 for <err> values.

The <code>-parameter is a two-letter abbreviation of the language. The language codes, as defined in ISO 639, consists of two characters, e.g. “sv”, “en” etc.

The complete set of language codes to be used are manufacturer specific and should all be possible to use with the command. Some examples are described under <code>. For a complete list see ISO 639.

The read command gives the current language as output. If the language has been set to “AUTO”, the read command returns the current language set from the SIM-card. Hence, the “AUTO”-code is never returned by the read-command.

Test command returns supported <code>s.

Defined values

<code>: (not all language codes are present in this list)

“AUTO” Read language from SIM. “Auto” is not returned by the read-command.

“sw” Swedish

“fi” Finnish

“da” Danish

“no” Norwegian

“de” German

“fr” French

“es” Spanish

“it” Italian

“en” English

Implementation

Optional.

8.31 Language Event +CLAE~~$(AT R98)$~~

Table 85: +CLAE parameter command syntax

Command	Possible response(s)
+CLAE=<mode>	*+CME ERROR: <err>*
+CLAE?	+CLAE: <mode> *+CME ERROR: <err>*
+CLAE=?	+CLAE: (list of supported <mode>s) *+CME ERROR: <err>*

Description

This command is used to enable/disable unsolicited result code +CLAV: <code>. If <mode>=1, +CLAV: <code > is sent from the ME when the language in the ME is changed. If setting fails, a ME error, `+CME ERROR: <err>` is returned. Refer subclause 9.2 for `<err>` values.

Read command returns the current status for <mode>.

Test command returns supported <mode>s.

Defined values

`<mode>`:

<u>0</u> Disable unsolicited result code +CLAE

1 Enable unsolicited result code +CLAE

`<code>`: For description see +CLAN.

Implementation

Optional.

8.32 Set Greeting Text +CSGT~~$(AT R98)$~~

Table 86: +CSGT parameter command syntax

Command	Possible response(s)
+CSGT=<mode>[,<text>]	*+CME ERROR: <err>*
+CSGT?	+CSGT: <text>, <mode> *+CME ERROR: <err>*
+CSGT=?	+CSGT:(list of supported <mode>s), <ltext> *+CME ERROR: <err>*

Description

This command sets and activates the greeting text in the ME. The greeting text is shown in the ME display when the ME is turned on. The command can also be used to deactivate a text. If setting fails in an ME error, +CME ERROR: <err> is returned. Refer subclause 9.2 for <err> values.

The read command queries the current <text> and the status of the <mode> parameter

Test command returns supported <mode>s and the maximum number of characters in <text>. For example,

`+CSGT: (0-1),20`

Defined values

`<text>`: string type; A free text that shall be displayed. The text can not include <CR>

<mode>:

0 ***Turn off greeting text.***

1 ***Turn on greeting text***

Implementation

Optional.

8.33 Set Voice Mail Number +CSVM~~$(AT R98)$~~

Table 87: +CSVM parameter command syntax

Command	Possible response(s)
+CSVM=<mode>[,<number>[,<type>]]	*+CME ERROR: <err>*
+CSVM?	+CSVM:<mode>,<number>,<type> *+CME ERROR: <err>*
+CSVM=?	+CSVM: (list of supported <mode>s), (list of supported <type>s) *+CME ERROR: <err>*

Description

The number to the voice mail server is set with this command. The parameters <number> and <type> can be left out if the parameter <mode> is set to 0. If setting fails, an ME error, +CME ERROR: <err> is returned. Refer subclause 9.2 for <err> values.

Read command returns the currently selected voice mail number and the status (i.e. enabled/disabled).

Test command returns supported <mode>s and <type>s.

Defined values

<mode>:

0 Disable the voice mail number.

1 Enable the voice mail number.

<number>: string type; Character string <0..9,+>

<type>: integer type; Type of address octet. (refer GSM 04.08 section 10.5.4.7)

129 ISDN / telephony numbering plan, national / international unknown

145 ISDN / telephony numbering plan, international number

161 ISDN / telephony numbering plan, national number

128 - 255 Other values refer GSM 04.08 section 10.5.4.7

<type>: type of address octet in integer format (refer GSM 04.08 [8] subclause 10.5.4.7); default 145 when dialling string includes international access code character "+", otherwise 129

Implementation

Optional.

8.34 Ring Melody Playback +CRMP~~$(AT R98)$~~

Table 88: +CRMP action command syntax

Command	Possible response(s)
+CRMP=<call type>[,<volume>[,<type>,<index>]]	*+CME ERROR: <err>*
+CRMP=?	+CRMP: (list of supported <call type>s),(list of supported <volume>s),(<type0>),(list of supported <index>s)[<CR><LF> +CRMP: (list of supported <call type>s),(list of supported <volume>s),(<type1>),(list of supported <index>s) *+CME ERROR: <err>*

Description

Execution command causes the ME to playback a specific ring type. The default values for the optional parameters are the current selected in the ME.

Test command returns the available ring melodies.

Defined values:

`<call type>`: integer type; manufacturer specific

`<volume>`: integer type value with manufacturer specific range (smallest value represents the lowest sound level)

<type>:

0 Manufacturer defined

1 User defined

`<index>`: integer type;

Implementation

Optional.

8.35 Master Reset +CMAR~~$(AT R98)$~~

Table 89: +CMAR action command syntax

Command	Possible response(s)
+CMAR=<phone lock code>	*+CME ERROR: <err>*
+CMAR=?	*+CME ERROR: <err>*

Description

This command requests the ME to reset user data. The user data in the phone will be reset to default values. If setting fails, a ME error, +CME ERROR: <err>, is returned. Refer subclause 9.2 for <err> values.

If the ME is locked and this command is used, then the ME will be unlocked after the master reset.

Test command returns OK

Defined values

`<phone lock code >` string type; Security code (Phone Lock code) must be verified before performing the master reset.

Implementation

Optional.

8.36 List all available AT commands +CLAC~~$(AT R98)$~~

Table 90: +C action command syntax

Command	Possible response(s)
+CLAC	<AT Command1> [<CR> <LF> <AT Command2>[…]] *+CME ERROR: <err>*
+CLAC=?	*+CME ERROR: <err>*

Description

Execution command causes the ME to return one or more lines of AT Commands.

Note: This command only returns the AT commands that are available for the user.

Defined values

<AT Command >:

Defines the AT command including the prefix AT. Text shall not contain the sequence `0<CR>` or `OK<CR>`

Implementation

Optional.

8.37 Delete alarm +CALD

Table 91: +CALD action command syntax

Command	Possible response(s)
+CALD=<n>	*+CME ERROR: <err>*
+CALD=?	+CALD: (list of supported <n>s) *+CME ERROR: <err>*

Description

Action command deletes an alarm in the ME. If the command fails in an ME error, `+CME ERROR: <err>` is returned. Refer subclause 9.2 for `<err>` values.

Test command returns supported array index values.

Defined values

`<n>`: integer type value indicating the index of the alarm; default is manufacturer specific

Implementation

Optional.

8.38 Postpone or dismiss an alarm +CAPD

Table 92: +CAPD action command syntax

Command	Possible response(s)
`+CAPD=[<sec>]`	*+CME ERROR: <err>*
`+CAPD=?`	`+CAPD: (`list of supported `<sec>`s`)` *+CME ERROR: <err>*

Description

Set command postpones or dismisses a currently active alarm. If the command fails in an ME error, `+CME ERROR: <err>` is returned. Refer subclause 9.2 for `<err>` values.

Test command returns supported `<sec>`-parameter values.

Defined values

`<sec>`: integer type value indicating the number of seconds to postpone the alarm. If `<sec>` is set to 0 (default), the alarm is dismissed.

Implementation

Optional.

8.39 Automatic Time Zone Update +CTZU

Table 93: +CTZU parameter command syntax

Command	Possible response(s)
`+CTZU=<onoff>`	*+CME ERROR: <err>*
`+CTZU?`	`+CTZU: <onoff>` *+CME ERROR: <err>*
`+CTZU=?`	`+CTZU: (`list of supported `<onoff>`s`)` *+CME ERROR: <err>*

Description

Set command enables and disables automatic time zone update via NITZ. If setting fails in an ME error, `+CME ERROR: <err>` is returned. Refer subclause 9.2 for `<err>` values.

Read command returns the current settings in the ME.

Test command returns supported on- and off-values.

Defined values

`<onoff>`: integer type value indicating:

- `0` – Disable automatic time zone update via NITZ (default).
- `1` – Enable automatic time zone update via NITZ.

Implementation

Optional.

8.40 Time Zone Reporting +CTZR

Table 94: +CTZR parameter command syntax

Command	Possible response(s)
+CTZR=<onoff>	*+CME ERROR: <err>*
+CTZR?	+CTZR: <onoff> *+CME ERROR: <err>*
+CTZR=?	+CTZR: (list of supported <onoff>s) *+CME ERROR: <err>*

Description

This set command enables and disables the time zone change event reporting. If the reporting is enabled the ME returns the unsolicited result code +CTZV: <tz> whenever the time zone is changed. If setting fails in an ME error, +CME ERROR: <err> is returned. Refer subclause 9.2 for <err> values.

Read command returns the current reporting settings in the ME.

Test command returns supported <onoff>-values.

NOTE: The Time Zone reporting is not affected by the Automatic Time Zone setting command, +CTZU.

Defined values

<onoff>: integer type value indicating:

0 – disable time zone change event reporting (default).

1 – Enable time zone change event reporting.

Implementation

Optional.

8.41 Enter protocol mode+CPROT

Table XX: +CPROT parameter command syntax

Command	Possible response(s)
+CPROT=<proto>[,<version>[,<lsap1>[,...[<lsapN>]]]]	CONNECT NO CARRIER OK ERROR *+CME ERROR: <err>*
+CPROT?	+CPROT : <proto>[,<version>[,<lsap1>[,...[,<lsapN]]]]
+CPROT=?	+CPROT: <proto1>[,(list of supported <version>s)[,(list of supported <lsap1>s)[,...[,(list of supported <lsapN>s)]]]] [<CR><LF> +CPROT : <proto2>[,(list of supported <version>s)[,(list of supported <lsap1>s)[,...[,(list of supported <lsapN>s)]]]]] [...]]]]]

Description

Set command informs TA that TE wants to establish a peer-to-peer protocol `<proto>` or upper layer connection (indicating by the `<lsap>s` setting) with the ME on the link from which the command was received.
This command can be used in case the link between TE and ME does not provide itself such a mechanism.

If ME has succeeded in establishing a logical link between application protocols and external interface, it will send CONNECT message to the TE. Otherwise, the NO CARRIER response will be returned.

If the CONNECT response is received, TE can start sending `<proto>` or upper layer frames.

The connection shall always return for `<proto>` mode when the protocol session is ended. When the ME receives a disconnect request from its peer entity, it will process it and send OK response to the TE indicating its capability for receiving new AT commands. Since `<proto>` or upper layers can be accessed in other ways, TA must have pre-knowledge of the fact that connection is initiated with AT+CPROT command. This means that switch to `<proto>` mode must include some sort of notification to the protocol entity.

This command can be aborted by sending a `<proto>` or upper layer disconnection frame. In that case, ME will return in command mode by sending the OK response.

Refer subclause 9.2 for possible `<err>` values.

Read command return the current `<proto>` optionally including `<version>` and `<lsapI>` settings.

Test command returns values supported by the TA as a compound value.

Defined values

`<proto>`

0 OBEX (refer.[x2])

…15 reserved by this TS

16... manufacturer specific

`<version>`: version number of `<proto>`. The total number of characters, including line terminators, in the information text shall not exceed 2048 characters.

`<lsap1>`: defines a level of service or application protocol on the top of `<proto>` layer. It may refer to services or protocols defined in other standards development organisations (SDOs).

1 IrMC level 1 (Minimum Level) Only .(refer [x1] subclause 2.9.4)

2 IrMC level 1 and 2 (Minimum and Access Levels) Only. .(refer [x1] subclause 2.9.4)

4 IrMC level 1, 2 and 3 (Minimum, Access, Index Levels) Only- implies static index support. .(refer [x1] subclause 2.9.4)

8 IrMC level 1, 2 and 4 (Minimum, Access and Sync Levels) Only-implies unique index support. .(refer [x1] subclause 2.9.4)

10 IrMC level 1, 2, 3 and 4 (Minimum, Access, Index and Sync Levels)-implies support of static and unique index. .(refer [x1] subclause 2.9.4)

…15 reserved by this TS

16... manufacturer specific

`<lsap2>...<lsapN>`

In case <lsapN>,<lsapN+1> received in the +CPROT command identifies protocol layers, the protocol identified by N+1 shall be on the top of the protocol identified by N on a framework point of view.

0…15 reserved by this TS

16... manufacturer specific

Implementation

Optional.

8.42 Informative examples

Phone Activity Status (+CPAS) is a general command used to detect the presence of the ME, if there is an incoming call, or if there is a call in progress. This command should be used before trying to operate the ME from the TE. Note that the activity status may change at any time after the execution of +CPAS, and hence the returned value may be obsolete. Detachment of the ME from the TA is indicated with a special final result code that indicates all errors related to the operation of the ME. Result code is +CME ERROR: <err>, where <err> is an integer or verbose value giving useful information about the reason for the command failure (refer subclause "Mobile Equipment error result code +CME ERROR").

Set Phone Functionality (+CFUN) can be used to reset the ME or set the power consumption level of the ME by disabling certain parts of the ME (e.g. the transmit and receive RF circuits). Mobile Equipment Control Mode (+CMEC) is a command which manages access sharing between the ME and the TE to operate the user interface of the ME. It has three subparameters which describe the access to keypad, display and indicators. Each subparameter has values for restricting the operation of the corresponding user interface part only to the ME or only to the TE, or to give the access for both of them.

Keypad Control command (+CKPD) is used to operate the keypad of the ME. Here lies the problem of different keypad types between manufacturers, and also between their ME models. The keypresses are sent to the ME as a string type subparameter of this command. Each character in that string represents a key which will be logically pressed. A special character (colon) followed by any character can be used by manufacturers (or TE application programmers) to represent a key which is not defined in this profile. An escape character (semicolon) for direct string entering is also defined. All text between single semicolon characters is treated as an alphanumeric entry and is not converted to keypressings. All semicolon characters inside the text shall be duplicated in the TE and stripped back to one before entering them to the ME. Command has also optional second and third parameters which can be used to alter the time to strike each key, and the pause to wait between keystrokes (in tenths of a second). A special pause character (W or w) may be added in the string type subparameter for an extra pause of the same length as given by the third subparameter. In the following example alphanumeric mode is entered and a person predefined in the ME phonebook, "Ilkka", is called; each key is struck for half a second and pauses between strokes are a tenth of a second:

```
AT+CKPD="@:Ilkka:S",5,1
OK
```

Display Control command (+CDIS) is used both for writing to the display text fields and for reading the current status of the fields. Mobile equipment usually have a character set of their own, so the TA shall be able to do a conversion between the TE and the ME character sets. TE can have several character sets and the TA must be informed of the character set in use before starting to write or read the display. Character set is set with general command Select TE Character Set +CSCS. The +CDIS=? query command is a way to get information about the length of the fields. In the following example an ME is first queried about the supported conversions and the lengths of the fields. The response shows there are three ten character long and two six character long fields. Then the TE character set is set to be IRA and the current status of the display is read. The last command writes the text "Hello, I'm writing to display" in the three fields, and keeps the contents of the two other fields same (the last two commas could also be left out).

```
AT+CSCS=?;+CDIS=?
+CSCS: ("IRA","PCCP850","8859-1")
+CDIS: 10,10,10,6,6
OK
AT+CSCS="IRA"
OK
AT+CDIS?
+CDIS: "RADIOLINJA","","","Menu","Memory"
OK
AT+CDIS="IRA","Hello, I'm","writing to","display",,
OK
```

The writing is possible only when it is permitted by the Mobile Equipment Control Mode command (and by the manufacturer). If a certain field is not writable (but is readable), writing to it should be ignored. The order of the text fields should be determined by manufacturers and follow the rule: first field is in the upper left corner, second in the next field to the right, and so on, until to the last field in the lower right corner.

Indicators can be handled with Indicator Control command (`+CIND`). Its query command returns a short description (abbreviation) of the purpose of the indicators and the supported values for each indicator. The setting and reading is done similarly as with Display Control command. In the following example the indicators of a phone are queried, their current value is read, and the value of message indicator is tried to set (but it is forbidden):.

```
AT+CIND=?
+CIND: ("memory",(0-2)),("call",(0,1)),("data",(0,1)),("roam",(0,1)),
("alpha",(0,1)),("message",(0,1)),("index1",(0-11)),("index2",(0-11)),
("index3",(0-11)),("signal",(0-5)),("service",(0,1)),("sel1",(0,1)),
("sel2",(0,1)),("sel3",(0,1)),("battchg",(0-5))
OK
AT+CIND?
+CIND: 1,0,0,0,0,1,0,0,0,3,1,0,0,0,5
OK
AT+CIND=,,,,,0
+CME ERROR: 10
```

The subparameter order in the command is defined by the query command order, not by the actual display order. The zero value of an indicator means that it is off (or in state which can be identified as "off"-state), value one means that the indicator is on (or in a state which is more substantial than "off"-state), value two is more substantial than one, and so on.

To this point, only operating through the TE is covered. But when ME can be operated also through its keypad, or there are changes in the status of the display elements, the information about these actions shall be given to the TE also. This can be solved only with unsolicited result codes which return keypad, display text and indicator events. Each event group has a result code of its own: `+CKEV` returns the key code and if the key pressed (1) or released (0), `+CDEV` returns the display text field running number (as specified by command `+CDIS`) and the new status of the field, and `+CIEV` returns the running number of the indicator (refer `+CIND`) and the new value of it. In the following example number key 1 is pressed, updated on the display, released, and signal strength changes its state to five:

```
+CKEV: 49,1
+CDEV: 1,"1"
+CKEV: 49,0
+CIND: 10,5
```

Mobile Equipment Event Reporting command (`+CMER`) has been specified for the purpose of controlling the sending of these unsolicited result codes to the TE. Four ways are provided to handle the buffering of the result codes (see figure 8). The first is to buffer them always. The second possibility is to discard them when in on-line data mode and otherwise forward them directly to the TE. The third possibility is to buffer them in data mode and otherwise forward them to the TE. The last possibility is to send them always to the TE (some inband technique - e.g. V.80 - shall be used in data mode to send the result codes within the data). This is the first subparameter of `+CMER` command. Next three subparameters are used to enable or disable each of the keypad, text field and indicator result codes. Sending codes can be enabled either so that only events generated from the ME user interface are returned, or so that also events caused by Keypad, Display and Indicator Control commands are returned. The fifth subparameter controls the flushing of the buffer when the value of the first subparameter is changed to a value from one to three.

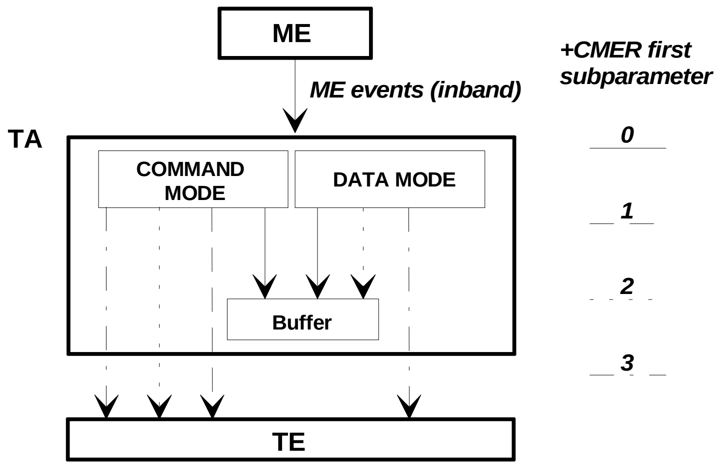

Figure 8: Mobile equipment event reporting

An example of complete setup of the TA where TE takes the control of keypad, but does not want to write to display nor control the indicators (in the start ME is powered off):

```
AT+CMEE=2;+CREG=1                (use verbose <err> values; report registration)
OK
AT+CPAS                          (query ME status)
+CPAS: 5                         (ME is asleep)
OK
AT+CFUN=1                        (set ME to full functionality state)
+CME ERROR: SIM PIN required     (SIM requests PIN)
AT+CPIN="1234"
+CME ERROR: incorrect password   (user entered wrong PIN)
AT+CPIN="4321"
OK                               (correct PIN)
AT+COPS=0,0                      (ask for automatic operator selection and registration)
OK
+CREG: 1                         (registered in the network)
AT+COPS?
+COPS: 0,0,"RADIOLINJA"          (get the operator name)
OK
AT+CMEC=1,0,0                    (take over the keypad, leave display to ME)
OK
AT+CDIS=?;+CIND=?                (query display text and indicator formats)
+CDIS: 10,10,10,6,6
+CIND: ("memory",(0-2)),("call",(0,1)),("data",(0,1)),("roam",(0,1)),
("alpha",(0,1)),("message",(0,1)),("index1",(0-11)),("index2",(0-11)),
("index3",(0-11)),("signal",(0-5)),("service",(0,1)),("sel1",(0,1)),
("sel2",(0,1)),("sel3",(0,1)),("battchg",(0-5))
OK
AT+CSCS="IRA"                    (set TE character set for display text results)
OK
AT+CMER=1,0,2,2,0                (return display text and indicator result codes when
OK                                in command state, in data mode discard them)
AT+CDIS?;+CIND?                  (read current state of display texts and indicators)
+CDIS: "","","     12345","Menu","Memory"     (user had pressed number buttons before
+CIND: 1,0,0,0,0,1,0,0,0,3,1,0,0,0,5            TE took control with +CMEC)
OK
AT+CKPD="C",20                   (clear main display text '12345' by holding the
OK                                'clear' button down two seconds)
+CDEV: 3,"1234"                  (first only one character deleted)
+CDEV: 3,""                      (while holding continues, whole display is cleared)
+CDEV: 1,"RADIOLINJA"            (operator name comes to the display)
```

The start of the previous example could go as follows when ME has already been powered on but is waiting for the PIN:

```
AT+CMEE=2;+CREG=1                (use verbose <err> values; report registration)
OK
AT+CPAS                          (query ME status)
+CPAS: 0                         (ME is ready to receive commands)
OK
AT+CPIN?                         (is ME asking passwords?)
+CPIN: SIM PIN                   (yes, SIM PIN required)
AT+CPIN="4321"
OK                               (correct PIN)
```

One of the most regular operations done through the ME user interface is phonebook control. To lessen the workload of the TE, some direct commands for phonebook reading and writing are practical. Command Select Phonebook Memory Storage `+CPBS` query version returns supported phonebook memories, read version returns current settings, and set version selects the memory. For GSM, the normal storages are SIM, ME and TA.

Read Phonebook Entries (`+CPBR`) can be used to read either one or many phonebook locations at the same time. A regular phonebook entry consists of three elements: memory index number, the phone number and its alphanumeric equivalent given by the user. Query version of this returns supported index values of the selected memory, and the maximum lengths of the number and alphanumeric elements. The query version of the Write Phonebook Entry command (`+CPBW`) is similar, but the action version sets or clears an entry in the phonebook. Find Phonebook Entries (`+CPBF`) may be used to search alphanumeric entries starting with specific string. An example where the whole phonebook of the ME is read, index number four is cleared, and number three is written:

```
AT+CPBS=?
+CPBS: ("ME","SM")                  (ME and SIM have phonebooks)
OK
AT+CPBS="ME"                        (select ME memory)
OK
AT+CPBR=?                           (read index range and element lengths)
+CPBR: (1-99),30,30
OK
AT+CPBR=1,99                        (read all entries but only the ones set are returned)
+CPBR: 1,"931123456",129,"Ilkka"
+CPBR: 2,"9501234567",129,""
+CPBR: 4,"901234567",129,"Hesari"
OK
AT+CPBW=4;+CPBW=3,"921123456",,"TS"  (clear index 4 and write index 3)
OK
```

9 Mobile Equipment errors

9.1 Report Mobile Equipment error +CMEE

Table 95: +CMEE parameter command syntax

Command	Possible response(s)
+CMEE=[<n>]	
+CMEE?	+CMEE: <n>
+CMEE=?	+CMEE: (list of supported <n>s)

Description

Set command disables or enables the use of result code +CME ERROR: <err> as an indication of an error relating to the functionality of the ME. When enabled, ME related errors cause +CME ERROR: <err> final result code instead of the regular ERROR final result code. ERROR is returned normally when error is related to syntax, invalid parameters, or TA functionality.

Test command returns values supported by the TA as a compound value.

Defined values

<n>:

<u>0</u> disable +CME ERROR: <err> result code and use ERROR instead

1 enable +CME ERROR: <err> result code and use numeric <err> values (refer next subclause)

2 enable +CME ERROR: <err> result code and use verbose <err> values (refer next subclause)

Implementation

Mandatory for <n> values 0 and 1.

9.2 Mobile Equipment error result code +CME ERROR

The operation of +CME ERROR: <err> result code is similar to the regular ERROR result code: if +CME ERROR: <err> is the result code for any of the commands in a command line, none of the following commands in the same command line is executed (neither ERROR nor OK result code shall be returned as a result of a completed command line execution). The format of <err> can be either numeric or verbose. This is set with command +CMEE (refer previous subclause).

NOTE: ITU-T V.25ter [14] command V does not affect the format of this result code.

<err> values (numeric format followed by verbose format):

9.2.1 General errors

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 required

6 PH-FSIM PIN required

7 PH-FSIM PUK required

10 SIM not inserted

11 SIM PIN required

12 SIM PUK required

13 SIM failure

14 SIM busy

15 SIM wrong

16 incorrect password

17 SIM PIN2 required

18 SIM PUK2 required

20 memory full

21 invalid index

22 not found

23 memory failure

24 text string too long

25 invalid characters in text string

26 dial string too long

27 invalid characters in dial string

30 no network service

31 network timeout

32 network not allowed - emergency calls only

40 network personalisation PIN required

41 network personalisation PUK required

42 network subset personalisation PIN required

43 network subset personalisation PUK required

44 service provider personalisation PIN required

45 service provider personalisation PUK required

46 corporate personalisation PIN required

47 corporate personalisation PUK required

100 unknown

9.2.2 GPRS-related errors

9.2.2.1 Errors related to a failure to perform an Attach

Numeric	Text
103	Illegal MS (#3)
106	Illegal ME (#6)
107	GPRS services not allowed (#7)
111	PLMN not allowed (#11)
112	Location area not allowed (#12)
113	Roaming not allowed in this location area (#13)

(Values in parentheses are GSM 04.08 cause codes.)

9.2.2.2 Errors related to a failure to Activate a Context

Numeric	Text
132	service option not supported (#32)
133	requested service option not subscribed (#33)
134	service option temporarily out of order (#34)
149	PDP authentication failure

(Values in parentheses are GSM 04.08 cause codes.)

9.2.2.3 Other GPRS errors

Numeric	Text
150	invalid mobile class
148	unspecified GPRS error

Other values in the range 101 - 150 are reserved for use by GPRS

Also all other values below 256 are reserved

Implementation
Mandatory for numeric format codes applicable to implemented command set.

9.3 Informative examples

An example of TA responses with all three +CMEE values when ME manufacturer identification is requested but ME is not connected to the TA:

```
AT+CMEE=0    (+CME ERROR shall not be used)
OK
AT+CGMI
ERROR
AT+CMEE=1    (use numeric <err>)
OK
AT+CGMI
+CME ERROR: 1
AT+CMEE=2    (use verbose <err>)
OK
AT+CGMI
+CME ERROR: no connection to phone
```

10 Commands for UMTS Packet Domain

This clause defines commands that a TE may use to control a MT supporting packet switched services. Other aspects of a Packet Domain MT are described in 3G TS 27.060 [34].

It is anticipated that Packet Domain MTs will vary widely in functionality. At one extreme, a MT supporting CS/PS or class-A mode of operation might support multiple PDP types as well as circuit switched data, and use multiple external networks and QoS profiles. At the other extreme a MT supporting only PS or class-C mode of operation might support only a single PDP type using a single external network, and rely on the HLR to contain the PDP context definition.

A comprehensive set of Packet Domain-specifc commands is defined in clause 10.1 to provide the flexibility needed by the more complex MT. The commands are designed to be expandable to accommodate new PDP types and interface protocols, merely by defining new values for many of the parameters. Multiple contexts may be activated if the interface link-layer protocol is able to support them. The commands use the extended information and error message capabilities described in this specification.

For MTs of intermediate complexity, most commands have simplified forms where certain parameters may be omitted.

For the simplest MTs, and for backwards compatibility with existing communications software, it is possible to control access to the Packet Domain using existing modem-compatible commands. A special dial-string syntax is defined for use with the D command. This "modem compatible" mode of operation is described in subclause 10.2.

A discussion on the interaction of the AT commands, Packet Domain Management and Packet Data Protocols, together with examples of command sequences for a number of applications may be found in 3G TS 27.060 [34].

10.1 Commands specific to MTs supporting the Packet Domain

10.1.1 Define PDP Context +CGDCONT

Table 96: +CGDCONT parameter command syntax

Command	**Possible response(s)**
+CGDCONT=[<cid> [,<PDP_type> [,<APN> [,<PDP_addr> [,<d_comp> [,<h_comp> [,<pd1> [,…[,pdN]]]]]]]]]	OK ERROR
+CGDCONT?	+CGDCONT: <cid>, <PDP_type>, <APN>,<PDP_addr>, <data_comp>, <head_comp>[,<pd1>[,…[,pdN]]] [<CR><LF>+CGDCONT: <cid>, <PDP_type>, <APN>,<PDP_addr>, <data_comp>, <head_comp>[,<pd1>[,…[,pdN]]] [...]]
+CGDCONT=?	+CGDCONT: (range of supported <cid>s), <PDP_type>,,,(list of supported <d_comp>s), (list of supported <h_comp>s)[,(list of supported <pd1>s)[,…[,(list of supported <pdN>s)]]] [<CR><LF>+CGDCONT: (range of supported <cid>s), <PDP_type>,,,(list of supported <d_comp>s), (list of supported <h_comp>s)[,(list of supported <pd1>s)[,…[,(list of supported <pdN>s)]]] [...]]

Description

The set command specifies PDP context parameter values for a PDP context identified by the (local) context identification parameter, `<cid>`. The number of PDP contexts that may be in a defined state at the same time is given by the range returned by the test command.

A special form of the set command, +CGDCONT= `<cid>` causes the values for context number `<cid>` to become undefined.

The read command returns the current settings for each defined context.

The test command returns values supported as a compound value. If the MT supports several PDP types, `<PDP_type>`, the parameter value ranges for each `<PDP_type>` are returned on a separate line.

Defined values

`<cid>`: (PDP Context Identifier) a numeric parameter which specifies a particular PDP context definition. The parameter is local to the TE-MT interface and is used in other PDP context-related commands. The range of permitted values (minimum value = 1) is returned by the test form of the command.

`<PDP_type>`: (Packet Data Protocol type) a string parameter which specifies the type of packet data protocol

X25	ITU-T/CCITT X.25 layer 3
IP	Internet Protocol (IETF STD 5)
OSPIH	Internet Hosted Octet Stream Protocol
PPP	Point to Point Protocol (IETF STD 51)

`<APN>`: (Access Point Name) a string parameter which is a logical name that is used to select the GGSN or the external packet data network.

If the value is null or omitted, then the subscription value will be requested.

<PDP_`address>`: a string parameter that identifies the MT in the address space applicable to the PDP.

If the value is null or omitted, then a value may be provided by the TE during the PDP startup procedure or, failing that, a dynamic address will be requested.

The read form of the command will continue to return the null string even if an address has been allocated during the PDP startup procedure. The allocated address may be read using the +CGPADDR command.

`<d_comp>`: a numeric parameter that controls PDP data compression
0 - off (default if value is omitted)
1 - on
Other values are reserved.

`<h_comp>`: a numeric parameter that controls PDP header compression
0 - off (default if value is omitted)
1 - on
Other values are reserved.

NOTE. At present only one data compression algorithm (V.42bis) is provided in SNDCP. If and when other algorithms become available, a command will be provided to select one or more of these.

`<pd1>`, … `<pdN>`: zero to N string parameters whose meanings are specific to the <PDP_type>

For PDP type OSP:IHOSS the following parameters are defined:

<pd1> = <host>	the fully formed domain name extended hostname of the Internet host
<pd2> = <port >	the TCP or UDP port on the Internet host
<pd3> = <protocol>	the protocol to be used over IP on the Internet - "TCP" or "UDP

Implementation

Mandatory unless only a single subscribed context is supported.

10.1.2 Define Secondary PDP Context +CGDSCONT

Table 97: +CGDSCONT parameter command syntax

Command	Possible response(s)
+CGDSCONT=[<cid> ,<p_cid> [,<d_comp> [,<h_comp>]]]	OK ERROR
+CGDSCONT?	+CGDSCONT: <cid>, <p_cid>, <data_comp>, <head_comp> [<CR><LF>+CGDSCONT: <cid>, <p_cid>, <data_comp>, <head_comp> [...]]
+CGDSCONT=?	+CGDSCONT: (range of supported <cid>s), (list of <cid>s for active primary contexts), <PDP_type>,,,(list of supported <d_comp>s), (list of supported <h_comp>s) [<CR><LF>+CGDCONT: (range of supported <cid>s), (list of <cid>s for active primary contexts) ,<PDP_type>,,,(list of supported <d_comp>s), (list of supported <h_comp>s) [...]]

Description

The set command specifies PDP context parameter values for a Secondary PDP context identified by the (local) context identification parameter, <cid>. The number of PDP contexts that may be in a defined state at the same time is given by the range returned by the test command.

A special form of the set command, +CGDSCONT= <cid> causes the values for context number <cid> to become undefined.

The read command returns the current settings for each defined context.

The test command returns values supported as a compound value. If the MT supports several PDP types, <PDP_type>, the parameter value ranges for each <PDP_type> are returned on a separate line.

Defined values

<cid>: (PDP Context Identifier) a numeric parameter which specifies a particular PDP context definition. The parameter is local to the TE-MT interface and is used in other PDP context-related commands. The range of permitted values (minimum value = 1) is returned by the test form of the command.

<p_cid>: (Primary PDP Context Identifier) a numeric parameter which specifies a particular PDP context definition which has been specified by use of the +CGDCONT command. The parameter is local to the TE-MT interface. The list of permitted values is returned by the test form of the command.

<PDP_type>: (Packet Data Protocol type) a string parameter which specifies the type of packet data protocol

X25	ITU-T/CCITT X.25 layer 3
IP	Internet Protocol (IETF STD 5)
OSPIH	Internet Hosted Octet Stream Protocol
PPP	Point to Point Protocol (IETF STD 51)

<d_comp>: a numeric parameter that controls PDP data compression (applicable to GPRS only)
0 - off (default if value is omitted)
1 - on
Other values are reserved.

<h_comp>: a numeric parameter that controls PDP header compression
0 - off (default if value is omitted)

1 - on
Other values are reserved.

NOTE. At present only one data compression algorithm (V.42bis) is provided in SNDCP. If and when other algorithms become available, a command will be provided to select one or more of these. (GPRS only)

Implementation

Optional.

10.1.3 Traffic Flow Template +CGTFT

Table 98: +CGTFT parameter command syntax

Command	Possible Response(s)
+CGTFT=[<cid>, [<packet filter identifier>, <evaluation precedence index> [,<source address and subnet mask> [,<protocol number (ipv4) / next header (ipv6)> [,<destination port range> [,<source port range> [,<ipsec security parameter index (spi)> [,<type of service (tos) (ipv4) and mask / traffic class (ipv6) and mask> [,<flow label (ipv6)>]]]]]]]]]	OK ERROR
+CGTFT?	+CGTFT: <cid>, <packet filter identifier>, <evaluation precedence index>, <source address and subnet mask>, <protocol number (ipv4) / next header (ipv6)>, <destination port range>, <source port range>, <ipsec security parameter index (spi)>, <type of service (tos) (ipv4) and mask / traffic class (ipv6) and mask>, <flow label (ipv6)> [<CR><LF>+CGTFT: <cid>, <packet filter identifier>, <evaluation precedence index>, <source address and subnet mask>, <protocol number (ipv4) / next header (ipv6)>, <destination port range>, <source port range>, <ipsec security parameter index (spi)>, <type of service (tos) (ipv4) and mask / traffic class (ipv6) and mask>, <flow label (ipv6)> […]]
+CGTFT=?	+CGTFT: <PDP_type>, (list of supported <packet filter identifier>s), (list of supported <evaluation precedence index>s), (list of supported <source address and subnet mask>s), (list of supported <protocol number (ipv4) / next header (ipv6)>s), (list of supported <destination port range>s), (list of supported <source port range>s), (list of supported <ipsec security parameter index (spi)>s), (list of supported <type of service (tos) (ipv4) and mask / traffic class (ipv6) and mask>s), (list of supported

	<flow label (ipv6)>s) [<CR><LF>+CGTFT: <PDP_type>, (list of supported <packet filter identifier>s), (list of supported <evaluation precedence index>s), (list of supported <source address and subnet mask>s), (list of supported <protocol number (ipv4) / next header (ipv6)>s), (list of supported <destination port range>s), (list of supported <source port range>s), (list of supported <ipsec security parameter index (spi)>s), (list of supported <type of service (tos) (ipv4) and mask / traffic class (ipv6) and mask>s), (list of supported <flow label (ipv6)>s) […]]

Description

This command allows the TE to specify a Packet Filter - PF for a Traffic Flow Template - TFT that is used in the GGSN for routing of down-link packets onto different QoS flows towards the TE. The concept is further described in the 3G TS 23.060[47]. A TFT consists of from one and up to eight Packet Filters, each identified by a unique `<packet filter identifier>`. A Packet Filter also has an `<evaluation precedence index>` that is unique within all TFTs associated with all PDP contexts that are associated with the same PDP address.

The set command specifies a Packet Filters that is to be added to the TFT stored in the MT and used for the context identified by the (local) context identification parameter, `<cid>`. The specified TFT will be stored in the GGSN only at activation or MS-initiated modification of the related context. Since this is the same parameter that is used in the +CGDCONT and +CGDSCONT commands, the +CGTFT command is effectively an extension to these commands. The Packet Filters consist of a number of parameters, each of which may be set to a separate value.

A special form of the set command, +CGTFT= `<cid>` causes all of the Packet Filters in the TFT for context number `<cid>` to become undefined. At any time there may exist only one PDP context with no associated TFT amongst all PDP contexts associated to one PDP address. At an attempt to delete a TFT, which would violate this rule, an ERROR or +CME ERROR response is returned. Extended error responses are enabled by the +CMEE command.

The read command returns the current settings for all Packet Filters for each defined context.

The test command returns values supported as a compound value. If the MT supports several PDP types, the parameter value ranges for each PDP type are returned on a separate line. TFTs shall be used for PDP-type IP and PPP only. For PDP-type PPP a TFT is applicable only when IP traffic is carried over PPP. If PPP carries header-compressed IP packets, then a TFT cannot be used.

Defined values

`<cid>`: a numeric parameter which specifies a particular PDP context definition (see the +CGDCONT and +CGDSCONT commands).

The following parameters are defined in 3G TS 23.060[47] -

`<packet filter identifier>`: Numeric parameter, value range from 1 to 8.

`<source address and subnet mask>`: Consists of dot-separated numeric (0-255) parameters on the form 'a1.a2.a3.a4.m1.m2.m3.m4', for IPv4 and 'a1.a2.a3.a4.a5.a6.a7.a8.a9.a10.a11.a12.a13.a14.a15.a16. m1.m2.m3.m4.m5.m6.m7.m8.m9.m10.m11.m12.m13.m14.m15.m16', for IPv6.

`<protocol number (ipv4) / next header (ipv6)>`: Numeric parameter, value range from 0 to 255.

`<destination port range>`: Consists of dot-separated numeric (0-65535) parameters on the form 'f.t'.

<source port range>:Consists of dot-separated numeric (0-65535) parameters on the form 'f.t'.

<ipsec security parameter index (spi)>: Hexadecimal parameter, value range from 00000000 to FFFFFFFF.

<type of service (tos) (ipv4) and mask / traffic class (ipv6) and mask>: Dot-separated numeric (0-255) parameters on the form 't.m'.

<flow label (ipv6)>: Hexadecimal parameter, value range from 00000 to FFFFF. Valid for IPv6 only.

<evaluation precedence index>: Numeric parameter, value range from 0 to 255.

Some of the above listed attributes may coexist in a Packet Filter while others mutually exclude each other, the possible combinations are shown in 3G TS 23.060[47].

Implementation

Optional.

10.1.4 Quality of Service Profile (Requested) +CGQREQ

Table 99: +CGQREQ parameter command syntax

Command	Possible Response(s)
+CGQREQ=[<cid> [,<precedence > [,<delay> [,<reliability.> [,<peak> [,<mean>]]]]]]	OK ERROR
+CGQREQ?	+CGQREQ: <cid>, <precedence >, <delay>, <reliability>, <peak>, <mean> [<CR><LF>+CGQREQ: <cid>, <precedence >, <delay>, <reliability.>, <peak>, <mean> […]]
+CGQREQ=?	+CGQREQ: <PDP_type>, (list of supported <precedence>s), (list of supported <delay>s), (list of supported <reliability>s) , (list of supported <peak>s), (list of supported <mean>s) [<CR><LF>+CGQREQ: <PDP_type>, (list of supported <precedence>s), (list of supported <delay>s), (list of supported <reliability>s) , (list of supported <peak>s), (list of supported <mean>s) […]]

Description

This command allows the TE to specify a Quality of Service Profile that is used when the MT sends an Activate PDP Context Request message to the network.

The set command specifies a profile for the context identified by the (local) context identification parameter, <cid>. Since this is the same parameter that is used in the +CGDCONT and +CGDSCONT commands, the +CGQREQ command is effectively an extension to these commands. The QoS profile consists of a number of parameters, each of which may be set to a separate value.

A special form of the set command, +CGQREQ= <cid> causes the requested profile for context number <cid> to become undefined.

The read command returns the current settings for each defined context.

The test command returns values supported as a compound value. If the MT supports several PDP types, the parameter value ranges for each PDP type are returned on a separate line.

Defined values

`<cid>`: a numeric parameter which specifies a particular PDP context definition (see the +CGDCONT and +CGDSCONT commands).

The following parameters are defined in GSM 03.60 -

`<precedence>`: a numeric parameter which specifies the precedence class

`<delay>`: a numeric parameter which specifies the delay class

`<reliability>`: a numeric parameter which specifies the reliability class

`<peak>`: a numeric parameter which specifies the peak throughput class

`<mean>`: a numeric parameter which specifies the mean throughput class

If a value is omitted for a particular class then the value is considered to be unspecified.

Implementation

Optional. If the command is not implemented then all the values are considered to be unspecified.

10.1.5 Quality of Service Profile (Minimum acceptable) +CGQMIN

Table 100: +CGQMIN parameter command syntax

Command	Possible Response(s)
+CGQMIN=[<cid> [,<precedence > [,<delay> [,<reliability.> [,<peak> [,<mean>]]]]]]	OK ERROR
+CGQMIN?	+CGQMIN: <cid>, <precedence >, <delay>, <reliability>, <peak>, <mean> [<CR><LF>+CGQMIN: <cid>, <precedence >, <delay>, <reliability.>, <peak>, <mean> […]]
+CGQMIN=?	+CGQMIN: <PDP_type>, (list of supported <precedence>s), (list of supported <delay>s), (list of supported <reliability>s) , (list of supported <peak>s), (list of supported <mean>s) [<CR><LF>+CGQMIN: <PDP_type>, (list of supported <precedence>s), (list of supported <delay>s), (list of supported <reliability>s) , (list of supported <peak>s), (list of supported <mean>s) […]]

Description

This command allows the TE to specify a minimum acceptable profile which is checked by the MT against the negotiated profile returned in the Activate PDP Context Accept message.

The set command specifies a profile for the context identified by the (local) context identification parameter, `<cid>`. Since this is the same parameter that is used in the +CGDCONT and +CGDSCONT commands, the +CGQMIN command is effectively an extension to these commands. The QoS profile consists of a number of parameters, each of which may be set to a separate value.

A special form of the set command, +CGQMIN= <cid> causes the minimum acceptable profile for context number <cid> to become undefined. In this case no check is made against the negotiated profile.

The read command returns the current settings for each defined context.

The test command returns values supported as a compound value. If the MT supports several PDP types, the parameter value ranges for each PDP type are returned on a separate line.

Defined values

<cid>: a numeric parameter which specifies a particular PDP context definition (see the +CGDCONT and +CGDSCONT commands).

The following parameters are defined in GSM 03.60 -

<precedence>: a numeric parameter which specifies the precedence class

<delay>: a numeric parameter which specifies the delay class

<reliability>: a numeric parameter which specifies the reliability class

<peak>: a numeric parameter which specifies the peak throughput class

<mean>: a numeric parameter which specifies the mean throughput class

If a value is omitted for a particular class then this class is not checked.

Implementation

Optional. If the command is not implemented then no check is made against the negotiated profile.

10.1.6 3G Quality of Service Profile (Requested) +CGEQREQ

Table 101: +CGEQREQ parameter command syntax

Command	Possible Response(s)
+CGEQREQ=[<cid> [,<Traffic class> [,<Maximum bitrate> [,<Guaranteed bitrate> [,<Delivery order> [,<Maximum SDU size> [,<SDU format information> [,<SDU error ratio> [,<Residual bit error ratio> [,<Delivery of erroneous SDUs> [,<Transfer delay> [,<Traffic handling priority> [,<Allocation/Retention Priority>]]]]]]]]]]]]]	OK ERROR
+CGEQREQ?	+CGEQREQ: <cid>, <Traffic class> ,<Maximum bitrate> ,<Guaranteed bitrate> ,<Delivery order> ,<Maximum SDU size> ,<SDU format information> ,<SDU error ratio> ,<Residual bit error ratio> ,<Delivery of erroneous SDUs> ,<Transfer delay> ,<Traffic handling priority> ,<Allocation/Retention Priority> [<CR><LF>+CGEQREQ: <cid>, <Traffic class> ,<Maximum bitrate> ,<Guaranteed bitrate> ,<Delivery order> ,<Maximum SDU size> ,<SDU format information> ,<SDU error ratio> ,<Residual bit error ratio> ,<Delivery of erroneous SDUs> ,<Transfer delay> ,<Traffic handling priority> ,<Allocation/Retention

	Priority> […]]
+CGEQREQ=?	+CGEQREQ: <PDP_type>, (list of supported <Traffic class>s) ,(list of supported <Maximum bitrate>s) ,(list of supported <Guaranteed bitrate>s) ,(list of supported <Delivery order>s) ,(list of supported <Maximum SDU size>s) ,(list of supported <SDU format information>s) ,(list of supported <SDU error ratio>s) ,(list of supported <Residual bit error ratio>s) ,(list of supported <Delivery of erroneous SDUs>s) ,(list of supported <Transfer delay>s) ,(list of supported <Traffic handling priority>s) ,(list of supported <Allocation/Retention Priority>s) [<CR><LF>+CGEQREQ: <PDP_type>, (list of supported <Traffic class>s) ,(list of supported <Maximum bitrate>s) ,(list of supported <Guaranteed bitrate>s) ,(list of supported <Delivery order>s) ,(list of supported <Maximum SDU size>s) ,(list of supported <SDU format information>s) ,(list of supported <SDU error ratio>s) ,(list of supported <Residual bit error ratio>s) ,(list of supported <Delivery of erroneous SDUs>s) ,(list of supported <Transfer delay>s) ,(list of supported <Traffic handling priority>s) ,(list of supported <Allocation/Retention Priority>s) […]]

Description

This command allows the TE to specify a UMTS Quality of Service Profile that is used when the MT sends an Activate PDP Context Request message to the network.

The set command specifies a profile for the context identified by the (local) context identification parameter, `<cid>`. The specified profile will be stored in the MT and sent to the network only at activation or MS-initiated modification of the related context. Since this is the same parameter that is used in the +CGDCONT and +CGDSCONT commands, the +CGEQREQ command is effectively an extension to these commands. The QoS profile consists of a number of parameters, each of which may be set to a separate value.

A special form of the set command, +CGEQREQ= `<cid>` causes the requested profile for context number `<cid>` to become undefined.

The read command returns the current settings for each defined context.

The test command returns values supported as a compound value. If the MT supports several PDP types, the parameter value ranges for each PDP type are returned on a separate line.

Defined values

`<cid>`: a numeric parameter which specifies a particular PDP context definition (see +CGDCONT and +CGDSCONT commands).

The following parameters are defined in 3G TS 23.107 [46] -

`<Traffic class>`: Indicates the type of application for which the UMTS bearer service is optimised.
conversational
streaming
interactive
background

`<Maximum bitrate>`: Indicates the maximum number of bits delivered by UMTS at a SAP within a period of time, divided by the duration of the period.

`<Guaranteed bitrate>`: Indicates the guaranteed number of bits delivered by UMTS at a SAP within a period of time (provided that there is data to deliver), divided by the duration of the period.

`<Delivery order>`: Indicates whether the UMTS bearer shall provide in-sequence SDU delivery or not.
0 - no (default if value is omitted)
1 - yes
Other values are reserved.

`<Maximum SDU size>`: Indicates the maximum allowed SDU size in bits.

`<SDU format information>`: List of possible exact sizes of SDUs in bits. If the list contains more than one value, colons separate the values.

`<SDU error ratio>`: Indicates the target value for the fraction of SDUs lost or detected as erroneous. SDU error ratio is defined only for conforming traffic. The value is specified as 'mEe'. As an example a target SDU error ratio of $5 \cdot 10^{-3}$ would be specified as '5E3'.

`<Residual bit error ratio>`: Indicates the target value for the undetected bit error ratio in the delivered SDUs. If no error detection is requested, Residual bit error ratio indicates the bit error ratio in the delivered SDUs. The value is specified as 'mEe'. As an example a target residual bit error ratio of $5 \cdot 10^{-3}$ would be specified as '5E3'.

`<Delivery of erroneous SDUs>`: Indicates whether SDUs detected as erroneous shall be delivered or not.
0 - no (default if value is omitted)
1 - yes
Other values are reserved.

`<Transfer delay>`: Indicates the targeted time between request to transfer an SDU at one SAP to its delivery at the other SAP, in milliseconds. Transfer delay is specified for one or more fixed SDU sizes. If transfer delay values are specified for more than one fixed SDU size the values shall be separated by commas and be in the same order as the corresponding fixed SDU sizes specified in the <SDU format information> parameter.

`<Traffic handling priority>`: Numeric parameter (1,2,3,…) that specifies the relative importance for handling of all SDUs belonging to the UMTS bearer compared to the SDUs of other bearers.

`<Allocation/Retention Priority>`: Numeric parameter (1,2,3,…) that specifies the relative importance compared to other UMTS bearers for allocation and retention of the UMTS bearer.

If a value is omitted for a particular class then the value is considered to be unspecified.

Implementation

Optional. If the command is not implemented then all the values are considered to be unspecified.

10.1.7 3G Quality of Service Profile (Minimum acceptable) +CGEQMIN

Table 102: +CGEQMIN parameter command syntax

Command	Possible Response(s)
`+CGEQMIN=[<cid> [,<Traffic class> [,<Maximum bitrate> [,<Guaranteed bitrate> [,<Delivery order> [,<Maximum SDU size> [,<SDU format information> [,<SDU error ratio> [,<Residual bit`	`OK` `ERROR`

error ratio> [,<Delivery of erroneous SDUs> [,<Transfer delay> [,<Traffic handling priority> [,<Allocation/Retention Priority>]]]]]]]]]]]]	
+CGEQMIN?	+CGEQMIN: <cid>, <Traffic class> ,<Maximum bitrate> ,<Guaranteed bitrate> ,<Delivery order> ,<Maximum SDU size> ,<SDU format information> ,<SDU error ratio> ,<Residual bit error ratio> ,<Delivery of erroneous SDUs> ,<Transfer delay> ,<Traffic handling priority> ,<Allocation/Retention Priority> [<CR><LF>+CGEQMIN: <cid>, <Traffic class> ,<Maximum bitrate> ,<Guaranteed bitrate> ,<Delivery order> ,<Maximum SDU size> ,<SDU format information> ,<SDU error ratio> ,<Residual bit error ratio> ,<Delivery of erroneous SDUs> ,<Transfer delay> ,<Traffic handling priority> ,<Allocation/Retention Priority> […]]
+CGEQMIN=?	+CGEQMIN: <PDP_type>, (list of supported <Traffic class>s) ,(list of supported <Maximum bitrate>s) ,(list of supported <Guaranteed bitrate>s) ,(list of supported <Delivery order>s) ,(list of supported <Maximum SDU size>s) ,(list of supported <SDU format information>s) ,(list of supported <SDU error ratio>s) ,(list of supported <Residual bit error ratio>s) ,(list of supported <Delivery of erroneous SDUs>s) ,(list of supported <Transfer delay>s) ,(list of supported <Traffic handling priority>s) ,(list of supported <Allocation/Retention Priority>s) [<CR><LF>+CGEQMIN: <PDP_type>, (list of supported <Traffic class>s) ,(list of supported <Maximum bitrate>s) ,(list of supported <Guaranteed bitrate>s) ,(list of supported <Delivery order>s) ,(list of supported <Maximum SDU size>s) ,(list of supported <SDU format information>s) ,(list of supported <SDU error ratio>s) ,(list of supported <Residual bit error ratio>s) ,(list of supported <Delivery of erroneous SDUs>s) ,(list of supported <Transfer delay>s) ,(list of supported <Traffic handling priority>s) ,(list of supported <Allocation/Retention Priority>s) […]]

Description

This command allows the TE to specify a minimum acceptable profile, which is checked by the MT against the negotiated profile returned in the Activate/Modify PDP Context Accept message.

The set command specifies a profile for the context identified by the (local) context identification parameter, `<cid>`. The specified profile will be stored in the MT and checked against the negotiated profile only at activation or MS-initiated modification of the related context. Since this is the same parameter that is used in the +CGDCONT and +CGDSCONT commands, the +CGEQMIN command is effectively an extension to these commands. The QoS profile consists of a number of parameters, each of which may be set to a separate value.

A special form of the set command, +CGEQMIN= `<cid>` causes the minimum acceptable profile for context number `<cid>` to become undefined. In this case no check is made against the negotiated profile.

The read command returns the current settings for each defined context.

The test command returns values supported as a compound value. If the MT supports several PDP types, the parameter value ranges for each PDP type are returned on a separate line.

Defined values

`<cid>`: a numeric parameter which specifies a particular PDP context definition (see +CGDCONT and +CGDSCONT commands).

The following parameters are defined in 3G TS 23.107 [46] -

`<Traffic class>:` Indicates the type of application for which the UMTS bearer service is optimised.
conversational
streaming
interactive
background

`<Maximum bitrate>:` Indicates the maximum number of bits delivered by UMTS at a SAP within a period of time, divided by the duration of the period.

`<Guaranteed bitrate>:` Indicates the guaranteed number of bits delivered by UMTS at a SAP within a period of time (provided that there is data to deliver), divided by the duration of the period.

`<Delivery order>:` Indicates whether the UMTS bearer shall provide in-sequence SDU delivery or not.
0 - no (default if value is omitted)
1 - yes
Other values are reserved.

`<Maximum SDU size>:` Indicates the maximum allowed SDU size in bits.

`<SDU format information>:` List of possible exact sizes of SDUs in bits. If the list contains more than one value, the values shall be separated by colons.

`<SDU error ratio>:` Indicates the target value for the fraction of SDUs lost or detected as erroneous. SDU error ratio is defined only for conforming traffic. The value is specified as 'mEe'. As an example a target SDU error ratio of $5 \bullet 10^{-3}$ would be specified as '5E3'.

`<Residual bit error ratio>:` Indicates the target value for the undetected bit error ratio in the delivered SDUs. If no error detection is requested, Residual bit error ratio indicates the bit error ratio in the delivered SDUs. The value is specified as 'mEe'. As an example a target residual bit error ratio of $5 \bullet 10^{-3}$ would be specified as '5E3'.

`<Delivery of erroneous SDUs>:` Indicates whether SDUs detected as erroneous shall be delivered or not.
0 - no (default if value is omitted)
1 - yes
Other values are reserved.

`<Transfer delay>:` Indicates the targeted time between request to transfer an SDU at one SAP to its delivery at the other SAP, in milliseconds. Transfer delay is specified for one or more fixed SDU sizes. If transfer delay values are specified for more than one fixed SDU size the values shall be separated by commas and be in the same order as the corresponding fixed SDU sizes specified in the <SDU format information> parameter.

`<Traffic handling priority>:` Numeric parameter (1,2,3,…) that specifies the relative importance for handling of all SDUs belonging to the UMTS bearer compared to the SDUs of other bearers.

`<Allocation/Retention Priority>:` Numeric parameter (1,2,3,…) that specifies the relative importance compared to other UMTS bearers for allocation and retention of the UMTS bearer.

If a value is omitted for a particular class then the value is considered to be unspecified.

Implementation

Optional. If the command is not implemented then no check is made against the negotiated profile.

10.1.8 3G Quality of Service Profile (Negotiated) +CGEQNEG

Table 103: +CGEQNEG action command syntax

Command	Possible Response(s)
+CGEQNEG =[<cid>[,<cid>[,…]]]	+CGEQNEG: <cid>, <Traffic class> ,<Maximum bitrate> ,<Guaranteed bitrate> ,<Delivery order> ,<Maximum SDU size> ,<SDU format information> ,<SDU error ratio> ,<Residual bit error ratio> ,<Delivery of erroneous SDUs> ,<Transfer delay> ,<Traffic handling priority> ,<Allocation/Retention Priority> [<CR><LF>+CGEQNEG: <cid>, <Traffic class> ,<Maximum bitrate> ,<Guaranteed bitrate> ,<Delivery order> ,<Maximum SDU size> ,<SDU format information> ,<SDU error ratio> ,<Residual bit error ratio> ,<Delivery of erroneous SDUs> ,<Transfer delay> ,<Traffic handling priority> ,<Allocation/Retention Priority> […]]
+CGEQNEG=?	+CGEQNEG: (list of <cid>s associated with active contexts)

Description

This command allows the TE to retrieve the negotiated QoS profiles returned in the Activate PDP Context Accept message.

The execution command returns the negotiated QoS profile for the specified context identifiers, `<cid>s`. The QoS profile consists of a number of parameters, each of which may have a separate value.

The test command returns a list of `<cid>`s associated with active contexts.

Defined values

`<cid>`: a numeric parameter which specifies a particular PDP context definition (see +CGDCONT and +CGDSCONT commands).

The following parameters are defined in 3G TS 23.107 [46] -

`<Traffic class>:` Indicates the type of application for which the UMTS bearer service is optimised.
conversational

streaming
interactive
background

<Maximum bitrate>: Indicates the maximum number of bits delivered by UMTS at a SAP within a period of time, divided by the duration of the period.

<Guaranteed bitrate>: Indicates the guaranteed number of bits delivered by UMTS at a SAP within a period of time (provided that there is data to deliver), divided by the duration of the period.

<Delivery order>: Indicates whether the UMTS bearer shall provide in-sequence SDU delivery or not.
0 - no (default if value is omitted)
1 - yes
Other values are reserved.

<Maximum SDU size>: Indicates the maximum allowed SDU size in bits.

<SDU format information>: List of possible exact sizes of SDUs in bits. If the list contains more than one value, colons separate the values.

<SDU error ratio>: Indicates the target value for the fraction of SDUs lost or detected as erroneous. SDU error ratio is defined only for conforming traffic. The value is specified as 'mEe'. As an example a target SDU error ratio of $5 \cdot 10^{-3}$ would be specified as '5E3'.

<Residual bit error ratio>: Indicates the target value for the undetected bit error ratio in the delivered SDUs. If no error detection is requested, Residual bit error ratio indicates the bit error ratio in the delivered SDUs. The value is specified as 'mEe'. As an example a target residual bit error ratio of $5 \cdot 10^{-3}$ would be specified as '5E3'.

<Delivery of erroneous SDUs>: Indicates whether SDUs detected as erroneous shall be delivered or not.
0 - no (default if value is omitted)
1 - yes
Other values are reserved.

<Transfer delay>: Indicates the targeted time between request to transfer an SDU at one SAP to its delivery at the other SAP, in milliseconds. Transfer delay is specified for one or more fixed SDU sizes. If transfer delay values are specified for more than one fixed SDU size the values shall be separated by commas and be in the same order as the corresponding fixed SDU sizes specified in the <SDU format information> parameter.

<Traffic handling priority>: Numeric parameter (1,2,3,…) that specifies the relative importance for handling of all SDUs belonging to the UMTS bearer compared to the SDUs of other bearers.

<Allocation/Retention Priority>: Numeric parameter (1,2,3,…) that specifies the relative importance compared to other UMTS bearers for allocation and retention of the UMTS bearer.

If a value is omitted for a particular class then the value is considered to be unspecified.

Implementation

Optional.

10.1.9 PS attach or detach +CGATT

Table 104: CGATT action command syntax

Command	**Possible Response(s)**
+CGATT= [<state>]	OK ERROR
+CGATT?	+CGATT: <state>
+CGATT=?	+CGATT: (list of supported <state>s)

Description

The execution command is used to attach the MT to, or detach the MT from, the Packet Domain service. After the command has completed, the MT remains in V.25ter command state. If the MT is already in the requested state, the command is ignored and the OK response is returned. If the requested state cannot be achieved, an ERROR or +CME ERROR response is returned. Extended error responses are enabled by the +CMEE command.

Any active PDP contexts will be automatically deactivated when the attachment state changes to detached.

The read command returns the current Packet Domain service state.

The test command is used for requesting information on the supported Packet Domain service states.

NOTE: This command has the characteristics of both the V.25ter action and parameter commands. Hence it has the read form in addition to the execution/set and test forms.

Defined Values

<state>: indicates the state of PS attachment
0 - detached
1 - attached
Other values are reserved and will result in an ERROR response to the execution command.

Implementation

Optional.

10.1.10 PDP context activate or deactivate +CGACT

Table 105: CGACT action command syntax

Command	Possible Response(s)
+CGACT=[<state> [,<cid>[,<cid>[,…]]]]	OK ERROR
+CGACT?	+CGACT: <cid>, <state> [<CR><LF>+CGACT: <cid>, <state> [...]]
+CGACT=?	+CGACT: (list of supported <state>s)

Description

The execution command is used to activate or deactivate the specified PDP context (s). After the command has completed, the MT remains in V.25ter command state. If any PDP context is already in the requested state, the state for that context remains unchanged. If the requested state for any specified context cannot be achieved, an ERROR or +CME ERROR response is returned. Extended error responses are enabled by the +CMEE command. If the MT is not PS attached when the activation form of the command is executed, the MT first performs a PS attach and them attempts to activate the specified contexts. If the attach fails then the MT responds with ERROR or, if extended error responses are enabled, with the appropriate failure-to-attach error message.

If no <cid>s are specified the activation form of the command activates all defined contexts.

If no <cid>s are specified the deactivation form of the command deactivates all active contexts.

An active secondary context can exist if and only if the corresponding active primary context exists. If the primary PDP context associated with a PDP address is deactivated, all the associated secondary contexts are deactivated too and the data transfer for that PDP address is disabled.

The read command returns the current activation states for all the defined PDP contexts.

The test command is used for requesting information on the supported PDP context activation states.

NOTE. This command has the characteristics of both the V.25ter action and parameter commands. Hence it has the read form in addition to the execution/set and test forms.

Defined Values

`<state>`: indicates the state of PDP context activation
0 - deactivated
1 - activated
Other values are reserved and will result in an ERROR response to the execution command.

`<cid>`: a numeric parameter which specifies a particular PDP context definition (see the +CGDCONT and +CGDSCONT commands).

Implementation

Optional.

10.1.11 PDP Context Modify +CGCMOD

Table 106: CGCMOD action command syntax

Command	Possible Response(s)
`+CGCMOD=[<cid>[,<cid>[,…]]]`	`OK` `ERROR`
`+CGCMOD=?`	`+CGCMOD: (list of <cid>s associated with active contexts)`

Description

The execution command is used to modify the specified PDP context (s) with repect to QoS profiles and TFTs. After the command has completed, the MT returns to V.25ter online data state. If the requested modification for any specified context cannot be achieved, an ERROR or +CME ERROR response is returned. Extended error responses are enabled by the +CMEE command.

If no `<cid>`s are specified the activation form of the command modifies all active contexts.

The test command returns a list of `<cid>`s associated with active contexts.

Defined Values

`<cid>`: a numeric parameter which specifies a particular PDP context definition (see the +CGDCONT and +CGDSCONT commands).

Implementation

Optional.

10.1.12 Enter data state +CGDATA

Table 107: +CGDATA action command syntax

Command	**Possible Response(s)**
+CGDATA=[<L2P> ,[<cid> [,<cid> [,…]]]]	CONNECT ERROR
+CGDATA=?	+CGDATA: (list of supported <L2P>s)

Description

The execution command causes the MT to perform whatever actions are necessary to establish communication between the TE and the network using one or more Packet Domain PDP types. This may include performing a PS attach and one or more PDP context activations. If the <L2P> parameter value is unacceptable to the MT, the MT shall return an ERROR or +CME ERROR response. Otherwise, the MT issues the intermediate result code CONNECT and enters V.25ter online data state.

Commands following +CGDATA command in the AT command line shall not be processed by the MT.

The detailed behaviour after the online data state has been entered is dependent on the PDP type. It is described briefly in ~~GSM 07.60~~3G TS 27.060[34] and in more detail in ~~GSM 09.61~~3G TS 29.061[39] and the specifications for the relevant PDPs. PS attachment and PDP context activation procedures may take place prior to or during the PDP startup if they have not already been performed using the +CGATT and +CGACT commands.

If context activation takes place during the PDP startup, one or more <cid>s may be specified in order to provide the information needed for the context activation request(s).

During each PDP startup procedure the MT may have access to some or all of the following information -

> The MT may have a priori knowledge, for example, it may implement only one PDP type.
>
> The command may have provided an <L2P> parameter value.
>
> The TE may provide a PDP type and/or PDP address to the MT during in the PDP startup procedure.

If any of this information is in conflict, the command will fail.

Any PDP type and/or PDP address present in the above information shall be compared with the PDP type and/or PDP address in any context definitions specified in the command in the order in which their <cid>s appear. For a context definition to match -

> The PDP type must match exactly.
>
> The PDP addresses are considered to match if they are identical or if either or both addresses are unspecified. For example, a PPP NCP request specifying PDP type = IP and no PDP address would cause the MT to search through the specified context definitions for one with PDP type = IP and any PDP address.

The context shall be activated using the matched value for PDP type and a static PDP address if available, together with the other information found in the PDP context definition. If a static PDP address is not available then a dynamic address is requested.

If no <cid> is given or if there is no matching context definition, the MT shall attempt to activate the context with whatever information is available to the MT. The other context parameters shall be set to their default values.

If the activation is successful, data transfer may proceed.

After data transfer is complete, and the layer 2 protocol termination procedure has completed successfully, the V.25ter command state is re-entered and the MT returns the final result code OK.

In the event of an erroneous termination or a failure to start up, the V.25ter command state is re-entered and the MT returns the final result code NO CARRIER or, if enabled, +CME ERROR. Attach, activate and other errors may be reported.

The test command is used for requesting information on the supported layer 2 protocols.

This command may be used in both normal and modem compatibility modes.

Defined Values

<L2P>: a string parameter that indicates the layer 2 protocol to be used between the TE and MT
NULL none, for PDP type OSP:IHOSS
PPP Point-to-point protocol for a PDP such as IP
PAD character stream for X.25 character (triple X PAD) mode
X25 X.25 L2 (LAPB) for X.25 packet mode
M-xxxx manufacturer-specific protocol (xxxx is an alphanumeric string)

If the value is omitted, the layer 2 protocol is unspecified. Other values are reserved and will result in an ERROR response.

<cid>: a numeric parameter which specifies a particular PDP context definition (see the +CGDCONT and +CGDSCONT commands).

Implementation

Optional if the D (dial) command can be used to specify Packet Domain operation.

10.1.13 Configure local Octet Stream PAD parameters +CGCLOSP

Table 108: CGCLOSP parameter command syntax

Command	Possible Response(s)
+CGCLOSP=[<parm>, <value>]	OK ERROR
+CGCLOSP?	+CGCLOSP: <parm>, <value> [<CR><LF>+CGCLOSP: <parm>, <value>> […]]
+CGCLOSP=?	+CGCLOSP: <parm>, (list of supported <value>s) [<CR><LF>+CGCLOSP: <parm>, (list of supported <value>s) […]]

Description

The set command sets the value of a specified OSP PAD parameter in the local PAD. The set of parameters to be supported is listed in the OSP protocol specification.

Setting the maximum sizes for the local Packet Assembly and Disassembly buffers will cause corresponding values for the GGSN relay buffers to be negotiated.

The read command returns, one per line, the value of each of the supported parameters.

The test command returns, one per line, the permitted range of values for each of the supported parameters.

Defined values

<parm>: a numeric parameter which specifies the PAD parameter to be configured

<value>: a numeric parameter which specifies the value to which PAD parameter is to be set

If <value> is omitted for a particular parameter then <parm> is set to the OSP-defined default, if any.

Implementation

Optional.

10.1.14 Show PDP address +CGPADDR

Table 109:+CGPADDR action command syntax

Command	Possible response(s)
+CGPADDR=[<cid> [,<cid> [,…]]]	+CGPADDR: <cid>,<PDP_addr> [<CR><LF>+CGPADDR: <cid>,<PDP_addr> [...]]
+CGPADDR=?	+CGPADDR: (list of defined <cid>s)

Description

The execution command returns a list of PDP addresses for the specified context identifiers.

The test command returns a list of defined <cid>s.

Defined values

<cid>: a numeric parameter which specifies a particular PDP context definition (see the +CGDCONT and +CGDSCONT commands). If no <cid> is specified, the addresses for all defined contexts are returned.

<PDP_address>: a string that identifies the MT in the address space applicable to the PDP. The address may be static or dynamic. For a static address, it will be the one set by the +CGDCONT and +CGDSCONT commands when the context was defined. For a dynamic address it will be the one assigned during the last PDP context activation that used the context definition referred to by <cid>. <PDP_address> is omitted if none is available.

Implementation

Optional.

10.1.15 Automatic response to a network request for PDP context activation +CGAUTO

Table 110: CGAUTO parameter command syntax

Command	Possible response(s)
+CGAUTO=[<n>]	OK ERROR
+CGAUTO?	+CGAUTO: <n>
+CGAUTO=?	+CGAUTO: (list of supported <n>s)

Description

The set command disables or enables an automatic positive response (auto-answer) to the receipt of a Request PDP Context Activation message from the network. It also provides control over the use of the V.25ter basic commands 'S0', 'A and 'H' for handling network requests for PDP context activation. The setting does not affect the issuing of the unsolicited result code RING or +CRING.

The test command returns the values of <n> supported by the MT as a compound value.

When the +CGAUTO=0 command is received, the MT shall not perform a PS detach if it is attached. Subsequently, when the MT announces a network request for PDP context activation by issuing the unsolicited result code RING or +CRING, the TE may manually accept or reject the request by issuing the +CGANS command or may simply ignore the network request.

When the +CGAUTO=1 command is received, the MT shall attempt to perform a PS attach if it is not already attached. Failure will result in ERROR or, if enabled, +CME ERROR being returned to the TE. Subsequently, when the MT announces a network request for PDP context activation by issuing the unsolicited result code RING or +CRING to the TE, this is followed by the intermediate result code CONNECT. The MT then enters V.25ter online data state and follows the same procedure as it would after having received a +CGANS=1 with no <L2P> or <cid> values specified.

Defined values

<n>:

0 turn off automatic response for Packet Domain only
1 turn on automatic response for Packet Domain only
2 modem compatibility mode, Packet Domain only
3 modem compatibility mode, Packet Domain and circuit switched calls (default)

For <n> = 0 Packet DomainS network requests are manually accepted or rejected by the +CGANS command.

For <n> = 1 Packet Domain network requests are automatically accepted according to the description above.

For <n> = 2, automatic acceptance of Packet Domain network requests is controlled by the 'S0' command. Manual control uses the 'A' and 'H' commands, respectively, to accept and reject Packet Domain requests. (+CGANS may also be used.) Incoming circuit switched calls can be neither manually nor automatically answered.

For <n> = 3, automatic acceptance of both Packet Domain network requests and incoming circuit switched calls is controlled by the 'S0' command. Manual control uses the 'A' and 'H' commands, respectively, to accept and reject Packet Domain requests. (+CGANS may also be used.) Circuit switched calls are handled as described elsewhere in this specification.

Implementation

Optional. If not implemented, the MT shall behave according to the case of <n> = 3.

10.1.16 Manual response to a network request for PDP context activation +CGANS

Table 111: CGANS action command syntax

Command	Possible response(s)
+CGANS=[<response>, [<L2P> ,[<cid>]]]	OK ERROR
+CGANS=?	+CGANS: (list of supported <response>s), (list of supported <L2P>s)

Description

The execution command requests the MT to respond to a network request for Packet Domain PDP context activation which has been signalled to the TE by the RING or +CRING: unsolicited result code. The <response> parameter allows the TE to accept or reject the request.

If <response> is 0, the request is rejected and the MT returns OK to the TE.

If <response> is 1, the following procedure is followed by the MT.

Commands following the +CGANS command in the AT command line shall not be processed by the MT.

If the <L2P> parameter value is unacceptable to the MT, the MT shall return an ERROR or +CME ERROR response. Otherwise, the MT issues the intermediate result code CONNECT and enters V.25ter online data state.

The detailed behaviour after the online data state has been entered is dependent on the PDP type. It is described briefly in ~~GSM 07.60~~3G TS 27.060[34] and in more detail in ~~GSM 09.61~~3G TS 29.061[39] and the specifications for the relevant PDPs. PDP context activation procedures shall take place prior to or during the PDP startup.

One or more <cid>s may be specified in order to provide the values needed for the context activation request.

During the PDP startup procedure the MT has the PDP type and the PDP address provided by the network in the Request PDP Context Activation message. The MT may also have some or all of the following information -

The MT may have a priori knowledge, for example, it may implement only one PDP type.

The command may have provided an <L2P> parameter value.

The TE may provide one or both of PDP type and PDP address to the MT in the PDP startup.

If any of this information is in conflict, the command will fail.

If one or more <cid> is given then an attempt shall be made to identify an appropriate context definition by matching the PDP type and PDP address in the network request with the PDP type and PDP address in each of the specified context definitions (in the order in which their <cid>s appear in the command) as follows -

The PDP type must match exactly.

The PDP addresses are considered to match if they are identical or if the address in the context definition is unspecified.

The context shall be activated using the values for PDP type and PDP address provided by the network, together with the other information found in the PDP context definition. An APN may or may not re required, depending on the application.

If no <cid> is given or if there is no matching context definition, the MT will attempt to activate the context using the values for PDP type and PDP address provided by the network, together with any other relevant information known to the MT. The other context parameters will be set to their default values.

If the activation is successful, data transfer may proceed.

After data transfer is complete, and the layer 2 protocol termination procedure has completed successfully, the V.25ter command state is re-entered and the MT returns the final result code OK

In the event of an erroneous termination or a failure to startup, the V.25ter command state is re-entered and the MT returns the final result code NO CARRIER or, if enabled, +CME ERROR. Attach, activate and other errors may be reported. It is also an error to issue the +CGANS command when there is no outstanding network request.

NOTE: This is not the same as if the MT issues a +CGDATA (or +CGACT) command after receiving a +CRING unsolicited result code. A +CGDATA (or +CGACT) does not command the MT to acknowledge the network request but rather to make a new request for context activation. The network request would be ignored.

The test command returns the values of <response> and <L2P> supported by the MT as compound values.

This command may be used in both normal and modem compatibility modes.

Defined values

<response>: is a numeric parameter which specifies how the request should be responded to.

0 reject the request
1 accept and request that the PDP context be activated

If <response> is omitted it is assumed to be 0. Other values are reserved and will result in the ERROR response.

<L2P>: a string parameter which indicates the layer 2 protocol to be used (see +CGDATA command).

<cid>: a numeric parameter which specifies a particular PDP context definition (see the +CGDCONT and +CGDSCONT commands).

Implementation

Optional.

10.1.17 GPRS mobile station class +CGCLASS (GPRS only)

Table 112: CGCLASS parameter command syntax

Command	Possible Response(s)
+CGCLASS= [<class>]	OK ERROR
+CGCLASS?	+CGCLASS: <class>
+CGCLASS=?	+CGCLASS: (list of supported <class>s)

Description

The set command is used to set the MT to operate according to the specified GPRS mobile class. If the requested class is not supported, an ERROR or +CME ERROR response is returned. Extended error responses are enabled by the +CMEE command.

The read command returns the current GPRS mobile class.

The test command is used for requesting information on the supported GPRS mobile classes.

Defined Values

<class>: a string parameter which indicates the GPRS mobile class (in descending order of functionality)

A	class A (highest)
B	class B
C	class C in GPRS and circuit switched alternate mode
CG	class C in GPRS only mode
CC	class C in circuit switched only mode (lowest)

Other values are reserved and will result in an ERROR response to the set command.

If the MT is GPRS attached when the set command is issued with a <class> = CC specified, a detach request shall be sent to the network.

Implementation

Optional.

10.1.12 Configure local triple-X PAD parameters +CGCLPAD (GPRS only)

Table 113: CGCLPAD parameter command syntax

Command	Possible Response(s)
+CGCLPAD=[<parm>, <value>]	OK ERROR
+CGCLPAD?	+CGCLPAD: <parm>, <value> [<CR><LF>+CGCLPAD: <parm>, <value>> […]]
+CGCLPAD=?	+CGCLPAD: <parm>, (list of supported <value>s) [<CR><LF>+CGCLPAD: <parm>, (list of supported <value>s) […]]

Description

The set command sets the value of a specified X.3 PAD parameter in the local PAD. A minimum set of parameters to be supported is listed in ~~GSM 07.60~~3G TS 27.060[34].

The read command returns, one per line, the value of each of the supported parameters.

The test command returns, one per line, the permitted range of values for each of the supported parameters.

Defined values

<parm>: a numeric parameter which specifies the X.3 parameter to be configured

<value>: a numeric parameter which specifies the value to which the X.3 parameter is to be set

If <value> is omitted for a particular class then <parm> is set to the X.3-defined default, if any.

Implementation

Optional.

10.1.18 Packet Domain event reporting +CGEREP

Table 114: CGEREP parameter command syntax

Command	Possible response(s)
+CGEREP=[<mode>[,<bfr>]]	OK ERROR
+CGEREP?	+CGEREP: <mode>,<bfr>
+CGEREP=?	+CGEREP: (list of supported <mode>s),(list of supported <bfr>s)

Description

Set command enables or disables sending of unsolicited result codes, +CGEV: XXX from MT to TE in the case of certain events occurring in the Packet Domain MT or the network. <mode> controls the processing of unsolicited result codes specified within this command. <bfr> controls the effect on buffered codes when <mode> 1 or 2 is entered. If a setting is not supported by the MT, ERROR or +CME ERROR: is returned.

Read command returns the current mode and buffer settings

Test command returns the modes and buffer settings supported by the MT as compound values.

Defined values

<mode>:

0 buffer unsolicited result codes in the MT; if MT result code buffer is full, the oldest ones can be discarded. No codes are forwarded to the TE.

1 discard unsolicited result codes when MT-TE link is reserved (e.g. in on-line data mode); otherwise forward them directly to the TE

2 buffer unsolicited result codes in the MT when MT-TE link is reserved (e.g. in on-line data mode) and flush them to the TE when MT-TE link becomes available; otherwise forward them directly to the TE

<bfr>:

0 MT buffer of unsolicited result codes defined within this command is cleared when <mode> 1 or 2 is entered

1 MT buffer of unsolicited result codes defined within this command is flushed to the TE when <mode> 1 or 2 is entered (OK response shall be given before flushing the codes)

Defined events

The following unsolicited result codes and the corresponding events are defined -

+CGEV: REJECT <PDP_type>, <PDP_addr>

A network request for PDP context activation occurred when the MT was unable to report it to the TE with a +CRING unsolicited result code and was automatically rejected.

+CGEV: NW REACT <PDP_type>, <PDP_addr>, [<cid>]

The network has requested a context reactivation. The <cid> that was used to reactivate the context is provided if known to the MT.

+CGEV: NW DEACT <PDP_type>, <PDP_addr>, [<cid>]

The network has forced a context deactivation. The <cid> that was used to activate the context is provided if known to the MT.

`+CGEV: ME DEACT  <PDP_type>, <PDP_addr>, [<cid>]`

The mobile equipment has forced a context deactivation. The `<cid>` that was used to activate the context is provided if known to the MT.

`+CGEV: NW DETACH`

The network has forced a PS detach. This implies that all active contexts have been deactivated. These are not reported separately.

`+CGEV: ME DETACH`

The mobile equipment has forced a PS detach. This implies that all active contexts have been deactivated. These are not reported separately.

`+CGEV: NW CLASS <class>`

The network has forced a change of MS class. The highest available class is reported (see +CGCLASS).

`+CGEV: ME CLASS <class>`

The mobile equipment has forced a change of MS class. The highest available class is reported (see +CGCLASS).

Implementation

Optional.

10.1.19 GPRS network registration status +CGREG

Table 115: CGREG parameter command syntax

Command	Possible response(s)
`+CGREG=[<n>]`	
`+CGREG?`	`+CGREG: <n>,<stat>[,<lac>,<ci>]` *`+CME ERROR: <err>`*
`+CGREG=?`	`+CGREG: (`list of supported `<n>`s`)`

Description

The set command controls the presentation of an unsolicited result code `+CGREG: <stat>` when `<n>`=1 and there is a change in the MT's GPRS network registration status, or code `+CGREG: <stat>[,<lac>,<ci>]` when `<n>`=2 and there is a change of the network cell.

NOTE. If the GPRS MT also supports circuit mode services, the +CREG command and +CREG: result code apply to the registration status and location information for those services.

The read command returns the status of result code presentation and an integer `<stat>` which shows whether the network has currently indicated the registration of the MT. Location information elements `<lac>` and `<ci>` are returned only when `<n>`=2 and MT is registered in the network.

Defined values

<n>:

0 disable network registration unsolicited result code

1 enable network registration unsolicited result code +CGREG: <stat>

2 enable network registration and location information unsolicited result code +CGREG: <stat>[,<lac>,<ci>]

<stat>:

0 not registered, ME is not currently searching a new operator to register to

1 registered, home network

2 not registered, but ME is currently searching a new operator to register to

3 registration denied

4 unknown

5 registered, roaming

<lac>: string type; two byte location area code in hexadecimal format (e.g. "00C3" equals 195 in decimal)

<ci>: string type; two byte cell ID in hexadecimal format

Implementation

Optional.

10.1.20 Select service for MO SMS messages +CGSMS

Table 116: CGSMS parameter command syntax

Command	Possible Response(s)
+CGSMS= [<service>]	OK ERROR
+CGSMS?	+CGSMS: <service>
+CGSMS=?	+CGSMS: (list of currently available <service>s)

Description

The set command is used to specify the service or service preference that the MT will use to send MO SMS messages.

The read command returns the currently selected service or service preference.

The test command is used for requesting information on the currently available services and service preferences.

Defined Values

<service>: a numeric parameter which indicates the service or service preference to be used

0 Packet Domain
1 circuit switched
2 Packet Domain preferred (use circuit switched if GPRS not available)
3 circuit switched preferred (use Packet Domain if circuit switched not available)

Other values are reserved and will result in an ERROR response to the set command.

Implementation

Optional.

10.2 Modem compatibility commands

This subclause describes how existing AT commands, designed for use with a modem, may be used to control a Packet Domain MT. This is to provide backwards compatibility with existing communications software. For new applications it is recommended that the Packet Domain-specific commands, described in previous subclauses, be used.

10.2.1 MT originated PDP context activation

In this mode of operation, the MT behaves like an originating modem and accepts the normal V.25ter commands associated with placing and clearing a call. If Packet Domain-specific configuration commands are required, they may be sent to the MT as part of the modem initialisation commands.

10.2.1.1 Request Packet Domain service 'D'

Table 117: D command syntax

Command	**Possible Response(s)**
D*<GPRS_SC>[*[<called_address>][*[<L2P>][*[<cid>]]]]#	CONNECT ERROR

Description

This command causes the MT to perform whatever actions are necessary to establish communication between the TE and the external PDN.

The V.25ter 'D' (Dial) command causes the MT to enter the V.25ter online data state and, with the TE, to start the specified layer 2 protocol. The MT shall return CONNECT to confirm acceptance of the command prior to entering the V.25ter online data state. No further commands may follow on the AT command line.

The detailed behaviour after the online data state has been entered is dependent on the PDP type. It is described briefly in clauses 8 (for X.25) and 9 (for IP) of ~~GSM 07.60~~3G TS 27.060[34]. PS attachment and PDP context activation procedures may take place prior to or during the PDP startup if they have not already been performed using the +CGATT and +CGACT commands.

When the layer 2 protocol has terminated, either as a result of an orderly shut down of the PDP or an error, the MT shall enter V.25ter command state and return the NO CARRIER final result code.

If `<called address>` is supported and provided, the MT shall automatically set up a virtual call to the specified address after the PDP context has been activated.

If `<L2P>` and `<cid>` are supported, their usage shall be the same as in the +CGDATA command. The +CGDCONT, +CGQREQ, etc. commands may be used in the modem initialisation AT command string to set values for for PDP type, APN, QoS etc..

If `<L2P>` is not supported or is supported but omitted, the MT shall use a layer 2 protocol appropriate to the PDP type.

If `<cid>` is not supported or is supported but omitted, the MT shall attempt to activate the context using:

(a) any information provided by the TE during the PDP startup procedure, e.g. the TE may provide a PDP type and/or PDP address to the MT,

or, (b) a priori knowledge, e.g. the MT may implement only one PDP type, or, (c) using the 'Empty PDP type' (GSM 04.08). (No PDP address or APN shall be sent in this case and only one PDP context subscription record shall be present in the HLR for this subscriber.)

This command may be used in both normal and modem compatibility modes.

NOTE. The dial string conforms to the syntax specified in ~~GSM 02.30~~3G TS 22.030 [19].

Defined Values

`<GPRS_SC>`: (GPRS Service Code) a digit string (value 99) which identifies a request to use the Packet Domain service

`<called_address>`: a string that identifies the called party in the address space applicable to the PDP. For communications software that does not support arbitrary characters in the dial string, a numeric equivalent may be used. Also, the character comma ',' may be used as a substitute for the character period '.'.
For PDP type OSP:IHOSS, the following syntax may be used for `<called_address>`:
[<host>][@[<port>][@[<protocol>]]]
where <host>, <port> and <protocol> are defined in the +CGDCONT description. For communications software that does not support arbitrary characters in the dial string, a numeric equivalent to the hostname may be used. However, this should be avoided if at all possible.

`<L2P>`: a string which indicates the layer 2 protocol to be used (see +CGDATA command). For communications software that does not support arbitrary characters in the dial string, the following numeric equivalents shall be used:

0	NULL
1	PPP
2	PAD
3	X25
9yyyy	M-xxxx

Other values are reserved and will result in an ERROR response

`<cid>`: a digit string which specifies a particular PDP context definition (see the +CGDCONT and +CGDSCONT commands).

Implementation

Optional if the +CGDATA command is supported. If the D command is provided, then support for `<called_address>`, `<L2P>` and `<cid>` are optional. If they are not supported but values are provided by the TE, the values shall be ignored and this shall not constitute an error.

10.2.1.2 Request Packet Domain IP service 'D'

Table 118: D command syntax

Command	Possible Response(s)
`D*<GPRS_SC_IP>[*<cid>]#`	CONNECT ERROR

Description

This command causes the MT to perform whatever actions are necessary to establish communication between the TE and the external PDN.

The V.25ter 'D' (Dial) command causes the MT to enter the V.25ter online data state and, with the TE, to start the specified layer 2 protocol. The MT shall return CONNECT to confirm acceptance of the command prior to entering the V.25ter online data state. No further commands may follow on the AT command line.

The detailed behaviour after the online data state has been entered is described briefly in clause 9, for IP, of ~~GSM 07.60~~3G TS 27.060[34]. GPRS attachment and PDP context activation procedures may take place prior to or during the PDP startup if they have not already been performed using the +CGATT and +CGACT commands.

When the layer 2 protocol has terminated, either as a result of an orderly shut down of the PDP or an error, the MT shall enter V.25ter command state and return the NO CARRIER final result code.

If `<cid>` is supported, its usage shall be the same as in the +CGDATA command. The +CGDCONT, +CGQREQ, etc. commands may be used in the modem initialisation AT command string to set values for for PDP type, APN, QoS etc..

If `<cid>` is not supported or is supported but omitted, the MT shall attempt to activate the context using:

(a) any information provided by the TE during the PDP startup procedure, e.g. the TE may provide a PDP type and/or PDP address to the MT,

or, (b) a priori knowledge, e.g. the MT may implement only one PDP type,

or, (c) using the 'Empty PDP type' (GSM 04.08). (No PDP address or APN shall be sent in this case and only one PDP context subscription record shall be present in the HLR for this subscriber.)

This command may be used in both normal and modem compatibility modes.

NOTE. The dial string conforms to the syntax specified in ~~GSM 02.30~~3G TS 22.030[19].

Defined Values

<GPRS_SC_IP>: (GPRS Service Code for IP) a digit string (value 98) which identifies a request to use the GPRS with IP (PDP types IP and PPP)

`<cid>`: a digit string which specifies a particular PDP context definition (see +CGDCONT command).

Implementation

Optional if the +CGDATA command is supported. If the D command is provided, then support for `<cid>` is optional. If it is not supported but a value is provided by the TE, the value shall be ignored and this shall not constitute an error.

10.2.2 Network requested PDP context activation

In this mode of operation, the MT behaves like an answering modem and accepts the normal V.25ter commands associated with answering a call. If Packet Domain-specific configuration commands are required, they may be sent to the MT as part of the modem initialisation commands.

The +CGAUTO command is used to select modem compatibility mode.

10.2.2.1 Automatic response to a network request for PDP context activation 'S0'

The V.25ter 'S0=n' (Automatic answer) command may be used to turn off (n=0) and on (n>0) the automatic response to a network request for a PDP context activation.

When the 'S0=n' (n>0) command is received, the MT shall attempt to perform a PS attach if it is not already attached. Failure will result in ERROR being returned to the TE. Subsequently, the MT will announce a network request for PDP context activation by issuing the unsolicited result code RING to the TE, followed by the intermediate result code CONNECT. The MT then enters V.25ter online data state and follows the same procedure as it would after having received a +CGANS=1 with no <L2P> or <cid> values specified.

NOTE. The 'S0=n' (n=0) command does not perform an automatic PS detach.

Implementation

Optional.

10.2.2.2 Manual acceptance of a network request for PDP context activation 'A'

The V.25ter 'A' (Answer) command may be used to accept a network request for a PDP context activation announced by the unsolicited result code RING. The MT responds with CONNECT, enters V.25ter online data state and follows the same procedure as it would after having received a +CGANS=1 with no <L2P> or <cid> values specified. It is an error to issue the 'A' command when there is no outstanding network request.

Implementation

Optional.

10.2.2.3 Manual rejection of a network request for PDP context activation 'H'

The V.25ter 'H' or 'H0' (On-hook) command may be used to reject a network request for PDP context activation announced by the unsolicited result code RING. The MT responds with OK. It is an error to issue the 'H' command when there is no outstanding network request.

NOTE: This is an extension to the usage of the 'H' command that is described in ITU-T V.25ter.

Implementation

Optional.

Annex A (normative): Summary of commands from other standards

Summary of ITU-T Recommendation V.25ter [14] commands applicable to ~~GSM~~GSM/UMTS:

Table A.1: V.25ter commands applicable to ~~GSM~~GSM/UMTS

Name	V.25ter section	Description	Subclauses in this TS
&C	6.2.8	Circuit 109 (Received line signal detector) Behaviour	4.3.
&D	6.2.9	Circuit 108 (Data terminal ready) Behaviour	4.3.
&F	6.1.2	Set to Factory-defined Configuration	5.8./ 3.
+DR	6.6.2	Data Compression Reporting	6.20.
+DS	6.6.1	Data Compression	6.20.
+GCAP	6.1.9	Request Complete Capabilities List	5.8.
+GCI	6.1.10	Country of Installation	5.8.
+GMI	6.14	Request Manufacturer Identification	5.8./ 5.1.
+GMM	6.1.5	Request Model Identification	5.8./ 5.2.
+GMR	6.1.6	Request Revision Identification	5.8./ 5.3.
+GOI	6.1.8	Request Global Object Identification	5.8.
+GSN	6.1.7	Request Product Serial Number Identification	5.8./ 5.4.
+ICF	6.2.11	DTE-DCE Character Framing	4.3.
+IFC	6.2.12	DTE-DCE Local Flow Control	4.3.
+ILRR	6.2.13	DTE-DCE Local Rate Reporting	4.3.
+IPR	6.2.10	Fixed DTE Rate	4.3.
A	6.3.5	Answer	6.19./ 6.6.
D	6.3.1	Dial	6.1.-6.4./ 6.6.
E	6.2.4	Command Echo	4.3.
H	6.3.6	Hook Control	6.19./ 6.5./ 6.6.
I	6.1.3	Request Identification Information	5.8.
L	6.3.13	Monitor Speaker Loudness	6.19.
M	6.3.14	Monitor Speaker Mode	6.19.
O	6.3.7	Return to Online Data State	6.19.
P	6.3.3	Select Pulse Dialling	6.19.
Q	6.2.5	Result Code Suppression	4.3.
S0	6.3.8	Automatic Answer	6.19.
S10	6.3.12	Automatic Disconnect Delay	6.19.
S3	6.2.1	Command Line Termination Character	4.3.
S4	6.2.2	Response Formatting Character	4.3.
S5	6.2.3	Command Line Editing Character	4.3.
S6	6.3.9	Pause Before Blind Dialling	6.19.
S7	6.3.10	Connection Completion Timeout	6.19.
S8	6.3.11	Comma Dial Modifier Time	6.19.
T	6.3.2	Select Tone Dialling	6.19.
V	6.2.6	DCE Response Format	4.3./ 3./ 4.1./ 4.2.
X	6.2.7	Result Code Selection and Call Progress Monitoring Control	4.3.
Z	6.1.1	Reset To Default Configuration	5.8.

The use of ITU-T Recommendation V.42 error control protocol is not specified for ~~GSM~~GSM/UMTS, but if a manufacturer chooses to implement it over transparent data service, +E prefixed commands of V.25ter [14] shall be used.

ITU-T T.31 [11] and T.32 [12] may be used as facsimile TA-TE protocols without deletions or additions to the command set.

TIA IS-99 [15] commands referenced in this TS:

Table A.2: TIA IS-99 commands in this TS

Command	IS-99 section	Description	Subclause in this TS
+CBC	5.6.5	Battery Charge	8.4.
+CGMI	5.6.10	Request Manufacturer Identification	5.1.
+CGMM	5.6.10	Request Model Identification	5.2.
+CGMR	5.6.10	Request Revision Identification	5.3.
+CGSN	5.6.10	Request Product Serial Number Identification	5.4.
+CRC	5.6.7	Cellular Result Codes	6.11.

TIA IS-135 [16] commands referenced in this TS:

Table A.3: TIA IS-135 commands in this TS

Command	IS-135 section	Description	Subclause in this TS
+CBC	4.1.24	Battery Charge	8.4.
+CRC	4.1.29	Cellular Result Codes	6.11.
+CSQ	4.1.31	Signal Quality	8.5.

PCCA STD-101[17] commands referenced in this TS:

Table A.4: PCCA STD-101 commands in this TS

Command	STD-101 section	Description	Subclause in this TS
+WS46	5.2.4.6	WDS-side Stack Selection	5.9.

Annex B (normative): Summary of result codes

V.25ter [14] result codes which can be used in ~~GSM~~GSM/UMTS and codes defined in this TS:

Table B.1: Result codes

Verbose result code (V.25ter command V1 set)	Numeric (V0 set)	Type	Description
+CALV	as verbose	unsolicited	refer subclause 8.16
+CCCM: <ccm>	as verbose	unsolicited	refer subclause 7.16 ~~$(AT R97)$~~
+CCWA: <number>,<type> ,<class>[,<alpha>]	as verbose	unsolicited	refer subclause 7.12
+CCWV	as verbose	unsolicited	refer subclause 8.28
+CDEV: <elem>,<text>	as verbose	unsolicited	refer subclause 8.10
+CDIP:<number>,<type>[,<subaddr>,<satype>]	as verbose	unsolicited	refer subclause 7.9
+CIEV: <ind>,<value>	as verbose	unsolicited	refer subclause 8.10
+CKEV: <key>,<press>	as verbose	unsolicited	refer subclause 8.10
+CLAV: <code>	as verbose	unsolicited	refer subclause 8.
+CLIP: <number> ,<type>[,<subaddr> ,<satype>[,<alpha>]]	as verbose	unsolicited	refer subclause 7.6
+CME ERROR: <err>	as verbose	final	refer subclause 9.2
+COLP: <number> ,<type>[,<subaddr> ,<satype>[,<alpha>]]	as verbose	intermediate	refer subclause 7.8
+CR: <type>	as verbose	intermediate	refer subclause 6.9
+CREG: <stat>[,<lac> ,<ci>]	as verbose	unsolicited	refer subclause 7.2
+CRING: <type>	as verbose	unsolicited	refer subclause 6.11
+CSSI: <code1> [,<index>]	as verbose	intermediate	refer subclause 7.17
+CSSU: <code2> [,<index>[,<number>, <type>[,<subaddr>, <satype>]]]	as verbose	unsolicited	refer subclause 7.17
+CTZV: <tz>	as verbose	unsolicited	refer subclause 8.40
+CUSD: <m>[,<str>,<dcs>]	as verbose	unsolicited	refer subclause 7.15
+DR: <type>	as verbose	intermediate	refer subclause 6.13
+ILRR: <rate>	as verbose	intermediate	refer subclause 4.3
BUSY	6	final	busy signal detected
CONNECT	1	intermediate	connection has been established
CONNECT <text>	manufacturer specific	intermediate	as CONNECT but manufacturer specific <text> gives additional information (e.g. connection data rate)
ERROR	4	final	command not accepted
NO ANSWER	7	final	connection completion timeout
NO CARRIER	3	final	connection terminated
NO DIALTONE	5	final	no dialtone detected
OK	0	final	acknowledges execution of a command line
RING	2	unsolicited	incoming call signal from network

Annex C (informative): Commands from TIA IS-101

C.1 Introduction

The "Voice Control Interim Standard for Asynchronous DCE", TIA IS-101, contains some commands that are useful when passing audio "data" (that is, data which represents audio information) between the computer and the TA.

Some of the following subsections describe commands from IS-101 which are central to this TA application. However, with the exception of necessary extensions, these descriptions are not intended to replace the definitions found in IS-101. Other novel commands from the interim standard are not included because they are peripheral to TA operation.

NOTE: IS-101 also uses V.25ter [14] AT commands, but these are not mentioned here.

The standard specifies the following modes:

- command mode, where there is no transfer of audio "data" between the TA and the computer. In command mode, the computer is neither sending audio data to the TA nor receiving audio data from the TA.
- transmit mode, where audio "data" is being transferred from the computer to the TA. No audio "data" is transferred from the TA to the computer in this state. A transition back to command mode occurs when an embedded command indicates "end of play" or "flush data", or an inactivity timer times out.
- receive mode, where audio "data" is being transferred from the TA to the computer. No audio "data" is transferred from the computer to the TA in this state. A transition back to command mode occurs when any command is sent from the computer, or an inactivity timer times out. During the receive mode, the TA embeds result codes into the audio "data". These result codes indicate pertanent events such as "silence detected", "busy detected", and so on.

Strictly, the standard specifies another mode (translation), but this is not directly of interest here.

NOTE: The TA "knows" the type of an incoming call (whether it is voice, data, fax, whatever), and certain POTS events cannot occur. Hence some standard result codes for indication of events and discrimination of call type are unnecessary.

There are three possible levels of service:

- a TA supporting level A performs the following operations and detects the following events: audio transmit, audio receive, DTMF detection, DTMF generation and single tone generation. The following indications are supported:

Event	Description	Handset state
3	ring	idle
4	DTMF received	idle
5	receive buffer overrun	receive
6	unsolicited fax request	idle
8	phone on/off hook	idle
9	presumed hangup	receive
10	presumed end of message	receive
18	ringback	idle
19	busy	idle
23	playback buffer underrun	transmit

25 fax or data request acknowledged idle

- a TA supporting level B performs the operations and events of level A, and also supports DTMF detection while in the transmit state.
- a TA supporting level C performs the operations and events of level B, and also supports double DTMF tone generation.

Since DTMF detection and generation cannot be guaranteed over current digital networks, it follows that none of the three levels of service can be supported.

C.2 Commands

C.2.1 Select mode +FCLASS

This command puts the TA into a particular mode of operation (data, fax, voice etc.). This causes the TA to process information in a manner suitable for that type of information (rather than for other types of information). The values and meanings of parameter `<n>` are specified in the following table.

<n>	Mode
0	data
1	fax class 1 (TIA-578-A)
1.0	fax class 1 (ITU-T T.31 [11])
2	fax (manufacturer specific)
2.0	fax class 2 (ITU-T T.32 [12] and TIA-592)
3...7	reserved for other fax modes
8	voice
9...15	reserved for other voice modes
16..79	reserved
80	VoiceView (Radish)
81..255	reserved

Table C.1: +FCLASS

Command	Return
+FCLASS=<n>	
+FCLASS?	<n>
+FCLASS=?	(list of supported <n>s)

Voice mode is of particular interest here, and has an additional result code `+VCON`. Specifically, `+VCON` indicates that the TA is entering the voice command mode and there is a voice connection to at least one audio input or output. This presupposes that some mechanism has previously initiated a connection to that audio I/O.

C.2.2 Buffer threshold setting +VBT

This refers to integers `<lo>` and `<hi>` that indicate levels within the TA transmit buffer at which flow control is asserted and deasserted. The buffer is used for averaging out the irregular timing of data from the computer, so that the data becomes synchronous and may be sent to some audio device.

Table C.2: +VBT

Command	Return
+VBT=<lo>,<hi>	
+VBT?	<lo>,<hi>
+VBT=?	(list of supported <lo>s),(list of supported <hi>s),(buffer size)

C.2.3 Calling number ID presentation +VCID

The command refers to an integer that allows a called party to enable or disable (<n>=0) the reporting of the ID of calling parties, and specifies the method of presentation of the ID. This is basically the same as ~~GSM~~GSM/UMTS supplementary service CLIP (Calling Line Identification Presentation). The presentation may be either formatted (<n>=1) or unformatted (<n>=2):

- Formatted presentation : data items are reported in the form of <tag>=<value> pairs.

<tag>	<value>
DATE	MMDD (month, day)
TIME	HHMM (hour, minute)
NMBR	calling number or P or O (P = number is private, O = number is unavailable)
NAME	subscription listing name
MESG	data from other (unknown) tags

- Unformatted presentation : here the data is presented in ASCII hex as printable numbers.

Table C.3: +VCID

Command	Return
+VCID=<n>	
+VCID?	<n>
+VCID=?	(0-2)

C.2.4 Receive gain selection +VGR

This refers to the amplification by the TA of audio samples sent from the TA to the computer. The command operates on an integer <n>, range 0...255. Values larger than 128 indicate a larger gain than nominal. Values less than 128 indicate a smaller gain than nominal. The entire range of 0...255 does not have to be provided. A value of zero implies the use of automatic gain control by the TA.

Table C.4: +VGR

Command	Return
+VGR=<n>	
+VGR?	<n>
+VGR=?	(list of supported <n>s)

C.2.5 Transmit gain selection +VGT

This refers to the amplification by the TA of audio samples sent from the computer to the TA. The command operates on an integer <n>, range 0...255. Values larger than 128 indicate a larger gain than nominal. Values less than 128 indicate a smaller gain than nominal. The entire range of 0...255 does not have to be provided. A value of zero implies the uses of automatic gain control by the TA.

Table C.5: +VGT

Command	Return
+VGT=<n>	
+VGT?	<n>
+VGT=?	(list of supported <n>s)

C.2.6 Initialise voice parameters +VIP

This recalls manufacturer determined settings <n> of voice parameters. The command is write only. The effect of the command is manufacturer specific.

Table C.6: +VIP

Command	Return
+VIP=<n>	
+VIP=?	(list of supported <n>s)

C.2.7 Inactivity timer +VIT

This refers to the value of the inactivity timer in the TA. It is used to monitor activity on the connection between the computer and the TA when the computer is in "transmit" mode and sending audio data to the TA. When the connection has been inactive for the time set by this command, the TA leaves "transmit" mode and reverts to command mode. An integer <n> different than zero implies a time of <n>/10 seconds. A value of zero disables the timer.

Table C.7: +VIT

Command	Return
+VIT=<n>	
+VIT?	<n>
+VIT=?	(list of supported <n>s)

C.2.8 Line selection +VLS

This determines the selection of sources and destinations of audio samples. An integer is used to label a particular combination of sources and destinations. The integer is defined in an entry in IS-101 which assumes as a model a TA, a local phone and a phone line. Two additional "manufacturer specific" configurations (16,17) are defined.

- label=0: this is the idle state - the phone is not connected to the radio network and no audio paths are used.

- label=1: the phone is connected to the radio network and no audio paths involving the internal microphone or internal loudspeaker are selected. This allows the computer to transmit audio data over the radio transmitter by selecting "transmit mode":

Table C.8: +VLS label 1a

	loudspeaker	computer i/p	transmit stage
microphone -->			
computer o/p -->			*
receiver stage -->			

This also allows the computer to receive audio data from the radio receiver by selecting "receive mode":

Table C.9: +VLS label 1b

	loudspeaker	computer i/p	transmit stage
microphone -->			
computer o/p -->			
receiver stage -->		*	

- label=4: the phone is not connected to the radio network but there is an audio path to the internal speaker. This allows the computer to play sound by selecting "transmit mode".

Table C.10: +VLS label 4

	loudspeaker	computer i/p	transmit stage
microphone -->			
computer o/p -->	*		
receiver stage -->			

- label=6: the phone is not connected to the radio network but there is an audio path to the internal microphone. This allows the computer to record sound by selecting "receive mode".

Table C.11: +VLS label 6

	loudspeaker	computer i/p	transmit stage
microphone -->		*	
computer o/p -->			
receiver stage -->			

- label=7: the phone is connected to the radio network. The internal microphone is connected to the radio transmitter. The radio receiver is connected to the internal loudspeaker. This allows the computer to enable normal phone operation (a human holding a conversation) by selecting command mode.

Table C.12: +VLS label 7

	loudspeaker	computer i/p	transmit stage
microphone -->			*
computer o/p -->			
receiver stage -->	*		

Table C.13: +VLS

Command	Return
`+VLS=<n>`	`+VCON`
`+VLS?`	`<n>`
`+VLS=?`	*complex; refer IS-101*

`+VCON` is returned if an audio path is established or if a connection is made to the radio network.

Manufacturer specific extension (reserved as such by IS-101)

- label=16: the phone is connected to the radio network. There is a path to the internal microphone, which is also connected to the radio transmitter. There is a path to the radio receiver, which is also connected to the internal loudspeaker. This allows the computer to record the sum of transmitted and received audio by selecting "receive mode".

Table C.14: +VLS label 16

	loudspeaker	computer i/p	transmit stage
microphone -->		*	*
computer o/p -->			
receiver stage -->	*	*	

- label=17: the phone is connected to the radio system and there is a path to the internal loudspeaker and to the radio transmitter. This allows the computer to simultaneously play sound and send audio over the radio by selecting "transmit mode".

Table C.15: +VLS label 17

	loudspeaker	computer i/p	transmit stage
microphone -->			
computer o/p -->	*		*
receiver stage -->			

C.2.9 Receive data state +VRX

This action command causes the TA to get audio data from a source determined by the `+VLS` command, and send it to the computer. Once the datastream has started, any result codes will be embedded in the data and shielded using the normal <DLE> methods. The receive process is terminated when the computer sends any command to the TA, or by time-out of the inactivity timer. The command is write only.

Table C.16: +VRX

Command	Return
+VRX	CONNECT

C.2.10 Select compression method +VSM

This selects the voice compression method <n1>, the voice sampling rate <n2>, the silence compression sensitivity <n3>, and a parameter related to silence expansion <n4>. There are several choices of compression method. IS-101 does not specify methods, but here is a list of some usual compression methods:

Name	Communications system
GSM/full-rate	GSM
GSM/half-rate	GSM
ADPCM/G.721	DECT, CT2
ADPCM/G.723	DECT, CT2
ADPCM/G.726	DECT, CT2
ADPCM/G.727	DECT, CT2
SIGNED PCM	POTS

Table C.17: +VSM

Command	Return
+VSM=<n1>,<n2>,<n3>,<n4>	
+VSM?	<n1>,<n2>,<n3>,<n4>
+VSM=?	*complex; refer IS-101*

NOTE: A value of <n3>=0 implies no silence compression sensitivity. A value of <n4>=0 implies no silence expansion.

C.2.11 DTMF and tone generation +VTS

This command allows the transmission of DTMF tones and arbitrary tones (see note). These tones may be used (for example) when announcing the start of a recording period. The command is write only. In this profile of commands, this command does not operate in data or fax modes of operation (+FCLASS=0,1,2-7).

NOTE: D is used only for dialling.

The string parameter of the command consists of combinations of the following separated by commas:

1. <DTMF>. A single ASCII character in the set 0-9, #,*,A-D. This is interpreted as a single ACSII character whose duration is set by the +VTD command.

NOTE: In GSM this operates only in voice mode.

2. [<tone1>,<tone2>,<duration>]. This is interpreted as a dual tone of frequencies <tone1> and <tone2>, lasting for a time <duration> (in 10 ms multiples).

NOTE: This does not operate in GSM.

3. {<DTMF>,<duration>}. This is interpreted as a DTMF tone of different duration from that mandated by the +VTD command.

NOTE: In GSM this operates only in voice mode.

Table C.18: +VTS

Command	Return
+VTS=*as above*	
+VTS=?	(list of supported <tone1>s),(list of supported <tone2>s),(list of supported <duration>s)

C.2.12 Tone duration +VTD

This refers to an integer <n> that defines the length of tones emitted as a result of the +VTS command. This does not affect the D command. A value different than zero causes a tone of duration <n>/10 seconds. The value zero causes a "manufacturer specific" value.

Table C.19: +VTD

Command	Return
+VTD=<n>	
+VTD?	<n>
+VTD=?	(list of supported <n>s)

NOTE: In ~~GSM~~GSM/UMTS the value of tone duration is preset and cannot be altered.

C.2.13 Transmit data state +VTX

This action command causes the TA to receive audio data from the computer and send it to a destination determined by the +VLS command. Once the audio datastream has started, commands to the TA shall be embedded in the data stream, and shielded using the normal <DLE> methods. The transmit process is terminated by the use of embedded commands or by the time-out of an inactivity timer. It is recommended that the TA has a buffer to allow the TA to convert potentially bursty data from the computer into synchronous data for "transmission". The command is write only.

Table C.20: +VTX

Command	Return
+VTX	CONNECT

Annex D (informative): Bibliography

Informative references:

1) IrDA Serial Infrared Physical Layer Specification

IrDA Serial Infrared MAC and Link Protocol

IrDA Serial Infrared Link Access Protocol

2) PCCA STD-101 Annex I: Data Transmission Systems and Equipment - Serial Asynchronous Automatic Dialling and Control for Character Mode DCE on Wireless Data Services - Annex I: Command Extensions for Analog Cellular Data Modems

3) TIA IS-101 Facsimile Digital Interfaces - Voice Control Interim Standard for Asynchronous DCE

4) TIA-578-A Facsimile Digital Interfaces - Asynchronous Facsimile DCE Control Standard, Service Class 1

5) TIA-592 Facsimile Digital Interfaces - Asynchronous Facsimile DCE Control Standard, Service Class 2

6) TIA-617 Data Transmission Systems and Equipment - In-Band DCE Control

7) ITU-T Recommendation V.80: In-band DCE control and synchronous data modes for asynchronous DTE

Annex E (informative): Mobile originated alternating voice/data call example

Figure E.1 illustrates the possible transitions in MO BS 61 call. Responses and result codes generated by TA are in bold face. In this example, data part of the call is asynchronous non-transparent 9600 bps service.

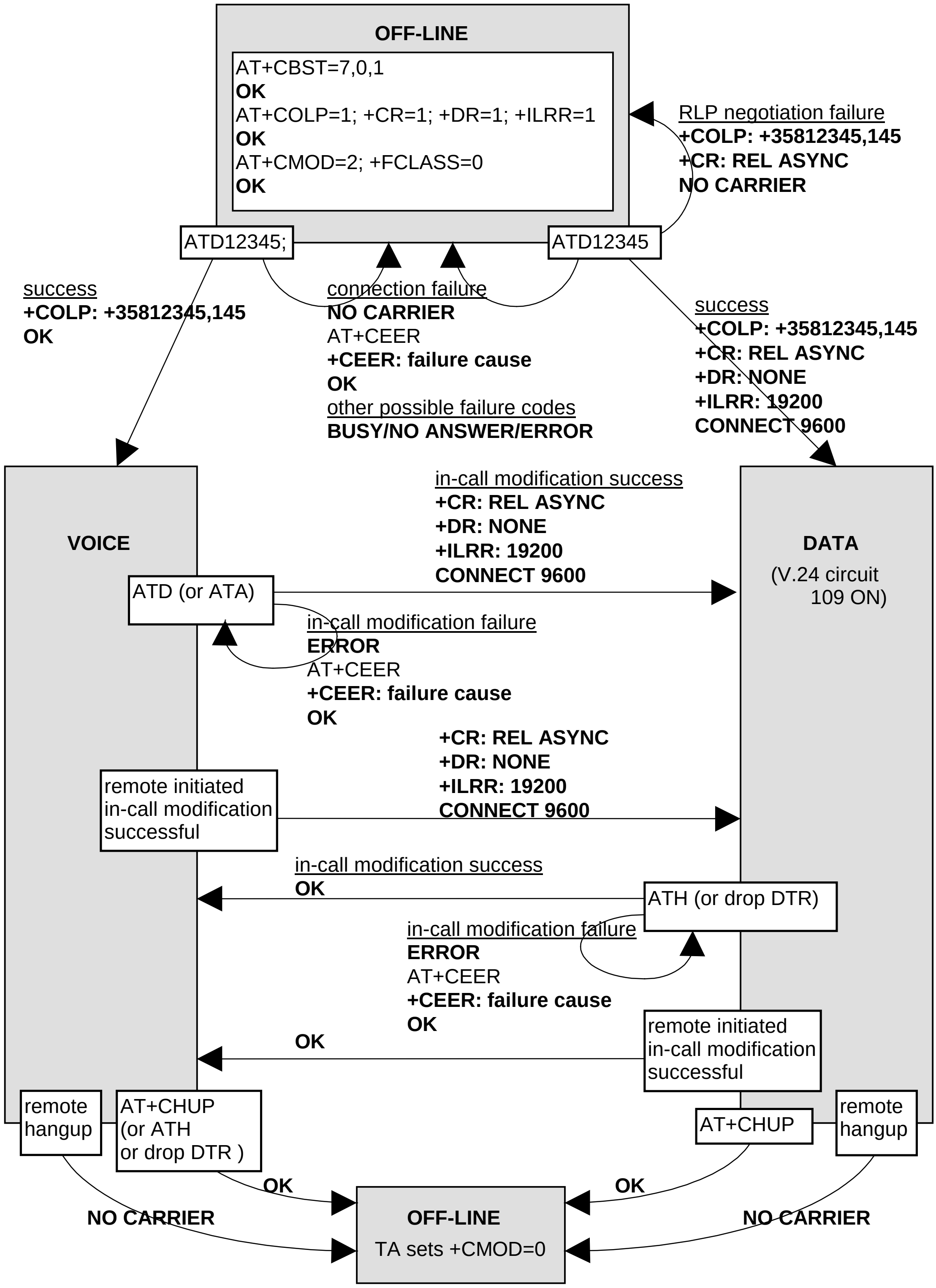

Figure E.1: MO BS 61 call

Annex F (informative): Mobile terminated voice followed by data call example

Figure F.1 illustrates the possible transitions in MT BS 81 call. Responses and result codes generated by TA are in bold face. In this example, data part of the call is asynchronous non-transparent 9600 bps service.

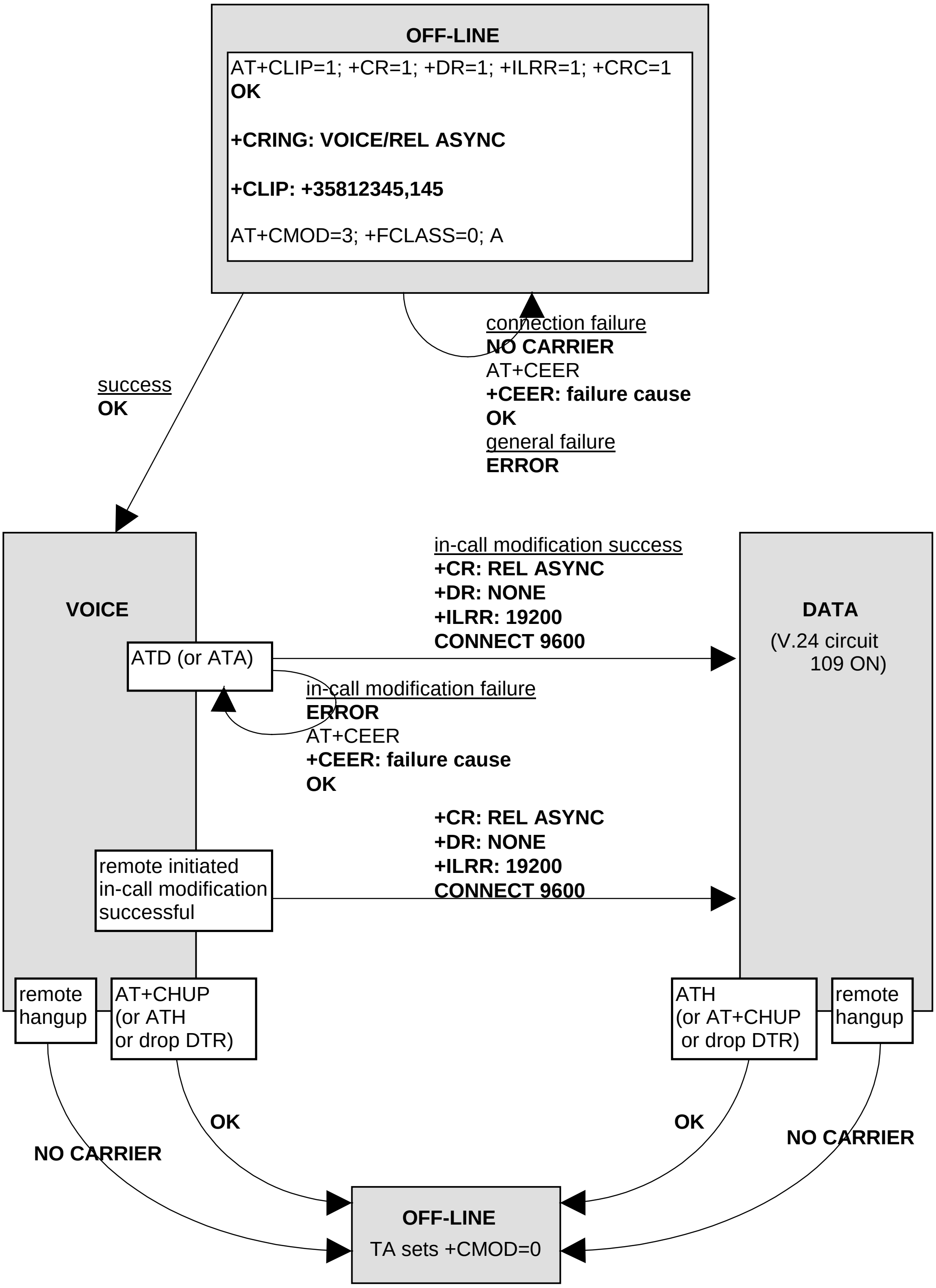

Figure F.1: MT BS 81 call

Annex G (informative): Voice call example

Figure G.1 illustrates the possible transitions in both MT and MO TS 11 calls. Responses and result codes generated by TA are in bold face.

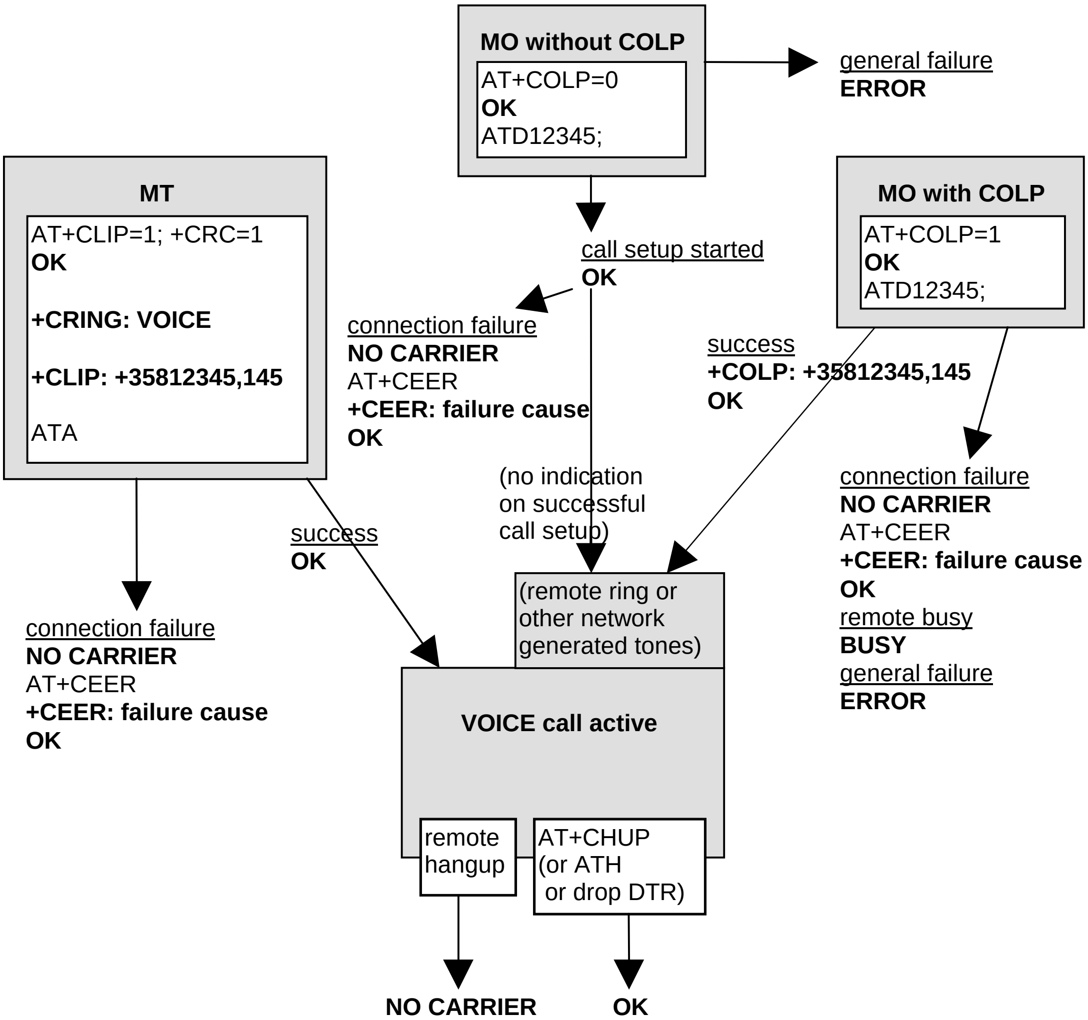

Figure G.1: TS 11 calls

Annex H (informative): Change History

TSG	TDoc	CR	REV	PH	CAT	SUBJECT	WORKITEM	NEW_VERS
T#4	TP-99118	New				Creation of 3GPP 27.007 v3.0.0 out of GSM 07.07 v7.2.0		3.0.0
T#4	TP-99124	001		R99	A	Additional result codes for +CLIP +CCWA	TEI	3.1.0
T#4	TP-99124	002		R99	B	ECSD additions	EDGE	3.1.0
T#4	TP-99124	003		R99	B	ECSD asymmetry (new command +CHSA)	EDGE	3.1.0
T#4	TP-99146	004		R99	A	Syntax error in +CHSN command	TEI	3.1.0
T#4	TP-99146	005		R99	A	Moving AT commands to 07.07 for 07.60 handover to SMG3 / 3GPP TSG CN WG3	GPRS	3.1.0
T#5	TP-99177	006		R99	D	ECSD AT command correction	EDGE	3.2.0
T#5	TP-99177	007		R99	B	Alarm functionality	TEI	3.2.0
T#5	TP-99177	008		R99	B	Phonebook storage	TEI	3.2.0
T#5	TP-99177	009		R99	B	Time Zone	TEI	3.2.0
T#5	TP-99177	010		R99	B	Additional result code for +CSSN	TEI	3.2.0
T#5	TP-99177	011		R99	B	New command for setting of Date format	TEI	3.2.0
T#5	TP-99177	012		R99	B	New command for Silent mode	TEI	3.2.0
T#5	TP-99177	013		R99	B	New command for setting of Time format	TEI	3.2.0
T#5	TP-99177	014		R99	B	GSM 400 Spectrum update	GSM 400	3.2.0
T#5	TP-99177	015		R99	A	AT command - Request GPRS service 'D'	GPRS	3.2.0
T#6	TP-99237	016		R99	F	Clarification to result codes for +CLIP +CCWA	TEI	3.3.0
T#6	TP-99237	017		R99	B	AT command for Frame Tunnelling Mode (FTM)	Frame Tunnelling Mode	3.3.0
T#6	TP-99237	018		R99	B	New AT command for application protocols activation	TEI	3.3.0
T#6	TP-99237	022		R99	B	Add new AT command (+CDIP) to inform the called line identification	TEI	3.3.0
T#6	TP-99237	020		R99	C	Packet Domain ATD command syntax	GPRS	3.3.0
T#6	TP-99237	021		R99	B	Additional parameter for +CBST	TEI	3.3.0
T#6	TP-99237	019		R99	B	AT-commands for Enhanced QoS Support management	Enhanced QoS Support in GPRS	3.3.0

History

Document history		
V3.0.0	July 1999	
V3.1.0	July 1999	
V3.2.0	October 1999	
V3.3.0	December 1999	

3GPP TSG T WG2
Puerto Vallerta, Mexico, 1-4 Feb 2000

***Document* T2-000059**

CHANGE REQUEST

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3G 27.007	**CR**	**026**	Current Version:	3.3.0

↑ CR number as allocated by MCC support team

For submission to:	T#7	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		For information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG   The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: *(at least one should be marked with an X)*	(U)SIM		ME	X	UTRAN / Radio		Core Network

Source: T2   **Date:** 25-01-2000

Subject: References to ASCI Specifications

Work item: ASCI

Category:				**Release:**	
	F	Correction		Phase 2	
	A	Corresponds to a correction in an earlier release		Release 96	
(only one category	B	Addition of feature		Release 97	
shall be marked	C	Functional modification of feature		Release 98	
with an X)	D	Editorial modification	X	Release 99	X
				Release 00	

Reason for change: References to ASCI specifications were missing in 27.007.

Clauses affected: 2

Other specs affected:			
	Other 3G core specifications		→ List of CRs:
	Other GSM core specifications		→ List of CRs:
	MS test specifications		→ List of CRs:
	BSS test specifications		→ List of CRs:
	O&M specifications		→ List of CRs:

Other comments:

[44] IrDA Object Exchange Protocol
version 1.2, March 18, 1999

[45] 3G TS 22.067: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; enhanced Multi-Level Precedence and Pre-emption service (eMLPP) - Stage 1".

[46] GSM 02.68: "Digital cellular telecommunication system (Phase 2+); Voice Group Call service (VGCS) - Stage 1".

[47] GSM 02.69: "Digital cellular telecommunication system (Phase 2+); Voice Broadcast Service (VBS) - Stage 1".

[48] 3G TS 23.067: " 3rd Generation Partnership Project; Technical Specification Group Core Network; enhanced Multi-Level Precedence and Pre-emption service (eMLPP) - Stage 2".

[49] GSM 03.68: "Digital cellular telecommunication system (Phase 2+); Voice Group Call service (VGCS) - Stage 2".

[50] GSM 03.69: "Digital cellular telecommunication system (Phase 2+); Voice Broadcast Service (VBS) - Stage 2".

[51] 3G TS 24.067: " Technical Specification Group Core Network; enhanced Multi-Level Precedence and Pre-emption service (eMLPP) - Stage 3".

[52] GSM 04.68: "Digital cellular telecommunication system (Phase 2+); Voice Group Call service (VGCS) - Stage 3".

[53] GSM 04.69: "Digital cellular telecommunication system (Phase 2+); Voice Broadcast Service (VBS) - Stage 3".

3 Abbreviations and definitions

3.1 Abbreviations

For the purposes of this TS, the following abbreviations apply:

AT	ATtention; this two-character abbreviation is always used to start a command line to be sent from TE to TA
BCD	Binary Coded Decimal
ETSI	European Telecommunications Standards Institute
FTM	Frame Tunnelling Mode (refer 3G TS 27.001 [41] and 3G TS 29.007[42])
HSCSD	High Speed Circuit Switched Data
IHOSS	Internet Hosted Octet Stream Service
IMEI	International Mobile station Equipment Identity
IRA	International Reference Alphabet (ITU-T T.50 [13])
IrDA	Infrared Data Association
ISO	International Standards Organisation
ITU-T	International Telecommunication Union - Telecommunications Standardization Sector
ME	Mobile Equipment, e.g. a GSM phone (equal to MS; Mobile Station)
MoU	Memorandum of Understanding (GSM operator joint)
OSP	Octet Stream Protocol
OSP:IHOSS	Octet Stream Protocol for Internet Hosted Octet Stream Service
PCCA	Portable Computer and Communications Association
RDI	Restricted Digital Information
RLP	Radio Link Protocol
SIM	Subscriber Identity Module
TA	Terminal Adaptor, e.g. a GSM data card (equal to DCE; Data Circuit terminating Equipment)
TE	Terminal Equipment, e.g. a computer (equal to DTE; Data Terminal Equipment)

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CHANGE REQUEST

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3G 27.007	**CR**	**027**	Current Version:	3.3.0

↑ CR number as allocated by MCC support team

For submission to:	T#7	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		For information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: *(at least one should be marked with an X)*	(U)SIM		ME	X	UTRAN / Radio		Core Network	

Source:	T2	**Date:**	25-01-2000
Subject:	Abbreviations related to ASCI		
Work item:	ASCI		

Category:	F	Correction		**Release:**	Phase 2	
	A	Corresponds to a correction in an earlier release			Release 96	
(only one category	B	Addition of feature			Release 97	
shall be marked	C	Functional modification of feature			Release 98	
with an X)	D	Editorial modification	X		Release 99	X
					Release 00	

Reason for change:	Abbreviations related to ASCI specifications were missing in 27.007.
Clauses affected:	3.1

Other specs affected:	Other 3G core specifications		→ List of CRs:	
	Other GSM core specifications		→ List of CRs:	
	MS test specifications		→ List of CRs:	
	BSS test specifications		→ List of CRs:	
	O&M specifications		→ List of CRs:	

Other comments:	

[44] IrDA Object Exchange Protocol
version 1.2, March 18, 1999

3 Abbreviations and definitions

3.1 Abbreviations

For the purposes of this TS, the following abbreviations apply:

AT	ATtention; this two-character abbreviation is always used to start a command line to be sent from TE to TA
ASCI	Advanced Speech Call Items, including VGCS, VBS and eMLPP
BCD	Binary Coded Decimal
eMLPP	Enhanced Multi-Level Precedence and Pre-emption Service
ETSI	European Telecommunications Standards Institute
FTM	Frame Tunnelling Mode (refer 3G TS 27.001 [41] and 3G TS 29.007[42])
HSCSD	High Speed Circuit Switched Data
IHOSS	Internet Hosted Octet Stream Service
IMEI	International Mobile station Equipment Identity
IRA	International Reference Alphabet (ITU-T T.50 [13])
IrDA	Infrared Data Association
ISO	International Standards Organisation
ITU-T	International Telecommunication Union - Telecommunications Standardization Sector
ME	Mobile Equipment, e.g. a GSM phone (equal to MS; Mobile Station)
MoU	Memorandum of Understanding (GSM operator joint)
OSP	Octet Stream Protocol
OSP:IHOSS	Octet Stream Protocol for Internet Hosted Octet Stream Service
PCCA	Portable Computer and Communications Association
PTT	Push to Talk
RDI	Restricted Digital Information
RLP	Radio Link Protocol
SIM	Subscriber Identity Module
TA	Terminal Adaptor, e.g. a GSM data card (equal to DCE; Data Circuit terminating Equipment)
TE	Terminal Equipment, e.g. a computer (equal to DTE; Data Terminal Equipment)
TIA	Telecommunications Industry Association
UDI	Unrestricted Digital Information
VBS	Voice Broadcast Service
VGCS	Voice Group Call Service

3.2 Definitions

For the purposes of this TS, the following syntactical definitions apply (refer also clause 4):

<CR> Carriage return character, which value is specified with command `S3`.

<LF> Linefeed character, which value is specified with command `S4`.

<...> Name enclosed in angle brackets is a syntactical element. Brackets themselves do not appear in the command line.

[...] Optional subparameter of a command or an optional part of TA information response is enclosed in square brackets. Brackets themselves do not appear in the command line. When subparameter is not given in *parameter type* commands, new value equals to its previous value. In *action type* commands, action should be done on the basis of the recommended default setting of the subparameter.

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CHANGE REQUEST

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3G 27.007	**CR**	**028**	Current Version:	3.3.0

↑ CR number as allocated by MCC support team

For submission to:	T#7	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		For information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: (U)SIM [ ] ME [X] UTRAN / Radio [ ] Core Network [ ]
(at least one should be marked with an X)

Source:	T2	**Date:**	25-01-2000
Subject:	Priority indication in +CLCC, List Current Calls		
Work item:	eMLPP		

Category:
(only one category Shall be marked With an X)

			Release:	
F	Correction		Phase 2	
A	Corresponds to a correction in an earlier release		Release 96	
B	Addition of feature	X	Release 97	
C	Functional modification of feature		Release 98	
D	Editorial modification		Release 99	X
			Release 00	

Reason for change: It was not possible to return the priority of calls in response to +CLCC.

Clauses affected: 7.18

Other specs Affected:

Other 3G core specifications		→ List of CRs:
Other GSM core specifications		→ List of CRs:
MS test specifications		→ List of CRs:
BSS test specifications		→ List of CRs:
O&M specifications		→ List of CRs:

Other comments: The value has been added in a way that the grammar stays look-ahead 1.

7.18 List current calls +CLCC

Table 51:+CLCC action command syntax

Command	Possible response(s)
+CLCC	[+CLCC: <id1>,<dir>,<stat>,<mode>,<mpty>[,<number>,<type>[,<alpha>[,<priority>]]] [<CR><LF>+CLCC: <id2>,<dir>,<stat>,<mode>,<mpty>[,<number>,<type>[,<alpha>[,<priority>]]] [...]]] *+CME ERROR: <err>*
+CLCC=?	

Description

Returns list of current calls of ME. If command succeeds but no calls are available, no information response is sent to TE. Refer subclause 9.2 for possible <err> values.

Defined values

<id*x*>: integer type; call identification number as described in GSM 02.30 [19] subclause 4.5.5.1; this number can be used in +CHLD command operations

<dir>:

0 mobile originated (MO) call

1 mobile terminated (MT) call

<stat> (state of the call):

0 active

1 held

2 dialing (MO call)

3 alerting (MO call)

4 incoming (MT call)

5 waiting (MT call)

<mode> (bearer/teleservice):

0 voice

1 data

2 fax

3 voice followed by data, voice mode

4 alternating voice/data, voice mode

5 alternating voice/fax, voice mode

6 voice followed by data, data mode

7 alternating voice/data, data mode

8 alternating voice/fax, fax mode

9 unknown

<mpty>:

0 call is not one of multiparty (conference) call parties

1 call is one of multiparty (conference) call parties

`<number>`: string type phone number in format specified by `<type>`

`<type>`: type of address octet in integer format (refer GSM 04.08 [8] subclause 10.5.4.7)

`<alpha>`: string type alphanumeric representation of `<number>` corresponding to the entry found in phonebook; used character set should be the one selected with command Select TE Character Set `+CSCS`

`<priority>`: optional digit type parameter indicating the eMLPP priority level of the call, values specified in 3G TS 22.067

Implementation

Optional. Recommended when `+CHLD` command is implemented.

7.19 Preferred operator list +CPOL $(AT R97)$

Table 1:+CPOL parameter command syntax

Command	Possible response(s)
`+CPOL=[<index>][, <format>[,<oper>]]`	*+CME ERROR: <err>*
`+CPOL?`	`+CPOL: <index1>,<format>,<oper1>` `[<CR><LF>+CPOL: <index2>,<format>,<oper2>` `[...]]` *+CME ERROR: <err>*
`+CPOL=?`	`+CPOL: (`list of supported `<index>`s`),(`list of supported `<format>`s`)` *+CME ERROR: <err>*

Description

This command is used to edit the SIM preferred list of networks. Execute command writes an entry in the SIM list of preferred operators ($EF_{PLMNsel}$). If `<index>` is given but `<oper>` is left out, entry is deleted. If `<oper>` is given but `<index>` is left out, `<oper>` is put in the next free location. If only `<format>` is given, the format of the `<oper>` in the read command is changed. Refer subclause 9.2 for possible `<err>` values.

NOTE: ME may also update this list automatically when new networks are selected.

Read command returns all used entries from the SIM list of preferred operators.

Test command returns the whole index range supported by the SIM.

Defined values

`<index`*n*`>`: integer type; the order number of operator in the SIM preferred operator list

`<format>`:

0 long format alphanumeric <oper>

1 short format alphanumeric <oper>

2 numeric <oper>

`<oper`*n*`>`: string type; `<format>` indicates if the format is alphanumeric or numeric (see `+COPS`)

Implementation

Optional.

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Document T2-000062

CHANGE REQUEST

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3G 27.007	**CR**	**029**	Current Version:	3.3.0

↑ *CR number as allocated by MCC support team*

For submission to:	T#7	for approval	X	strategic		*(for SMG use only)*
list expected approval meeting # here ↑		For information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG   The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: *(at least one should be marked with an X)*	(U)SIM		ME	X	UTRAN / Radio		Core Network	

Source:	T2	**Date:**	25-01-2000

Subject: Indication of priority, sub-address, sub-address type and TS 91/TS92 in +CRC, Cellular Result Codes

Work item: ASCI

Category:				**Release:**		
	F	Correction			Phase 2	
	A	Corresponds to a correction in an earlier release			Release 96	
(only one category	B	Addition of feature	X		Release 97	
Shall be marked	C	Functional modification of feature			Release 98	
With an X)	D	Editorial modification			Release 99	X
					Release 00	

Reason for change: It was not possible to specify the priority, sub-address, sub-address type of a call in +CRC.
It was not possible to specify TS 91/92 and their relevant parameters in +CRC.

Clauses affected: 6.11

Other specs Affected:			
	Other 3G core specifications		→ List of CRs:
	Other GSM core specifications		→ List of CRs:
	MS test specifications		→ List of CRs:
	BSS test specifications		→ List of CRs:
	O&M specifications		→ List of CRs:

Other comments: New parameters have been introduced in the non-terminal symbol <mode> in order to follow the example of GPRS.

Table 1: +CEER action command syntax

Command	Possible response(s)
+CEER	+CEER: <report>
+CEER=?	

Description

Execution command causes the TA to return one or more lines of information text <report>, determined by the ME manufacturer, which should offer the user of the TA an extended report of the reason for

- the failure in the last unsuccessful call setup (originating or answering) or in-call modification,
- the last call release,
- the last unsuccessful GPRS attach or unsuccessful PDP context activation,
- the last GPRS detach or PDP context deactivation.

Typically, the text will consist of a single line containing the cause information given by GSM network in textual format.

Defined values

<report>: the total number of characters, including line terminators, in the information text shall not exceed 2041 characters.

Text shall not contain the sequence 0<CR> or OK<CR>

Implementation

Optional.

6.11 Cellular result codes +CRC

Table 18: +CRC parameter command syntax

Command	Possible response(s)
+CRC=[<mode>]	
+CRC?	+CRC: <mode>
+CRC=?	+CRC: (list of supported <mode>s)

Description

Set command controls whether or not the extended format of incoming call indication or GPRS network request for PDP context activation is used. When enabled, an incoming call is indicated to the TE with unsolicited result code +CRING: <type> instead of the normal RING.

Test command returns values supported by the TA as a compound value.

NOTE: Similar command may be found in TIA IS-99 [15] and TIA IS-135 [16].

Defined values

<mode>:

<u>0</u> disables extended format

1 enables extended format

<type>:

ASYNC <u>[,<priority>[,<subaddr>,<satype>]]</u> asynchronous transparent

SYNC [,<priority>[,<subaddr>,<satype>]] synchronous transparent

REL ASYNC [,<priority>[,<subaddr>,<satype>]] asynchronous non-transparent

REL SYNC [,<priority>[,<subaddr>,<satype>]] synchronous non-transparent

FAX [,<priority>[,<subaddr>,<satype>]] facsimile (TS 62)

VOICE [,<priority>[,<subaddr>,<satype>]] normal voice (TS 11)

VOICE/*XXX* [,<priority>[,<subaddr>,<satype>]] voice followed by data (BS 81) (*XXX* is ASYNC, SYNC, REL ASYNC or REL SYNC)

ALT VOICE/*XXX* [,<priority>[,<subaddr>,<satype>]] alternating voice/data, voice first (BS 61)

ALT *XXX*/VOICE [,<priority>[,<subaddr>,<satype>]] alternating voice/data, data first (BS 61)

ALT VOICE/FAX [,<priority>[,<subaddr>,<satype>]] alternating voice/fax, voice first (TS 61)

ALT FAX/VOICE [,<priority>[,<subaddr>,<satype>]] alternating voice/fax, fax first (TS 61)

GPRS <PDP_type>, <PDP_addr>[, <L2P>] GPRS network request for PDP context activation

VGC <GCA>, <GId>, <ackflag> [,<priority>] voice group call (TS 91)

VBC <GCA>, <GId>, <ackflag> [,<priority>] voice broadcast call (TS 92)

The optional <priority> indicates the eMLPP priority level of the incoming call by paging, notification or setup message. The priority level values are as defined in eMLPP specification 3G TS 22.067.

<subaddr>: string type subaddress of format specified by <satype>

<satype>: type of subaddress octet in integer format (refer 3G TS 24.008 subclause 10.5.4.8)

<PDP_type> and <PDP_addr> are as defined in the Define PDP Context (+CGDCONT) command. The optional <L2P> proposes a layer 2 protocol to use between the MT and the TE. It is defined in the Enter GPRS Data Mode (+CGDATA) command. If the MT is unable to announce to the TE the network's request (for example it is in V.25ter online data state) the MT shall reject the request. No corresponding unsolicited result code shall be issued when the MT returns to a command state.

<GCA> is a part of the group call reference as specified in GSM 03.03 and indicates group call area.

<GId> is a part of the group call reference as specified in GSM 03.03 and indicates group call identification. The <ackflag>=1 proposes that a predefined confirmation procedure is to be used after the call is ended. For <ackflag>=0 no confirmation procedure is required.

Implementation

Mandatory when data or fax circuit mode calls implemented or for a ME supporting AT commands only and eMLPP or VGCS or VBS is implemented.

6.12 HSCSD device parameters +CHSD

Table 2: +CHSD action command syntax

Command	Possible response(s)
+CHSD	+CHSD: <mclass>,<maxRx>,<maxTx>,<sum>,<codings> *+CME ERROR: <err>*
+CHSD=?	

Description

Execution command returns information about HSCSD features (refer GSM 02.34 [29]) supported by the ME/TA. Refer subclause 9.2 for possible <err> values.

Defined values

<mclass>: integer type; multislot class

<maxRx>: integer type; maximum number of receive timeslots that ME can use

<maxTx>: integer type; maximum number of transmit timeslots that ME can use

<sum>: integer type; total number of receive and transmit timeslots that ME can use at the same time (per TDMA frame). The following applies in a HSCSD call: 1 ≤ (receive slots) + (transmit slots) ≤ <sum>

<codings> is a sum of integers each representing a supported channel coding (e.g. value 5 indicates that 4.8k and 9.6k channel codings are supported):

1 4.8k full rate data traffic channel

4 9.6k full rate data traffic channel

8 14.4k full rate data traffic channel

3GPP TSG T WG2
Puerto Vallerta, Mexico, 1-4 Feb 2000

Document ***T2-000063***

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

3G 27.007	**CR**	**030**	Current Version: 3.3.0

↑ *CR number as allocated by MCC support team*

For submission to:	T#7	for approval	X	strategic		*(for SMG use only)*
list expected approval meeting # here ↑		For information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)*	(U)SIM		ME	X	UTRAN / Radio		Core Network	

Source:	T2	**Date:**	25-01-2000
Subject:	Commands for ASCI		
Work item:	ASCI		

Category:	F	Correction		**Release:**	Phase 2	
	A	Corresponds to a correction in an earlier release			Release 96	
(only one category	B	Addition of feature	X		Release 97	
Shall be marked	C	Functional modification of feature			Release 98	
With an X)	D	Editorial modification			Release 99	X
					Release 00	

Reason for change:	Relevant commands for ASCI were missing in 27.007..
Clauses affected:	New section 11

Other specs Affected:	Other 3G core specifications		→ List of CRs:	
	Other GSM core specifications		→ List of CRs:	
	MS test specifications		→ List of CRs:	
	BSS test specifications		→ List of CRs:	
	O&M specifications		→ List of CRs:	

Other comments:	

11 Commands for VGCS and VBS

This clause defines commands that a TE may use to control a VGCS or VBS supporting MT. The requirements for the VGCS and VBS are included in the following specifications:

- Voice Group Call service (VGCS): GSM 02.68,GSM 03.68,GSM 04.68 [],
- Voice Broadcast Service (VBS): GSM 02.69,GSM 03.69,GSM 04.69.

It is anticipated that VGCS or VBS supporting MTs will vary widely in functionality.

A comprehensive set of VGCS and VBS-specific commands is defined in clause 11.1 to provide the flexibility needed by the more complex MT. The commands use the extended information and error message capabilities described in this specification.

For the simplest MTs, and for backwards compatibility with existing communications software, it is possible to control access to the VGCS and VBS using existing modem-compatible commands. A special dial-string syntax is defined for use with the D command. This "modem compatible" mode of operation is described in subclause 11.2.

11.1 Commands specific to MTs supporting the VGCS and VBS

11.1.1 Accept an incoming Voice Group or Voice Broadcast Call +CAJOIN

Table 1: CAJOIN parameter command syntax

Command	**Possible Response(s)**
`+CAJOIN=<service>, <GId> ,<GCA>`	*`+CME ERROR: <err>`*
`CAJOIN=?`	

Description

The execute command accepts an incoming voice group or voice broadcast call indicated by RING or +CRING, the command is applicable as long as the indication is pending.

See command +CALCC to get a list of current voice group or voice broadcast calls.

Defined Values

`<GId>`: a digit string that specifies the group identification for the incoming voice group or voice broadcast call.

`<GCA>`: a digit string that specifies the group call area identification for the incoming voice group or voice broadcast call.

`<service>` (teleservice):

17 voice group call

18 voice broadcast call

Implementation

Mandatory for a ME supporting AT commands only and VGCS or VBS is implemented.

11.1.2 Reject an incoming Voice Group or Voice Broadcast Call +CAREJ

Table 2: CAREJ parameter command syntax

Command	Possible Response(s)
+CAREJ=<service>, <GId>, <GCA>	*+CME ERROR: <err>*
+CAREJ=?	

Description

The execute command rejects an incoming voice group or voice broadcast call indicated by RING or +CRING, the command is applicable as long as the indication is pending.

If the call is once rejected the RING or +CRING indication is not repeated to TE although the call is still running and notifications for the call are received.

See command +CALCC to get a list of current voice group or voice broadcast calls.

Defined Values

<GId>: a digit string that specifies the group identification for the incoming voice group or voice broadcast call.

<GCA>: a digit string that specifies the group call area identification for the incoming voice group or voice broadcast call.

<service> (teleservice):

17 voice group call

18 voice broadcast call

Implementation

Mandatory for a ME supporting AT commands only and VGCS or VBS is implemented.

11.1.3 Leave an ongoing Voice Group or Voice Broadcast Call +CAHLD

Table 3: CAHLD parameter command syntax

Command	Possible Response(s)
+CAHLD	*+CME ERROR: <err>*
+CAHLD=?	

Description

The execute command forces the MT to leave the active voice group or voice broadcast call without terminating it. The command is only applicable if the MT is in group receive mode. The MT returns to idle mode.

Implementation

Mandatory for a ME supporting AT commands only and VGCS or VBS is implemented.

11.1.4 Talker Access for Voice Group Call +CAPTT

Table 4: CAPTT parameter command syntax

Command	**Possible Response(s)**
`+CAPTT=[<mode> [,<time>]]`	*+CME ERROR: <err>*
`+CAPTT?`	`+CAPTT: <mode>` *+CME ERROR: <err>*
`+CAPTT=?`	`+CAPTT:` (list of supported `<mode>`s), (list of supported `<time>`s)

Description

The execute command emulates the Push To Talk function for VGCS talker access.
If the parameter <mode> is set to value "0" i.e. "RELEASED" the PTT key is assumed to be released immediately.
If the parameter <mode> is set to value "1" i.e. "PUSHED" the PTT key is assumed to be pushed immediately for the period of <time> in seconds. If the command execution is repeated before the <time> expires the PTT timer will be loaded with the new <time> value and the PTT key remains "PUSHED" for the period of new <time> in seconds.
If the parameter <mode> is set to value "2" i.e. "PUSHED" the PTT key is assumed to be pushed immediately for an infinite period of time and can be relesed by <mode> value 0.
For <mode>=0 if the parameter <time> is issued it is ignored.

If the PTT timer expires after <time> seconds during <mode> "PUSHED" an unsolicited result code +CAPTT: 0 is issued to the TE.

The read command returns the current <mode>.

The test command returns values supported as a compound value.

Defined Values

`<mode>`:

0 status of the PTT key is RELEASED (default value)

1 status of the PTT key is PUSHED for a limited time by <time> in seconds

2 status of the PTT key is PUSHED for an infinite time

`<time>`:

3..255 this gives the time in seconds to wait before the PTT key is released, default value 10

Implementation

Mandatory for a ME supporting AT commands only and VGCS is implemented.

11.1.5 Voice Group Call Uplink Status Presentation +CAULEV

Table 5: CAULEV parameter command syntax

Command	**Possible Response(s)**
`+CAULEV=[<mode>]`	*+CME ERROR: <err>*
`+CAULEV?`	`+CAULEV: <mode>,<status>` *+CME ERROR: <err>*
`+CAULEV=?`	`+CAULEV:` (list of supported `<mode>`s)

Description

The set command enables or disables the presentation of uplink access status for an active VGCS call. When enabled the unsolicited response `+CAULEV: <status>` is returned from MT to TE after every UPLINK_FREE or UPLINK_BUSY message received from the network.

Read command returns the current uplink <status> and the selected <mode>.

The test command returns values supported as a compound value.

Defined Values

`<mode>:` status of unsolicited result response presentation

0 disabled (default)

1 enabled

`<status>:` network uplink access status

0 uplink free

1 uplink busy

Implementation

Mandatory for a ME supporting AT commands only and VGCS is implemented.

11.1.6 List current Voice Group and Voice Broadcast Calls +CALCC

Table 6:+CALCC action command syntax

Command	Possible response(s)
`+CALCC=<mode>`	`+CALCC: <GId>,<GCA>,<service>,<stat>,<dir>,<ack_flag>[,<priority>]` `[<CR><LF>+CALCC: <GId>,<GCA>,<service>,<stat>,<dir>,<ack_flag>[,<priority>]` `[...]]` *`+CME ERROR: <err>`*
`+CALCC=?`	`+CALCC:` (list of supported `<mode>`s)

Description

The set command returns
for <mode>=1 the active voice group or voice broadcast call and
for <mode>=0 a list of all current running voice group and voice broadcast calls for which the user has a subscription and the GId is activated on the SIM. If the command succeeds but no calls are available, OK response is returned.

Defined values

`<GId>`: a digit string that specifies the group identification of the voice group or voice broadcast call.

`<GCA>`: a digit string that specifies the group call area of the voice group or voice broadcast call.

`<service>` (teleservice):

17 voice group call

18 voice broadcast call

`<stat>` (state of the call):

0 active, i.e. user participating at the call as talker or listener

1 held, the call is running but put to background, notifications ignored

2 incoming (MT call), the user doesn't respond to notifications of this call yet

<dir>:

0 mobile originated (MO) call, the user is the originator of the call

1 mobile terminated (MT) call, the user is not the originator of the call

<ack_flag>: proposes that a predefined confirmation procedure is to be used after the call is ended

0 confirmation procedure is not required

1 confirmation procedure is required

<priority>: optional integer type parameter which identifies the priority level of the voice group or voice broadcast call, values specified in GSM 02.67.

Implementation

Optional. Recommended for a ME supporting AT commands only and VGCS or VBS is implemented.

11.1.7 Voice Group or Voice Broadcast Call State Attribute Presentation +CACSP

Table 7: CACCS parameter command syntax

Command	Possible Response(s)
+CACSP=[<mode>]	*+CME ERROR: <err>*
+CACSP?	+CACSP: <mode>[,<da>,<ua>,<comm>,<oi>] *+CME ERROR: <err>*
+CACSP=?	+CACSP: (list of supported <mode>s)

Description

The set command enables or disables the presentation of unsolicited result response +CACSP: <da>,<ua>,<comm>,<oi> from MT to TE if the call control state attributes of the active voice group or voice broadcast call changes.

Read command returns the current call control state attributes <da>,<ua>,<comm>,<oi> and selected <mode>.

The test command returns values supported as a compound value.

Defined Values

<mode>: status of unsolicited result response presentation

<u>0</u> disabled (default)

1 enabled

<da>: User connection in the downlink

0 not attached

1 attached

<ua>: User connection in the uplink

0 not attached

1 attached

<comm>: The MT assumes that communication with its peer entity is

0 not enabled in both directions

1 enabled in both directions

<oi>: The MS assumes to be

0 not the originator of the call

1 the originator of the call

Implementation

Optional. Recommended for a ME supporting AT commands only and VGCS or VBS is implemented.

11.1.8 NCH Support Indication +CANCHEV

Table 8: CAULEV parameter command syntax

Command	Possible Response(s)
+CANCHEV=[<mode>]	*+CME ERROR: <err>*
+CANCHEV?	+CANCHEV: <status>,<mode> *+CME ERROR: <err>*
+CANCHEV=?	+CANCHEV: (list of supported <mode>s)

Description

The set command enables or disables the presentation of unsolicited result response +CANCHEV: <status> from MT to TE if the status of the network NCH support information changes.

Read command returns in parameter <status> the network NCH support information in the selected cell and the selected <mode>.

The test command returns values supported as a compound value.

Defined Values

<mode>: status of unsolicited result response presentation

0 disabled (default)

1 enabled

<status>: network NCH support information

0 NCH not available

1 NCH available

Implementation

Optional. Recommended for a ME supporting AT commands only and VGCS or VBS is implemented.

11.2 Modem compatibility commands

This sub-clause describes how existing AT commands, designed for use with a modem, may be used to control a VGCS or VBS supporting MT. This is to provide backwards compatibility with existing communications software.

11.2.1 Request VGCS or VBS service 'D'

Table 9: D command syntax

Command	**Possible Response(s)**
`D*<SC1>[*<SC2>]#<GId>;`	*+CME ERROR: <err>*

Description

This Dial command extension is a service request application according to GSM 02.30 [Ref.@]. No further commands may follow on the AT command line. The requested service, GId and priority level are checked against the subscriptions of the user and the status of the GId stored on the SIM. In case if no subscription is available for this service, GId or priority level or the GId is deactivated an ERROR or +CMEE ERROR result code is returned. See +CMEE ERROR extensions for VGCS, VBS and eMLPP in Ref.@.

NOTE. The dial string conforms to the syntax specified in GSM 02.30.

Defined Values

<SC1>: Service Code is a digit string which identifies a request to use
value 17 Voice Group Call Service
value 18 Voice Broadcast Service

<SC2>: Service Code is a digit string which identifies a request to use eMLPP priority . Service Code values for different priority levels are specified in GSM 02.30

<GId>: a digit string that specifies the group identification of a called party.

Implementation

Mandatory for a ME supporting AT commands only and VGCS or VBS is implemented.

11.2.2 Termination of an Voice Group or Voice Broadcast Call 'H'

The V.25ter 'H' or 'H0' (On-hook) command may be used to terminate an ongoing voice group or voice broadcast call. The MT responds with OK. It is an error to issue the 'H' command when there is no outstanding network request.

It is an error to issue the 'H' command if the user is in group receive mode or the user is not the originator of the call and a ERROR or +CME ERROR result code is returned to the TE

NOTE: This is an extension to the usage of the 'H' command that is described in ITU-T V.25ter.

Implementation

Mandatory for a ME supporting AT commands only and VGCS or VBS is implemented.

11.3 Informative examples

As supplementary services may be invoked and controlled using dial command according to GSM 02.30 [19].

An example of eMLPP Supplementary Service usage for a ptp voice call:

`ATD*752#+436644101453;`	(originate a voice call with the priority level 2, see for priority level definitions GSM 02.30)
`OK`	(call setup was successful)

An example of voice group call service request usage:

`ATD*17*753#500;`	(originate voice group call with the priority level 3)
`OK`	(voice group call setup was successful)

3GPP TSG T WG2
Puerto Vallerta, Mexico, 1-4 Feb 2000

Document T2-000064

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

3G 27.007	**CR**	**031**	Current Version:	3.3.0

↑ *CR number as allocated by MCC support team*

For submission to:	T#7	for approval	X	Strategic		*(for SMG use only)*
list expected approval meeting # here ↑		For information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG   The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: (U)SIM [ ] ME [X] UTRAN / Radio [ ] Core Network [ ]
(at least one should be marked with an X)

Source: T2 **Date:** 25-01-2000

Subject: Commands for eMLPP

Work item: EMLPP

Category:				**Release:**		
	F	Correction			Phase 2	
	A	Corresponds to a correction in an earlier release			Release 96	
(only one category	B	Addition of feature	X		Release 97	
shall be marked	C	Functional modification of feature			Release 98	
With an X)	D	Editorial modification			Release 99	X
					Release 00	

Reason for change: Suitable commands for eMLPP were missing in 27.007.

Clauses affected: New subsection of section 7.

Other specs Affected:				
	Other 3G core specifications		→ List of CRs:	
	Other GSM core specifications		→ List of CRs:	
	MS test specifications		→ List of CRs:	
	BSS test specifications		→ List of CRs:	
	O&M specifications		→ List of CRs:	

Other comments:

[new text]

7.xx eMLPP Priority Registration and Interrogation +CAEMLPP

Table xx: CAEMLPP parameter command syntax

Command	Possible Response(s)
`+CAEMLPP=<priority>`	*`+CME ERROR: <err>`*
`+CAEMLPP?`	`+CAEMLPP: <default_priority>,<max_priority>` *`+CME ERROR: <err>`*
`+CAEMLPP=?`	

Description

The execute command is used to change the default priority level of the user in the network. The requested priority level is checked against the eMLPP subscription of the user stored on the SIM EF_{eMLPP}. If the user doesn't have subscription for the requested priority level an ERROR or +CMEE ERROR result code is returned.

The read command triggers an interrogation of the provision of the maximum priority level which the service subscriber is allowed to use and default priority level activated by the user.

If the service is not provisioned, a result code including the SS-Status (?) parameter is returned.

Defined Values

`<priority>:` integer type parameter which identifies the default priority level to be activated in the network, values specified in GSM 02.67

`<default_priority>:` integer type parameter which identifies the default priority level which is activated in the network, values specified in GSM 02.67

`<max_priority>:` integer type parameter which identifies the maximum priority level for which the service subscriber has a subscription in the network, values specified in GSM 02.67

Implementation

Mandatory for a ME supporting AT commands only and supplemantery service eMLPP is implemented.

3GPP TSG T WG2
Puerto Vallerta, Mexico, 1-4 Feb 2000

***Document* T2-000065**

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

3G 27.007	**CR**	**032**	Current Version:	3.3.0

↑ *CR number as allocated by MCC support team*

For submission to:	T#7	for approval	X	Strategic		*(for SMG use only)*	
list expected approval meeting # here ↑		For information		non-strategic			

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: *(at least one should be marked with an X)*	(U)SIM		ME	X	UTRAN / Radio		Core Network	

Source:	T2	**Date:**	25-01-2000
Subject:	Example for usage of priority		
Work item:	EMLPP		

Category:	F	Correction		**Release:**	Phase 2	
	A	Corresponds to a correction in an earlier release			Release 96	
(only one category	B	Addition of feature	X		Release 97	
shall be marked	C	Functional modification of feature			Release 98	
with an X)	D	Editorial modification			Release 99	X
					Release 00	

Reason for change:	Examples help understanding the specifications.
Clauses affected:	Section 7.21

Other specs affected:	Other 3G core specifications		→ List of CRs:	
	Other GSM core specifications		→ List of CRs:	
	MS test specifications		→ List of CRs:	
	BSS test specifications		→ List of CRs:	
	O&M specifications		→ List of CRs:	

Other comments:	The CR does not introduce a new functionality. Input strings for priority are already define in 22.030.

7.21 Informative examples

....

[text added at the end of subclause:]

An example of eMLPP Supplementary Service usage for a ptp voice call:

`ATD*752#+436644101453;`	(originate a voice call with the priority level 2, see for priority level definitions GSM 02.30)
`OK`	(call setup was successful)

3GPP TSG-T2 #8 / ETSI SMG4
Puerto Vallarta, MEXICO
1 - 4 Feb 2000

TSGT2#8(00)0057

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

27.010 CR 005 Current Version: 3.2.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSG-T#7
list expected approval meeting # here ↑

for approval	X	strategic		*(for SMG use only)*
for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects:
(at least one should be marked with an X)

(U)SIM	ME	UTRAN / Radio	Core Network
	X		

Source: T2 **Date:** 25/01/00

Subject: Adaptations for UMTS

Work item: TEI

Category:
(only one category shall be marked with an X)

F	Correction	X
A	Corresponds to a correction in an earlier release	
B	Addition of feature	
C	Functional modification of feature	
D	Editorial modification	

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change: This specification has been transferred from SMG to 3GPP. Therefore, adaptations for UMTS are required.

Clauses affected:

Other specs affected:

Other 3G core specifications		→ List of CRs:
Other GSM core specifications		→ List of CRs:
MS test specifications		→ List of CRs:
BSS test specifications		→ List of CRs:
O&M specifications		→ List of CRs:

Other comments:

help.doc

<--------- double-click here for help and instructions on how to create a CR.

3G TS 27.010 V3.3~~2~~.0 (2000~~1999~~-03~~10~~)

Technical Specification

3rd Generation Partnership Project;
Technical Specification Group Terminals;
Terminal Equipment to User Equipment~~Mobile Station~~ (TE-~~MS~~UE) multiplexer protocol
(3G TS 27.010 version 3.3~~2~~.0)

Reference

DTS/TSGT-0227010U

Keywords

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Contents

Foreword

This Technical Specification has been produced by the 3GPP.

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of this TS, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 Indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the specification;

Introduction

The ~~07.10~~ multiplexer protocol described in the present document operates between an ~~MS~~UE and a TE and allows a number of simultaneous sessions over a normal serial asynchronous interface. Each session consists of a stream of bytes transferring various kinds of data; for instance, voice, fax, data, SMS, CBS, phonebook maintenance, battery status, GPRS, USSD etc. This permits, for example, SMS and CBS to be transferred to a TE when a data connection is in progress. Many other combinations are possible including digital voice. It is, for instance, possible to transfer digital voice in combination with SMS. The multiplexer allows a complete system to be partitioned in a flexible way between a ~~MS~~UE and TE.

The design of the multiplexer is flexible and independent of ~~MS~~UE/TE platforms, and allows existing applications to work without any modifications.

The multiplexer is designed, with special care for battery-powered devices, to include very important functionality such as power saving control and priorities. It is also specially designed to require minimum processing power and memory consumption.

The multiplexer is defined as a single mode with different options based on the ISO HDLC standard (ISO/IEC 13239:1997) although the basic option is not in accordance with HDLC.

In the basic option, the multiplexer does not make use of any transparency mechanism or error recovery method. The advanced option uses the ISO HDLC standard transparency mechanism and gives the multiplexer an easy re-synchronisation method and the ability to operate over links which ~~already~~ use DC1/DC3 (XON/XOFF) flow control. The advanced option also may include error-recovery for links subject to errors.

In its basic option, the multiplexer is intended for use in situations where the link between ~~MS~~UE and TE is of a very good quality and where the HDLC transparency mechanism (byte stuffing) can not be implemented in the ~~MS~~UE. If an ~~MS~~UE supports the HDLC transparency mechanism, it shall be used by the multiplexer. The ISO HDLC transparency mechanism must be used if loss of synchronisation may occur caused by, for example, data over-runs or under-runs. The error-recovery option should be used in situations where the link is subject to errors.

The multiplexer is based on a control channel. On this channel, management information is exchanged, such as parameter negotiation, power saving control information, testing, flow control, close down etc.

The multiplexer is optional, but when supported, it is activated with the ~~07.07~~ AT+CMUX command described in 3G TS 27.007 [4].

1 Scope

The scope of the present document is to define a multiplexing protocol between a ~~mobile station~~UE and a TE~~terminal~~. The multiplexing protocol can be used to send any data, for instance voice, SMS, USSD, fax etc.

The present document describes the protocol, but not the commands or data transported with it.

2 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.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.
- ~~For this Release 1998 document, references to GSM documents are for Release 1998 versions (version 7.x.y).~~

[1] GSM 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".

[2] ISO/IEC 13239:1997: "Information technology -- Telecommunications and information exchange between systems -- High-level data link control (HDLC) procedures".

[3] 3G TS 27.005: "Use of Data Terminal Equipment - Data Circuit terminating Equipment (DTE - DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)"

[4] 3G TS 27.007: "AT command set for 3G User Equipment (UE)"

[5] 3G TR 21.905: "3G Vocabulary"

[6] GSM 06.21: "Digital cellular telecommunications system (Phase 2+); Half rate speech; Substitution and muting of lost frames for half rate speech traffic channels"

3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ABM	Asynchronous Balanced Mode
ERM	Error-Recovery Mode
DLC	Data Link Connection
FCS	Frame Check Sequence
SABM	Set Asynchronous Balanced Mode
UAU	Unumbered Acknowledgement
DM	Disconnected Mode
UIH	Unnumbered Information with header Check
UI	Unnumbered Information
PSC	Power Saving Control
MSC	Modem Status Command

Additional ~~GSM related~~ abbreviations can be found in GSM 01.04 [1] and 3G TR 21.905 [5].

4 Overview of Multiplexing System

The multiplexer provides mechanisms for conveying streams of data between TE and UE~~MS~~ over a single start-stop framed, serial link. Figure 1 shows the arrangement of the various protocol levels and functions. The multiplexer layer provides multiplexing of data arranged in octet streams with no other framing; if the structure of the data has to be conveyed, a convergence layer may be necessary. This Specification defines some convergence layers, others may be added later.

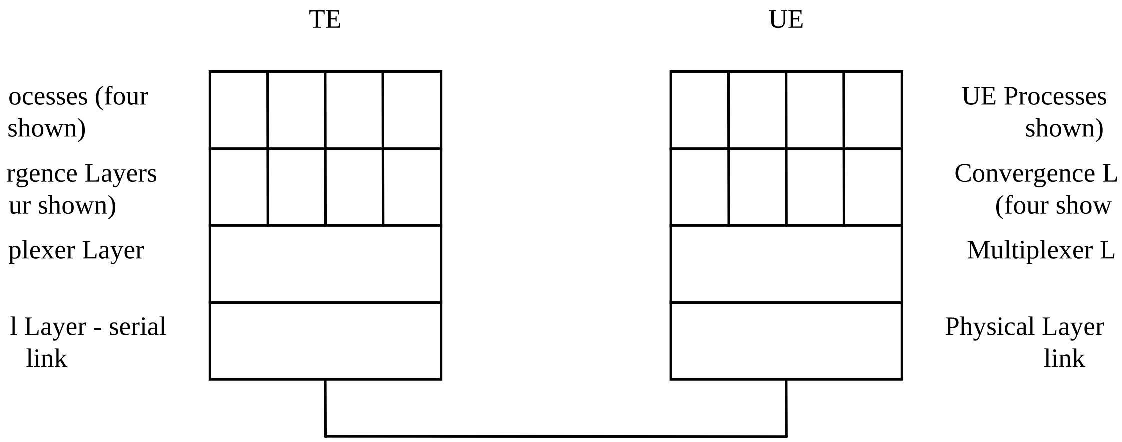


Figure 1: Protocol Stacks

The multiplexer provides a virtual connection between a process in the TE and a similar process in the ~~MS~~UE. For example, a PC application supporting SMS functions could be connected to the SMS handler in the UE~~MS~~ via a multiplexer channel.

This Specification uses start-stop transmission with eight-bit characters. Communication between the two multiplexing entities takes place using frames constructed as defined below.

Each channel between TE and UE~~MS~~ is called a Data Link Connection (DLC) and is established separately and sequentially.

Each DLC may have individual flow control procedures for buffer management purposes and the aggregate link also has overall flow control mechanisms.

DLCs have two modes of operation; Error-Recovery Mode (ERM) and non-error-recovery mode (non-ERM), the choice of mode is made when a DLC is established. DLCs using error recovery mode may exist on the same link as DLCs using non-error recovery mode. If the error-recovery mode (ERM) is to be used at least on one DLC, then the multiplexer must be configured with the ISO HDLC transparency mechanism. The use of error recovery mode is optional. Non-error recovery mode uses the UI frame or UIH frame to carry user data; error recovery mode uses the I frame.

The multiplexer has three operating options, basic, advanced without error recovery and advanced with error recovery. The characteristics of the options are:

Basic:

- Length indicator used instead of the HDLC transparency mechanism.
- Different flag octet from that used by HDLC.
- Can not be used on links which use XON/XOFF flow control.
- May have longer recovery procedure from loss of synchronisation.

Advanced without error recovery:

- Asynchronous HDLC procedures in accordance with ISO/IEC 13239.
- Can be used on links which use XON/XOFF flow control.

- Recovers quickly from loss of synchronisation.

Advanced with error recovery:

- Uses HDLC error-recovery procedures.

5 Non Error Recovery mode Options

This clause describes the non-error-recovery options (basic and advanced) of the multiplexer. The main are given below:

- A simple set of procedures with no error recovery mechanism, for use on reliable connections.
- Data transparency is provided by the HDLC mechanism (advanced option only).
- A multiplexer control channel which conveys management and control information between the UE~~MS~~ and TE.
- A mechanism that permits either UE~~MS~~ or TE to enter power-saving modes without compromising the integrity of the multiplexer.
- A comprehensive set of convergence layers which enables many types of data to be carried while preserving the structure of the original data.

The use of the transparency mechanism must be set up at the beginning of the multiplexing session. It is a characteristic for the entire multiplexing session.

The simple set of procedures uses UIH frames to transmit information; these frames are easy to process because their structure permits the HDLC Frame Check Sequence (FCS) to be pre-calculated rather than being constructed on a character-by character basis. The procedures used are very straightforward and it is not necessary to implement the usual HDLC state machines.

UI frames or UIH frames may be used for those channels where the timely delivery of the information is more important than its reliability because erroneous frames will be discarded. UI frames would be used in those cases where it is important that the data delivered is accurate.

5.1 Service Interface Definition

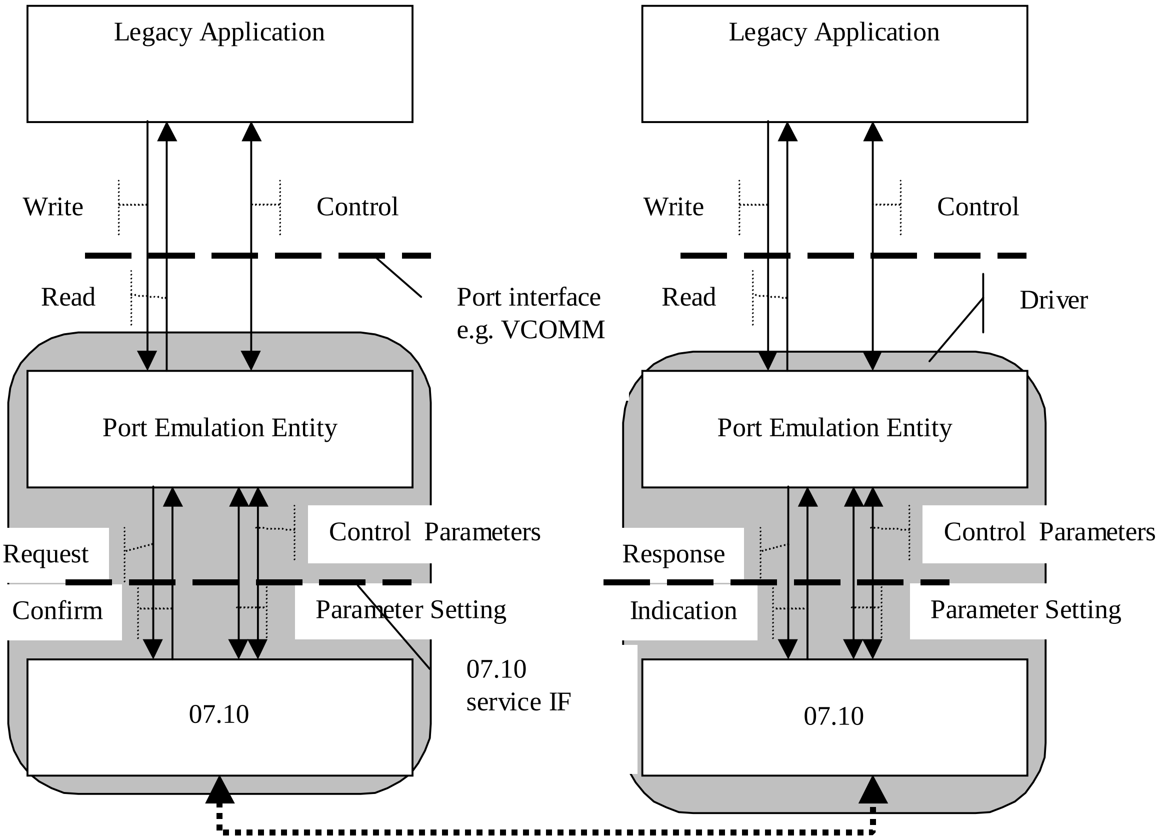
This clause describes the services provided by the 3G TS 2~~0~~7.010 data link layer to the upper layer. The interface is specified in terms of primitives and parameters.

NOTE: this clause is only for information, detailed description of the parameters is found in the following subclauses.

5.1.1 Service Definition Model

The ~~07.10~~27.010 specification is intended to define a protocol that can be used to emulate a serial port. In most systems the ~~07.10~~27.010 will be a part of a port driver which includes a port emulation entity that must support existing communication APIs. The communication APIs vary from operating system to operating system and from device to device. The present document does not specify how ~~07.10~~27.010 is used by a port driver to emulate an existing API but instead focus on a set of services that can be used by all port drivers. Port drivers are not required to use all the services of ~~07.10~~27.010.

The figure below shows a model of how ~~07.10~~27.010 fits into a typical system.



The legacy application utilises a conventional serial port communication interface. The port emulation entity maps a system specific communication interface to ~~07.10~~27.010 services. The ~~07.10~~27.010 provides several transparent data stream channels and a control channel. The port interface is the application programmers interface for communication. It varies from system to system and one example is Virtual comm ports in windows.

5.1.2 Start up services

These services are used to start the TS ~~07.10~~27.010 multiplexer operation over a serial channel. The following services are provided:

TS0710_START.request (*mode, system_parameters*)

TS0710_START.indication (*mode, system_parameters*)

TS0710_START.response (*mode, system_parameters, accept*)

TS0710_START.confirm (*mode, system_parameters, accept*)

Description: The *request* primitive is used to request that the multiplexer mode to be turned on in the desired mode and system parameters. The *indication* primitive transfers the request to start multiplexer operation along with the desired mode and system parameters to the upper layer of the target device. If the target device accepts the request by issuing an affirmative *response* primitive, the suggested mode and system parameters will become valid. The *confirm* primitive is returned to the upper layer of the requesting device. A successful establishment of the multiplexer mode is indicated by the *accept* parameter being set to “true”. If the *accept* parameter is set to “false” the returned values for the other parameters are those suggested by the responding device.

Parameters:

mode = [Basic | HDLC - UIH frames | HDLC - UI frames | HDLC - frames]. (Note that the frame type for HDLC mode refers to the multiplexer control channel. For subsequently opened DLCs this parmeter can be negotiated.

system_parameters = Port speed [9,6 | 19,2 | 38,4 | 57,6 | 115,2 | 230,4 kBit/s],
Maximum Frame Size [1 – 128 in Basic mode, 1 – 512 in HDLC modes default: 31 for the basic option and 64 for the advanced option]
Acknowledgement Timer [0,01s-2,55s, default: 0,1s]
Maximum number of retransmissions [0 – 100, default : 3]
Response timer for the multiplexer control channel [0,01s-2,55s, default: 0,3s]
Wake up response timer [1s – 255s, default 10s]
Window size for error recovery mode [1 – 7, default : 2]

accept = [true | false]

Support of the mode parameter is optional. If the mode parameter is omitted, Basic mode is implied. Note that some of the above system parameters can be redefined for the individual DLCs, se below under DLC establishment services.

5.1.3 DLC establishment services

The DLC establishment services are used to open DLC's on the multiplexer channel. The following services are provided:

TS_0710_DLC_ESTABLISHMENT.request(DLCI, system_parameters)

TS_0710_DLC_ESTABLISHMENT.indication(DLCI, system_parameters)

TS_0710_DLC_ESTABLISHMENT.response(DLCI, system_parameters, accept)

TS_0710_DLC_ESTABLISHMENT.confirm(DLCI, system_parameters, accept)

Description: The transmitting device uses the *request* primitive initiate the establishment of a new DLC with a desired set of system parameters on the multiplexer channel. The *indication* primitive is passed to the upper layer by the TS ~~0710~~27.010 layer of the receiving device on reception of the DLC establishment request. The receiving device uses the *response* primitive to either accept or reject the proposed DLCI with its system parameters. On rejection, it is possible to suggest a modified set of system parameters. The *confirm* primitive is passed to the upper layer of the transmitting device on reception of the response from the receiving device.

Parameters:

DLCI = 1-63 (DLCI number)

System parameters = Type of frame [UIH | UI | I, default: UIH],
Convergence layer [1 - 4, default: 1]
Priority [0-63]
Acknowledgement Timer [0,01s-2,55s, default: 0,1s]
Maximum Frame Size [1 – 32768, default: 31 for the basic option and 64 for the advanced option]
Maximum number of retransmissions [0 – 255, default : 3]
Window size for error recovery mode [1 – 7, default : 2]

Accept = [true | false]

All entries in the system parameters parameter are optional. The entries not implemented assumes the default values.

5.1.4 Data services

The data services provided are:

TS_0710_DATA.request(DLCI, User_data)

TS_0710_DATA.indication(DLCI, User_data)

Description: The transmitting unit initiates transmission of data using the frame type specified for the chosen DLCI by means of the request primitive. The transmitted data is delivered to the upper layer of the receiving by the *indication* primitive. No confirmation primitive exists even for the error recovery mode. In this mode TS ~~0710~~27.010 will take care of all mechanisms involved in the error checking and thus deliver data error free.

Parameters:

DLCI = [1 – 63] DLC over which the data is to be transmitted.

User_data = Data to be transferred organised in accordance with the convergence layer of the DLC

5.1.5 Power Control services

In some application it might be desirable for either the DTE or the DCE to enter a power saving mode with a minimum of communication activities taking place. Services that support this functionality are the Sleep services and the Wakeup services

5.1.5.1 Sleep services

TS_0710_SLEEP.*request*

TS_0710_SLEEP.*indication*

TS_0710_SLEEP.*confirm*

Description: The *request* primitive is used to advice the receiving device that the transmitter wishes to enter a low power state. The TS ~~0710~~27.010 layer of the receiving unit sends an *indication* primitive to the upper layer in order to inform that the transmitting unit has entered the power saving state. The TS ~~0710~~27.010 layer will automatically transmit an acknowledge message to the transmitting device, thus no *response* primitive is required. The *confirm* primitive is sent to the upper layer of the transmitting device when the low power request has been received, and indicates that the TS ~~0710~~27.010 layer has entered the low power mode. Note that the Receiving device is not required to enter a low power mode, but it will be considered to have done so by the TS ~~07.10~~27.010 layer.

5.1.5.2 Wakeup services

TS_0710_WAKEUP.*indication*

TS_0710_WAKEUP.*response*

Description: The *indication* primitive is sent to the upper layer when the TS ~~0710~~27.010 layer of the receiving unit receives a request to wake up from the power saving state. When the receiving device is ready to resume operation on the multiplexer channel this is indicated to the TS ~~0710~~27.010 layer in the receiving unit by means of the *response* primitive. Sins the wakeup routine is initiated by the transmitting device attempting to communicate, neither *request* nor *confirm* primitives are provided for the wakeup service. The transmitting device instead uses the Data services described below.

5.1.6 DLC Release services

The DLC release services are used to disconnect a DLC. The following services are provided:

TS_0710_DLC_RELEASE.*request(DLCI)*

TS_0710_DLC_RELEASE.*indication(DLCI)*

Description: The *request* primitive is used by the upper layer in the transmitting device to initiate close down of the selected DLC in TS ~~0710~~27.010. The TS ~~0710~~27.010 layer of the receiving device uses the *indication* primitive to inform the upper layer that the DLC has been closed down.

Parameters:

DLCI = [1 – 63] Number of the DLC to be released.

5.1.7 Close down services

The Close down services are used to terminate multiplexer operation on the serial channel and resume AT mode. The services provided are:

TS_0710_CLOSE.*request*

TS_0710_CLOSE.*indication*

Description: When the request primitive is passed to the TS ~~0710~~27.010 layer of the transmitting device close down of the multiplexer mode is initiated and a close down command is sent to the receiving device. On reception of the close down command the TS ~~0710~~27.010 layer of the receiving device sends the indication primitive to the upper layer and the multiplexer mode is terminated.

5.1.8 Control Services

5.1.8.1 ~~07.10~~27.010 Services

5.1.8.1.1 DLC parameter negotiation

These services are used to negotiate and set parameters for a specific DLC. The following services are provided:

TS0710_PARNEG.request (*DLC, DLC parameters*)

TS0710_PARNEG.indication (DLC, *DLC_parameters*)

TS0710_PARNEG.response (DLC, *DLC_parameters, accept*)

- TS0710_PARNEG.confirm (*DLC,* DLC*_parameters, accept*)

Description: The *request* primitive is used to request that the remote ~~07.10~~27.010 entity changes a specific DLC connection parameters. An indication is sent to the remote port emulation entity. The remote emulation entity replies with a response witch is forwarded as an confirmation to the originating port emulating entity.

DLC_parameters = frame type [UIH | UI | I ,
default: UIH]
Convergence Layer Type [Type 1 | Type 2 | Type 3 | Type 4,
default: Type 1]
Priority [1-63,
default: according to table in subclause 5.6]
Acknowledgement timer [10 ms - 25.5 sec,
deault: 100 ms]
Maximum Frame Size [1 – 32768,
default: 31 for the basic option and
64 for the advanced option]
Maximum number of retransmissions [0 – 100,
default : 3]
Response timer for the multiplexor control
channel [0,01s-2,55s, default: 0,3s]
Wake up response timer [1s – 255s, default 10s]
Window size for error recovery mode [1 – 7,
default : 2]

accept = [true | false]

5.1.8.1.2 DLC Service Negotiation service

These services are used to negotiate and set a specific service on a DLC. The following services are provided:

TS0710_SERVNEG.request (*DLC, Service_parameters*)

TS0710_SERVNEG.indication (DLC*, Service_parameters*)

TS0710_SERVNEG.response (DLC*, Service parameters, accept*)

TS0710_SERVNEG.confirm (*DLC, Service_parameters, accept*)

Description: The *request* primitive is used to request a specific service on a DLC. The indication is sent to the other port emulation. The remote port emulation entity replies with a response containing accepted or possible services. The originating port emulation entity receives a confirm on the request with either an accept or a possible service list.

service_parameters = *Service* [data | voice 64kbit/s A-law PCM | reserved 1 | reserved 2], voice codec [GSM 06.21 | 64kbit/s u-law PCM | coded ADPCM 32kbit/s | coded half rate | 128 kbit/s PCM | reserved]

5.1.8.1.3 Test service

These services are used to test the communication link between two ~~07.10~~27.010 entities. The following services are provided:

TS0710_TEST.request (*Test data*)

TS0710_TEST.confirm (*Test data*)

Description: The *request* primitive is used to request a test of the communication link. The data is sent to the remote entity, which loops it back. The confirmation is sent to the originating port emulation entity containing the looped data.

Test Data = Data to be transferred as a test pattern, organised in accordance with the convergence layer of the ~~07.10~~27.010 control channel.

5.1.8.1.4 Flow control services

The flow control services provided are:

TS_0710_FLOW.request(DLCI,State)

TS_0710_FLOW.indication(DLCI, State)

Description:

The request primitive with *State* = *disable* disables the issuing of TS_0710_DATA.*indications* by the ~~07.10~~27.010 entity. The request primitive with *State* = *enable* enables the issuing of TS_0710_DATA.*indications* by the ~~07.10~~27.010 entity. These requests may or may not result in the remote ~~07.10~~27.010 entity issuing a TS_0710_FLOW.*indication* to the remote service user, depending on the states of the buffers in the ~~07.10~~27.010 entities.

The indication primitive with *State* = *disable* disables the issuing of TS_0710_DATA.*requests* by the service user. The indication primitive with *State* = *enable* enables the issuing of TS_0710_DATA.*requests* by the service user. These indications may or may not have resulted from the receipt by the remote ~~07.10~~27.010 entity of a TS_0710_FLOW.*request* from the remote service user. They may have been issued by the local ~~07.10~~27.010 entity as a result of its buffer state.

The initial state of the ~~07.10~~27.010 entity is with data flow enabled.

Parameters:

DLCI = [1 – 63] DLC over which the data is to be transmitted.

State = *enabled* (data may be transferred), *disabled* (data may not be transferred)

5.1.8.2 Port Emulation Services

5.1.8.2.1 Remote DLC parameter negotiation service

These services are used to negotiate and set of parameters for a remote communication port. The following services are provided:

TS0710_PORTNEG.request (*DLC*, *Port_parameters*)

TS0710_PORTNEG.indication (DLC*, Port_parameters*)

TS0710_PORTNEG.response (DLC*, Port parameters*, *accept*)

TS0710_PORTNEG.confirm (*DLC*, *Port_parameters, accept*)

Description: The *request* primitive is used to request that the remote port changes its parameters. The indication is sent to the other port emulation entity. The remote port emulation entity replies with a response. A confirm is sent to the originating port entity.

port_parameters = Port speed [2,4 | 4,8 | 7,2 | 9,6 | 19,2 | 38,4 | 57,6 | 115,2 |
230,4 kBit/s],
Data bits [5 | 6 | 7 | 8,
default: 8 bits |
Stop bits [1 | 1,5,
default: 1 bit |
Parity [no parity | parity,
default: no parity |
Parity Type [odd | even | mark | space]

accept = [true | false]

5.1.8.2.2 DLC Control Parameter service

The DLC Control Parameter service is used to convey control parameters between Port Emulation Entities. Default values should be assumed if no control parameter has been designated since the DLC has been made. This service is to control a specific DLC. It includes such as flow control, Modem signals, Break. The following services are provided:

TS0710_CONTROL.request (*DLC*, *Control_parameters*)

TS0710_CONTROL.indication (DLC, *Contol_parameters*)

TS0710_CONTROL.response (DLC*, Contro_parameters*)

TS0710_CONTROL.confirm (*DLC*, *Control_parameters*)

Description: The *request* primitive is used to convey control information to the remote port. The indication is sent to the other port emulation entity. The remote port emulation entity replies with a response which is sent to the originating ~~07.10~~27.010 entity. A confirm is sent back to the port emulation entity.

system_parameters = Modem Signal [DTR/DSR | RTS/CTS | RI | DCD],
Break Signal [0—3 s in steps of 200 ms,
default 0ms],
Buffers [do not discard buffers, discard buffer
default: do not discard buffers],
Break signal sequence [as soon as possible | in sequence,
default: in sequence]

5.1.8.2.3 DLC Line status indication service

These services are used to indicate a DLC line status to a remote port emulation entity.. The following services are provided:

TS0710_PORTNEG.request (DLC, *Line Status parameter*)

TS0710_PORTNEG.indication (DLC, *Line Status parameter*)

Description: The *request* primitive is used to send the line status to the remote device. The indication is sent to the other port emulation entity. The remote port emulation does not reply.

Line status parameter = Port speed [no errors, overrun error, parity error, framing error]

5.2 Frame Structure

All information transmitted between the TE and ~~MS~~UE is conveyed in frames.

5.2.1 Frame Fields

The frame structure is composed of an opening and a closing flag, an Address field, a Control field, an Information field and FCS field. A length indication field is present in each frame if no transparency mechanism is used for the multiplexing session.

5.2.1.1 Flag Sequence Field

Each frame begins and ends with a flag sequence octet which is defined as a constant bit pattern.

5.2.1.2 Address Field

The address field consists of a single octet. It contains the Data Link Connection Identifier (DLCI), the C/R bit and the address field extension bit as shown in Figure 2.

Bit No.	1	2	3	4	5	6	7	8
	EA	C/R		D	L	C	I	

Figure 2: Format of Address Field

The DLCI is used to identify an individual user information stream as well as to identify connections between TE and ~~MS~~UE. Multiple DLCIs shall be supported but the number is implementation-specific. The DLCIs are dynamically assigned. The values used for specific DLCIs are given in subclause 5.6.

The C/R (command/response) bit identifies the frame as either a command or a response. In conformance with HDLC rules, a command frame contains the address of the data link connection entity to which it is transmitted while a response frame contains the address of the data link connection entity transmitting the frame. For a given DLC, the DLCI value of the address field remains the same but the C/R bit changes, as shown in Table 1.

Table 1: Command/response bit usage

Command/response	Direction			C/R value
Command	Initiator	⟶	Responder	1
	Responder	⟶	Initiator	0
Response	Initiator	⟶	Responder	0
	Responder	⟶	Initiator	1

Initiator is the station that take the initiative to initialize the multiplexer (i.e. sends the SABM command at DLCI 0) and the responder is the station that accepts the initialization of the multiplexer (i.e. sends the UA response at DLCI 0)

See subclause 5.4.3.1 for more details about C/R bit.

According to the rules of ISO/IEC 13239:1997, the range of the address field may be extended by use of the EA bit. When the EA bit is set to 1 in an octet, it signifies that this octet is the last octet of the address field. When the EA bit is set to 0, it signifies that another octet of the address field follows. In this Specification there is only one address octet so the EA bit is always set to 1. Note that future amendments to this Specification may extend the address field and use the EA bit.

5.2.1.3 Control Field

The content of the control field defines the type of frame. The control fields of the frames used in this Specification are described in Table 2.

Table 2: Coding of Control Field

Frame Type	1	2	3	4	5	6	7	8	Notes
SABM (Set Asynchronous Balanced Mode)	1	1	1	1	P/F	1	0	0	
UA (Unnumbered Acknowledgement)	1	1	0	0	P/F	1	1	0	
DM (Disconnected Mode)	1	1	1	1	P/F	0	0	0	
DISC (Disconnect)	1	1	0	0	P/F	0	1	0	
UIH (Unnumbered Information with Header check)	1	1	1	1	P/F	1	1	1	
UI (Unnumbered Information)	1	1	0	0	P/F	0	0	0	Optional

In Table 2, P/F is the Poll/Final bit. The functions of these bits are described later.

5.2.1.4 Information Field

The information field is the payload of the frame and carries the user data and any convergence layer information. The field is octet structured. The information field is only present in I frames, UI frames and UIH frames.

5.2.1.5 Length Indicator

This field is present only in case when basic option is activated.

It has the following format:

Bit	1	2	3	4	5	6	7	8
	E/A	L1	L2	L3	L4	L5	L6	L7

Figure 3: Length field, first byte

The L1 to L7 bits indicates the length of the following data field. The default length is 31 bytes.

According to the rule of ISO/IEC 13239:1997, the range of the length field may be extended by use of the EA bit. When the EA bit is set to 1 in an octet, it is signifies that this octet is the last octet of the length field. When the EA bit is set to 0, it signifies that a second octet of the length field follows. The total length of the length field is in that case 15bits, L1-L15.

The second octet of the length field (only present when the EA field in the first byte is set to 1) format:

Bit	1	2	3	4	5	6	7	8
	L8	L9	L10	L11	L12	L13	L14	L15

Figure 4: Length field, second byte

The length field shall always be present, even if the data field is empty.

5.2.1.6 Frame Checking Sequence Field (FCS)

The FCS shall be the ones complement of the sum (modulo 2) of

a) the remainder of

$x^k (x^7 + x^6 + x^5 + x^4 + x^3 + x^2 + x^1 + 1)$

divided (modulo 2) by the generator polynomial

$x^8 + x^2 + x + 1$,

where k is the number of bits in the frame existing between, but not including, the final bit of the opening flag and the first bit of the FCS, excluding start and stop elements (start/stop transmission), and bits (synchronous transmission) and octets (start/stop transmission) inserted for transparency, and

b) the remainder of the division (modulo 2) by the generator polynomial

$x^8 + x^2 + x + 1$

of the product of x^8 by the content of the frame existing between, but not including, the final bit of the opening flag and the first bit of the FCS, excluding start and stop elements (start/stop transmission), and bits (synchronous transmission) and octets (start/stop transmission) inserted for transparency.

As a typical implementation, at the transmitter, the initial content of the register of the device computing the remainder of the division is preset to all ones and is then modified by division by the generator polynomial (as described above) of the address, control and information fields; the ones complement of the resulting remainder is transmitted as the 8-bit FCS.

At the receiver, the initial content of the register of the device computing the remainder is preset to all ones. The final remainder after multiplication by x^8 and then division (modulo 2) by the generator polynomial

$x^8 + x^2 + x + 1$

of the serial incoming protected bits and the FCS, will be 1111 0011 (x^7 through x^0, respectively) in the absence of transmission errors.

In the case of the UIH frame, the contents of the I-field shall not be included in the FCS calculation. FCS is calculated on the contents of the address, control and length fields only. This means that only the delivery to the correct DLCI is protected, but not the information. The FCS is calculated in the normal manner for all other frames in Table 2.

5.2.2 Format Conventions

All transmitted characters will be sent using one start bit, eight data bits, no parity bit and one stop bit.

In the field descriptions, bit 1 is transmitted first.

Addresses, commands, responses and sequence numbers shall be transmitted low-order bit first (for example, the first bit of the sequence number that is transmitted shall have the weight 2^0).

The FCS shall be transmitted to the line commencing with the coefficient of the highest term.

NOTE: The use of these conventions in this Specification means that octet values are often expressed in the reverse bit order from conventions used in many other standards. The conventions are used here because of the importance of the correct order of bit transmission; care should be taken during implementation.

5.2.3 Frame Validity

An invalid frame in the frame format is one which meets any one (or more) of the following conditions:

- is not properly bounded by two flags;
- does not have at least three octets between flags after removal of characters inserted for transparency;
- indicates presence of a transmission error in that the FCS check fails;

- contains an address field with more than one octet.

Invalid frames shall be discarded without notification to the sender. Actions taken by the multiplexer to indicate reception of an invalid frame to the ~~MS~~UE or TE are left to implementers. However, an indication that a frame with an FCS error has been received may be of use when supporting DLCs for voice/audio.

As an optional procedure in response to an invalid frame in error recovery mode, a receiver may transmit an REJ frame.

5.2.4 Frame Abort

Aborting a frame is not supported.

5.2.5 Inter-frame Fill

The time between frames shall be filled by sending continuous stop-polarity except in the case of the wake-up procedure (see subclause 5.4.7). The receiver shall also operate correctly if the time between frames is filled with flag characters. If a receiver receives more than three consecutive flags it shall begin to transmit continuous flags at the first available time (see subclause 5.4.7)

5.2.6 Basic Option

In this case, opening flag and closing flags may appear in the Information field of the frame. The flags cannot be used to determine beginning and end of a frame. A length indication for the frame must be given instead. The frame structure is then as follows:

Flag	Address	Control	Length Indicator	Information	FCS	Flag
1 octet	1 octet	1 octet	1or2 octets	Unspecified length but integral number of octets	1 octet	1 octet

Figure 5: Frame Structure for Basic option

The flag field in basic option has the following format:

Bit	1	2	3	4	5	6	7	8
	1	0	0	1	1	1	1	1

Figure 6: Flag field in basic option

5.2.6.1 Constraint

The closing flag may also be the opening flag of the following frame.

The flag value is different from the one used when the advanced option is activated.

Operation on link using DC1/XON and DC3/XOFF control characters defined in ISO/IEC 646 is not supported.

5.2.7 Advanced Option

If the advanced option is activated at the beginning of the multiplexing session, then it is used for all frames. This mechanism is based on a control octet transparency. It is based on a unique appearance of the opening and the closing flag in each frame. These flags will never appear in the information field of the frame. This mechanism allows a very quick synchronisation if a loss of synchronisation has occurred on the TE-~~MS~~UE link.

5.2.7.1 Control-octet transparency

The following transparency mechanism shall be applied to each frame from address field to FCS field inclusive.

The control escape octet is a transparency identifier that identifies an octet occurring within a frame to which the following transparency procedure is applied. The encoding of the control escape octet is:

1	2	3	4	5	6	7	8	Bit position in octet
1	0	1	1	1	1	1	0	

Low order bit, first bit transmitted/received

The transmitter shall examine the frame between the opening and closing flag sequences including the address, control, and FCS fields and, following completion of the FCS calculation, shall:

- Upon the occurrence of the flag or a control escape octet, complement the 6th bit of the octet, and
- Insert a control escape octet immediately preceding the octet resulting from the above prior to transmission.

The receiver shall examine the frame between the two flag octets and shall, upon receipt of a control escape octet and prior to FCS calculation:

- Discard the control escape octet, and
- Restore the immediately following octet by complementing its 6th bit.

Other octet values may optionally be included in the transparency procedure by the transmitter. Such inclusion shall be subject to prior system/application agreement.

5.2.7.2 Start/stop transmission - extended transparency

The transmitter may apply the above transparency procedure to other octets in addition to the flag and control escape octets. At present, the only other octets are flow-control characters. The procedure is described in subclause 5.2.6.3.

5.2.7.3 Flow-control transparency

The flow-control transparency option provides transparency processing for the DC1/XON and DC3/XOFF control characters defined in ISO/IEC 646 (i.e., 1000100x and 1100100x, respectively, where x may be either 0 or 1). This has the effect of assuring that the octet stream does not contain values which could be interpreted by intermediate equipment as flow control characters (regardless of parity).

5.2.7.4 Frame Structure

The frame structure is shown in Figure 7. Note that this structure does not include information added for synchronisation (i.e. Start and stop bits) or transparency purposes. The order of transmission is from left to right.

In case the Transparency mechanism is activated, the frame structure is as follows:

Flag	Address	Control	Information	FCS	Flag
1 octet	1 octet	1 octet	Unspecified length but integral number of octets	1 octet	1 octet

Figure 7: Frame Structure for Advanced option

The flag field in advanced option has the following format:

Bit	1	2	3	4	5	6	7	8
	0	1	1	1	1	1	1	0

Figure 8: Flag field in advanced option

NOTE: The closing flag may also be the opening flag of the following frame.

5.3 Frame Types

5.3.1 Set Asynchronous Balanced Mode (SABM) command

The SABM command shall be used to place the addressed station in the Asynchronous Balanced Mode (ABM) where all control fields shall be one octet in length. The station shall confirm acceptance of the SABM command by transmission of a UA response at the first opportunity. Upon acceptance of this command, the DLC send and receive state variables shall be set to zero.

5.3.2 Unnumbered Acknowledgement (UA) response

The UA response shall be used by the station to acknowledge the receipt and acceptance of SABM and DISC commands.

5.3.3 Disconnected Mode (DM) response

The DM response shall be used to report a status where the station is logically disconnected from the data link. When in disconnected mode no commands are accepted until the disconnected mode is terminated by the receipt of a SABM command. If a DISC command is received while in disconnected mode a DM response should be sent.

5.3.4 Disconnect (DISC) command

The DISC command shall be used to terminate an operational or initialization mode previously set by a command. It shall be used to inform one station that the other station is suspending operation and that the station should assume a logically disconnected mode. Prior to actioning the command, the receiving station shall confirm the acceptance of the DISC command by the transmission of a UA response.

DISC command sent at DLCI 0 have the same meaning as the Multiplexer Close Down command (see subclause 5.4.6.3.3). See also subclause 5.8.2 for more information about the Close-down procedure.

5.3.5 Unnumbered information with header check (UIH) command and response

The UIH command/response shall be used to send information without affecting the V(S) or V(R) variables at either station. UIH is used where the integrity of the information being transferred is of lesser importance than its delivery to the correct DLCI. For the UIH frame, the FCS shall be calculated over only the address, control and length fields.

Reception of the UIH command/response is not sequence number verified by the data link procedures; therefore, the UIH frame may be lost if a data link exception occurs during transmission of the protected portion of the command, or duplicated if an exception condition occurs during any reply to the command. There is no specified response to the UIH command/response.

5.3.6 Unnumbered Information (UI) command and response

The UI command/response shall be used to send information without affecting the V(S) or V(R) variables at either station. Reception of the UI command/response is not sequence number verified by the data link procedures; therefore, the UI frame may be lost if a data link exception occurs during transmission of the protected portion of the command, or duplicated if an exception condition occurs during any reply to the command. There is no specified response to the UI command/response.

For the UI frame, the FCS shall be calculated over all fields (Address, Control, Length Indicator, Information).

Support of UI frames is optional.

5.4 Procedures and States

5.4.1 DLC Establishment

In most cases the establishment of a DLC will be initiated by the TE, however, the protocol is balanced and the initiation may come from the ~~MS~~UE. The action taken by the higher layers of the TE upon the initiation of the establishment of a DLC from the ~~MS~~UE is outside the scope of this specification.

The station wishing to establish a DLC transmits a SABM frame with the P-bit set to 1. The address field contains the DLCI value associated with the desired connection. If the responding station is ready to establish the connection it will reply with a UA frame with the F-bit set to 1. If the responding station is not ready or unwilling to establish the particular DLC it will reply with a DM frame with the F-bit set to 1.

Once a DLC has been established the stations are both said to be in a connected mode, for the particular DLC, and transfer of information may commence.

If no UA or DM response has been received after T1 the initiating station may retransmit the SABM. This action may be repeated until a response is obtained or action is taken by a higher layer.

If no negotiation procedure is used, DLC parameters are the default one.

5.4.2 DLC Release

The release of a DLC may be initiated by either station by the transmission of a DISC frame with the P-bit set to one. Confirmation of the DLC release is signalled by the other station sending a UA frame with the F-bit set to 1. Once the DLC has been released the stations enter disconnected mode for that particular DLC.

If the station receiving the DISC command is already in a disconnected mode it will send a DM response.

If no UA or DM response has been received after T1 the initiating station may retransmit the DISC. This action may be repeated until a response is obtained or action is taken by a higher layer.

5.4.3 Information Transfer

5.4.3.1 Information Data

Information is conveyed using UI or UIH frames. Support of UIH frames is mandatory and support of UI frames is optional. UI frames are used when it is important to know that data received is correct. An example of the use of UI frames is in carrying IP (Internet Protocol) traffic where error recovery procedures are performed, if necessary, by a higher layer. The use of UIH frames is appropriate if the link is not subject to errors. UI or UIH frames may also be used for data in situations where the delays inherent in error-recovery procedures are unacceptable, such as transmission of voice data.

The transmitter takes information from the convergence layer for the particular DLC and places it in the I-field of the transmitted frame. Once a UI or UIH frame has been correctly received, the contents of its I-field is passed to the convergence layer.

The frames sent by the initiating station have the C/R bit set to 1 and those sent by the responding station have the C/R bit set to 0. Both stations set the P-bit to 0.

See subclause 5.2.1.2 for more details about C/R bit

The maximum length of the information field in UI or UIH frames shall be parameter N1 (see subclause 5.7.2).

5.4.3.2 Priority

Each data stream has a priority associated with it. The priority is a number in the range 0-63 with lower numbers having higher priority. The TE assigns a priority to each DLC and informs the ~~MS~~UE of the priority by means of the multiplexer control channel (see subclause 5.4.6.3.1). In the absence of a message assigning priorities DLCs shall be given the priority according to the DLCI Assignment table in subclause 5.6. The transmitter is in control of which frames are transmitted and how they are constructed and it is not intended to specify precisely how this task is performed. If data of higher priority than that currently being transmitted is waiting the transmitter has several options available:

a) complete the transmission of the current frame, or

b) terminate the assembly of the current frame by sending the current FCS and terminating flag (only for Advanced option),

and start sending the frame of higher-priority data.

Handling of DLC with equal priorities should not favour one over the others. The DLC with the highest priority shall not block any of the lower priorities DLC. Interleaving of higher priority and lower priority frames is necessary in order to avoid permanent blocking of lower priority channels. Optimization of this interleaving for a specific implementation may have a significant impact on the application in use and therefore implementers are encouraged to consider this carefully.

5.4.4 Frame Variables

The poll (P) bit set to 1 shall be used by a station to solicit (poll) a response or sequence of responses from the other station.

The final (F) bit set to 1 shall be used by a station to indicate the response frame transmitted as the result of a soliciting (poll) command.

The poll/final (P/F) bit shall serve a function in both command frames and response frames. (In command frames, the P/F bit is referred to as the P bit. In response frames, it is referred to as the F bit.)

5.4.4.1 Functions of the poll bit

The P bit set to 1 shall be used to solicit a response frame with the F bit set to 1 from the other station at the earliest opportunity.

On a particular DLCI, only one frame with a P bit set to 1 shall be outstanding in a given direction at a given time.

In the case where a SABM or DISC command with the P bit set to 0 is received then the received frame shall be discarded.

If a unsolicited DM response is received then the frame shall be processed irrespective of the P/F setting.

Before a station issues another frame with the P bit set to 1, it shall have received a response frame from the other station with the F bit set to 1. If no valid response frame is obtained within a system-defined time-out period, the retransmission of a command with the P bit set to 1 for error recovery purposes shall be permitted.

5.4.4.2 Functions of the final bit

A response frame with the F bit set to 1 shall be used by a station to acknowledge the receipt of a command frame with the P bit set to 1. The response shall be made at the earliest opportunity.

The station may transmit response frames with the F bit set to 0 at any opportunity on an asynchronous basis. However, in the case where a UA response is received with the F bit set to 0 then the received frame shall be discarded.

If an unsolicited DM response is received then the frame shall be processed irrespective of the P/F setting.

If a station receives a command with the P bit set to 1, transmission of a response with the F bit set to 1 shall take precedence over transmission of other commands, with the exception of the mode setting commands (SABM or DISC).

5.4.5 Time-out considerations

In order to detect a no-reply or lost-reply condition, each station shall provide a response time-out function (T1). The expiry of the time-out function shall be used to initiate appropriate error recovery procedures.

The duration of the time-out function in the two stations shall be unequal in order to resolve contention situations.

The time-out function shall be started whenever a station has transmitted a frame for which a reply is required. When the expected reply is received, the time-out function shall be stopped. If, during the interval that the time-out function is running, other frames are sent for which acknowledgements are required, the time-out function may have to be restarted.

If the response time-out function runs out, a command with the P bit set to 1 may be (re)transmitted, and the response time-out function restarted.

5.4.6 Multiplexer Control Channel

At the initiation of communication between the TE and ~~MS~~UE a control channel is set up with DLCI 0 using the procedures of subclause 5.8.1. This channel is used to convey information between the two multiplexers. The control channel may use either error recovery mode or non-error recovery mode procedures as defined by the +CMUX command (~~GSM 07.07~~3G TS 27.007 [4]). If error recovery mode procedures are available they should be used.

5.4.6.1 Message format

All messages sent between the multiplexers conform to the following type, length, value format:

Type	Length	Value 1	Value2	…	Value n

Each box in the diagram represents a field of minimum size one octet. The type and length octets have extension bits so those fields may contain more than one octet.

The first type field octet has the following format:

Bit	1	2	3	4	5	6	7	8
	EA	C/R	T1	T2	T3	T4	T5	T6

Subsequent type field octets have the following format:

Bit	1	2	3	4	5	6	7	8
	EA	T7	T8	T9	T10	T11	T12	T13

The EA bit is an extension bit. The EA bit is set to 1 in the last octet of the sequence; in other octets EA is set to 0. If only one octet is transmitted EA is set to 1.

The C/R bit indicates whether the message is a command or a response.

The T bits indicate the type coding. Each command has a unique pattern of bits. This means that a single-octet type field can encode 63 different message types. Only single octet message types are defined in this specification.

The first length field octet has the following structure:

Bit	1	2	3	4	5	6	7	8
	EA	L1	L2	L3	L4	L5	L6	L7

Subsequent length field octets have the same structure.

The EA bit is an extension bit. The EA bit is set to 1 in the last octet of the sequence; in other octets EA is set to 0. If only one octet is transmitted EA is set to 1.

The L bits define the number of value octets that follow. In the case of a single-octet length field L1 is the LSB and L7 is the MSB; this permits messages with up to 127 value octets to be constructed.

The contents of the value octets are defined for each message type in subclause 5.4.6.3.

Multiple messages may be included in the same frame (as long as the maximum frame size is not exceeded). Messages may not be split over more than one frame.

5.4.6.2 Operating procedures

Messages always exist in pairs; a command message and a corresponding response message. If the C/R bit is set to 1 the message is a command, if it is set to 0 the message is a response. A response message has the same T bits as the command that provoked it.

If a command does not produce a response within a time T2 the command may be sent again up to N2 times. If no response is received on the N2 transmissions, the multiplexer control channel should be considered faulty and an alarm raised. Resolution of the error situation is implementation dependent.

NOTE: Notice that when UIH frames are used to convey information on DLCI 0 there are at least two different fields that contain a C/R bit, and the bits are set of different form. The C/R bit in the Type field shall be set as it is stated above, while the C/R bit in the Address field (see subclause 5.2.1.2) shall be set as it is described in subclause 5.4.3.1.

5.4.6.3 Message Type and Actions

5.4.6.3.1 DLC parameter negotiation (PN)

This procedure is optional. If this command is not supported, default values are applied to each DLC.

Before a DLC is set up using the mechanism in subclause 5.4.1, the TE and ~~MS~~UE must agree on the parameters to be used for that DLC. These parameters are determined by parameter negotiation.

The parameter negotiation uses the following type field octet:

Bit	1	2	3	4	5	6	7	8
	EA	C/R	0	0	0	0	0	1

The length field octet contains the value 8 and there follow eight value octets. The value octets contain the information in Table 3.

Table 3: Parameter Negotiation

Value Octet	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Bit 8
1	D1	D2	D3	D4	D5	D6	0	0
2	I1	I2	I3	I4	CL1	CL2	CL3	CL4
3	P1	P2	P3	P4	P5	P6	0	0
4	T1	T2	T3	T4	T5	T6	T7	T8
5	N1	N2	N3	N4	N5	N6	N7	N8
6	N9	N10	N11	N12	N13	N14	N15	N16
7	NA1	NA2	NA3	NA4	NA5	NA6	NA7	NA8
8	K1	K2	K3	0	0	0	0	0

The various fields are coded as follows:

The D-bits define the DLCI that the other information refers to; Bit D1 is the least significant.

The I-bits define the type of frames used for carrying information in the particular DLC - See Table 4.

Table 4: Meaning of I-bits

Meaning	I1	I2	I3	I4
Use UIH frames	0	0	0	0
Use UI frames	1	0	0	0
Use I frames (note)	0	1	0	0

NOTE: Refer to clause 6

Other values are reserved. Default value is 0000.

In the absence of negotiation the frame type used (for DLCI>0) is the same as used by the multiplexer control channel.

The CL-bits define the type of convergence layer to be used on the particular DLCI - see Table 5.

Table 5: Meaning of CL-bits

Meaning	CL1	CL2	CL3	CL4
Type 1	0	0	0	0
Type 2	1	0	0	0
Type 3	0	1	0	0
Type 4	1	1	0	0

Other values are reserved. Default value is 0000

The P-bits define the priority to be assigned to the particular DLC. The range of values is 0 to 63 with 0 being the lowest priority. P1 is the least significant bit. Default value for P-bits are given by the DLCI values. See subclause 5.6.

The T-bits define the value of the acknowledgement timer (T1) - see subclause 5.7.1. The units are hundredths of a second and T1 is the least significant bit.

The N-bits define the maximum frame size (N1) - see subclause 5.7.2. The parameter is a sixteen-bit number with N1 as the least significant bit.

The NA-bits define the maximum number of retransmissions (N2) - see subclause 5.7.3. The parameter is an eight-bit number with NA1 as the least significant bit.

The K-bits define the window size for error recovery mode (k) - see subclause 5.7.4. The parameter is a three-bit number with K1 as the least significant bit.

The TE transmits a parameter negotiation command to the ~~MS~~UE with the fields set to the values that the TE intends to use for the particular DLCI. The ~~MS~~UE replies with a parameter negotiation response with its proposed set of values. The following rules must be observed by the ~~MS~~UE in constructing its response:

- The DLCI value may not be changed.
- The use of I frames or UI frames is optional so an ~~MS~~UE may respond with a UIH choice if it does not implement UI frames or I frames.
- The ~~MS~~UE may not change the convergence layer proposed by the TE.
- The ~~MS~~UE may not change the priority proposed by the TE.
- The T1 value is the one that the TE will use and is not negotiable; the ~~MS~~UE will insert its own T1 value. It is advisable that different T1s are used in each direction.
- The ~~MS~~UE may propose a smaller value for maximum frame size (N1) if it has insufficient memory to handle the size proposed.
- The N2 value is the one that the TE will use and is not negotiable; the ~~MS~~UE will insert its own N2 value.
- The ~~MS~~UE may propose a smaller value for window size (k) if it has insufficient memory to handle the size proposed.

If the TE considers the response from the ~~MS~~UE to be acceptable the TE will start to establish the DLC in accordance with the procedures of subclause 5.3.1. If the response is not acceptable the TE may initiate another parameter negotiation command with revised parameters or pass the failure information to a higher layer.

If an incoming call arrives at the ~~MS~~UE from the network for which no DLC has been set up, the ~~MS~~UE may initiate the parameter negotiation procedure and set up a DLC. This situation should not occur in practice since a TE will generally set up DLCs for all the functions it shares with the ~~MS~~UE after the capabilities exchange. The indication of an incoming call will be through an 07.07 or 07.05 result code.

5.4.6.3.2 Power Saving Control (PSC)

(see also subclause 5.4.7)

The power saving control messages use the following type field octet:

Bit	1	2	3	4	5	6	7	8
	EA	C/R	0	0	0	0	1	0

The length byte contains the value 0 and there are no value octets.

If a station wishes to enter a low-power state it transmits a power saving control command; the other station replies with a power saving control response.

If a station wishes to request that the other station enter a low-power state it sends a power saving control command; the other station replies with a power saving control response. The responding station may enter a low-power state but need not do so.

5.4.6.3.3 Multiplexer close down (CLD)

(see also subclause 5.8.2)

The multiplexer close down command is used to reset the link into normal AT command mode without multiplexing.

The multiplexer close down messages use the following type field octet:

Bit	1	2	3	4	5	6	7	8
	EA	C/R	0	0	0	0	1	1

The length byte contains the value 0 and there are no value octets.

5.4.6.3.4 Test Command (Test)

The test command is used to test the connection between ~~MS~~UE and the TE. The length byte describes the number of values bytes, which are used as a verification pattern. The opposite entity shall respond with exactly the same value bytes.

The type field octet has the following format:

Bit	1	2	3	4	5	6	7	8
	EA	C/R	0	0	0	1	0	0

5.4.6.3.5 Flow Control On Command (FCon)

The flow control command is used to handle the aggregate flow. When either entity is able to receive new information it transmits this command.

The length byte contains the value 0 and there are no value octets

The type field octet has the following format:

Bit	1	2	3	4	5	6	7	8
	EA	C/R	0	0	0	1	0	1

5.4.6.3.6 Flow Control Off Command (FCoff)

The flow control command is used to handle the aggregate flow. When either entity is not able to receive information it transmits the FCoff command. The opposite entity is not allowed to transmit frames except on the control channel (DLC=0).

The length byte contains the value 0 and there are no value octets

The type field octet has the following format:

Bit	1	2	3	4	5	6	7	8
	EA	C/R	0	0	0	1	1	0

5.4.6.3.7 Modem Status Command (MSC)

It is desired to convey virtual V.24 control signals to a data stream, this is done by sending the MSC command. The MSC command has one mandatory control signal byte and an optional break signal byte. This command is only relevant when the basic option is chosen.

This command shall be sent prior to any user data after a creation of a DLC.

Command	Length	DLCI	V.24 signals	Break Signals (optional)

The length byte contains the value 2 or 3 and there are 2 or 3 value octets.

Both the DTE and DCE uses this command to notify each other of the status of their own V.24 control signals. The length of the Modem Status Command is either 4 or 5 bytes depending on the break signal.

The command field octet has the following format:

Bit	1	2	3	4	5	6	7	8
	EA	C/R	0	0	0	1	1	1

The C/R bit is used to indicate if it is a Modem Status Command or Modem Status Response.

Every time the signals change, the DTE or DCE sends this command to indicate the current status of each signal. When a DTE or DCE receives a Modem Command it always sends a Response back. The mappings of the V.24 signals to the bits in the control signal octet for the receiver and sender are given in tables 6 and 7, respectively.

In a Modem Status Command it is the status of the sender's own V.24 signals that shall be sent, but in a Response it is copy of the V.24 signals that are received from the Command frame that shall be returned.

The DLCI field identifies the specific DLC to which the command applies. Bit 2 is always set to 1 and the EA bit is set according to the description in subclause 5.2.1.2.

Bit No.	1	2	3	4	5	6	7	8
	EA	1		D	L	C	I	

Figure 9: Format of Address Field

The DLCI field is followed by the control signals field which contains a representation of the state of the signals in accordance with Figure 10. The use of the extension bit allows other octets to be added to cater for other circumstances. At present, an optional second octet is defined for handling the transmission of break signals.

Bit No	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Signal	EA	FC	RTC	RTR	reserved 0	reserved 0	IC	DV

Figure 10: Format of control signal octet

Description of the control signal byte:

Bit 1. The EA bit is set to 1 in the last octet of the sequence; in other octets EA is set to 0. If only one octet is transmitted EA is set to 1.

Bit 2.Flow Control (FC). The bit is set to 1(one) when the device is unable to accept frames.

Bit 3. Ready To Communicate (RTC). The bit is set to 1 when the device is ready to communicate.

Bit 4. Ready To Receive (RTR). The bit is set to 1 when the device is ready to receive data.

Bit 5. Reserved for future use. Set to zero by the sender, ignored by the receiver.

Bit 6. Reserved for future use. Set to zero by the sender, ignored by the receiver.

Bit 7. Incoming call indicator (IC). The bit is set to 1 to indicate an incoming call.

Bit 8. Data Valid (DV). The bit is set to 1 to indicate that valid data is being sent.

The control byte is mapped to V.24 signals according to the tables below:

Table 6: Mapping from the control signal octet by a receiving entity

Control Signal Byte	DTE receiving		DCE receiving	
bit number, name	signal	V.24 circuit	signal	V.24 circuit
3, RTC	DSR	107	DTR	108/2
4, RTR	CTS	106	RFR (note)	133
7, IC	RI	125	-ignored	-
8, DV	DCD	109	-ignored	-

NOTE. Circuit 133, RFR (Ready for Receiving) is commonly assigned to the connector pin that is alternatively used for circuit 105, RTS. It is sometimes referred to by that name.

Table 7: Mapping to the control signal octet by a sending entity

Control Signal Byte	DTE sending		DCE sending	
bit number, name	signal	V.24 circuit	signal	V.24 circuit
3, RTC	DTR	108/2	DSR	107
4, RTR	RFR (note)	133	CTS	106
7, IC	always 0-	-	RI	125
8, DV	always 1-	-	DCD	109

NOTE Circuit 133, RFR (Ready for Receiving) is commonly assigned to the connector pin that is alternatively used for circuit 105, RTS. It is sometimes referred to by that name.

If a station is unable to transmit frames because of flow control but wishes to stop accepting further frames itself, it may still send frames containing no user data (i.e. Only the control signal octet and, optionally, the break signal octet) in order to signal flow control.

The EA bit is set to 1 in the last octet of the sequence; in other octets EA is set to 0. If only one octet is transmitted EA is set to 1.

Bit No	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Signal	EA	B1	B2	B3	L1	L2	L3	L4

Figure 11: Format of Break signal octet (Optional)

The break signal octet carries information about a break signal detected in the data stream for the DLC. The meanings of the bits are shown in Table 8.

Table 8: Break signal octet meanings

Bit	Value	Meaning
B1	1	Octet encodes a break signal
	0	Octet does not encode a break signal
B2	0	reserved: set to 0 by sender, ignored by receiver
B3	0	reserved: set to 0 by sender, ignored by receiver
L1-L4	4-bit value	Length of break in units of 200ms

L1 is the least significant bit and L4 is the most significant bit of the break length.

When a station receives a break octet it shall process the information and pass it on in an appropriate way. This is outside the scope of this Specification.

5.4.6.3.8 Non Supported Command Response (NSC)

This response is sent whenever a command type is not supported by the receiving entity.

The length byte contains the value 1 and there is one value octets.

The type field octet has the following format:

Bit	1	2	3	4	5	6	7	8
	EA	C/R	0	0	1	0	0	0

The value octet contains the Command Type of the non supported command.

The value octet has the following format:

Bit	1	2	3	4	5	6	7	8
	EA	C/R	Command Type					

The C/R bit (in the value octet above) shall be set to the same value as the C/R bit in the type field octet of the not supported command frame.

5.4.6.3.9 Remote Port Negotiation Command (RPN)

This command is optional.

This command is used for set the remote port communication settings.

All devices must assure that the communication settings are correctly set, prior sending data. There are default values assigned on all parameters, if no negotiation is performed, the default value is chosen.

During a connection, a device must send the RPN whenever the communication settings are changed. The same applies for the Port Line Status.

Command RPN	Length 1 or 8	Value octet1 optional (DLCI)	Value octet2 optional	Value octet3 optional	Value octet4 optional	Value octet5 optional	Value octet6 optional	Value octet7 optional	Value octet8 optional

The Remote Port Negotiation Command use the following type field octet:

Table 9: Type field octet

Bit	1	2	3	4	5	6	7	8
	EA	C/R	0	0	1	0	0	1

The length byte contains the value 1 or 8 and there are one or eight value octets.

Table 10: DLCI octet

Bit No.	1	2	3	4	5	6	7	8
	EA	1		D	L	C	I	

Bit 2 in the DLCI octet is not used and always set to 1, the EA bit is according to the description in subclause 5.2.1.2. The DLCI field indicated which DLC the command is applied to.

Table 11: Port Value Octets

Value Octet	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Bit 8
2	B1	B2	B3	B4	B5	B6	B7	B8
3	D1	D2	S	P	PT1	PT2	res	res
4	FLC1	FLC2	FLC3	FLC4	FLC5	FLC6	res	res
5	XON1	XON2	XON3	XON4	XON5	XON6	XON7	XON8
6	XOF1	XOF2	XOF3	XOF4	XOF5	XOF6	XOF7	XOF8
7	PM1	PM2	PM3	PM4	PM5	PM6	PM7	PM8
8	PM9	PM10	PM11	PM12	PM13	PM14	PM15	PM16

A device transmits a remote port negotiation command to the other device with the fields set to the desired values with the parameter mask indicating which parameters are set..

When the remote port negotiation command is received, the responding station replies according to the following rules:

The DLCI value may not be changed.

The receiver may accept the Port Value Octet bits proposed by the sender, and reply with a respons with the parameter mask set to 1 for all the parameters accepted. If the receiver does not support any of the proposed values, it replies with the parameter mask set to zero for the parameters not supported. For those parameters with the parameters mask set to 1, the new value is accepted and used.

If the receiver does not support any of the proposed values indicated by the parameter mask, the receiver replies with the Remote Parameter Negotiation response with the parameter mask set to zero.
If only one value byte is included in the command, it is interpreted as a request, and the receiver shall respond with the current Port Values setting.

If the sender considers the response to be acceptable, that is, the bits match, the sender will start to use the DLC according to the Port Value Octets. If the response is not acceptable the sender may initiate another remote port negotiation command with revised parameters until a final agreement is reached or pass the failure information to a higher layer.

The B1-B8 indicates the baudrate, see table below:

Table 12: Meaning of B-bits

Meaning	B1	B2	B3	B4	B5	B6	B7	B8
2400 bit/s	0	0	0	0	0	0	0	0
4800 bit/s	1	0	0	0	0	0	0	0
7200 bit/s	0	1	0	0	0	0	0	0
9600 bit/s	1	1	0	0	0	0	0	0
19200 bit/s	0	0	1	0	0	0	0	0
38400 bit/s	1	0	1	0	0	0	0	0
57600 bit/s	0	1	1	0	0	0	0	0
115200 bit/s	1	1	1	0	0	0	0	0
230 400 bit/s	0	0	0	1	0	0	0	0

All other values of the B-bits are reserved.

The default value is 1100 0000 (9600).

The D1-D2 indicates the number of data bits:

D1, D2

00 5 bits

01 6 bits

10 7 bits

11 8 bits - default

The S bit indicate number of stop bits: S=0: 1 stop bit, S=1: 1,5 stop bits. Default value = 0 (1 stop bit)

The P bit indicate the parity. P=0: no parity, P=1: parity. Default value = 0 (no parity)

The PT1 - PT2 indicates the parity type:

PT1,PT2

00 odd parity

01 even parity

10 mark parity

11 space parity

FLC1-FLC6: (Default value=0, no flow control)

Bit1 XON/XOFF on input

Bit2 XON/XOFF on output

Bit3 RTR on input

Bit4 RTR on output

Bit5 RTC on input

Bit6 RTC on output

Note. The RTR is mapped to either CTS (circuit 106) or RFR (circuit 133). The RTC is mapped to either DTR (circuit 108/2) or DSR (circuit 107). (Circuit 133, RFR(Ready for Receiving) is commonly assigned to the connector pin that is alternatively used for circuit 105, RTS. It is sometimes referred to by that name)

XON1-XON8: XON character (default DC1)

XOF1-XOF8: XOFF character.(default DC3)

PM1-PM8: Parameter mask

The parameter mask is used to indicate which parameters in the Remote Port Negotiation command are negotiated. For a command, the parameter mask shall be interpreted as follows:

0=no change

1= change.

For a response the following values applies:

0=not accepted proposal

1= accepted proposal, and the new values are used.

The bit mask for the value octets 7 and 8 are shown below:

Bit1 bit rate

Bit2 data bits

Bit3 stop bits

Bit4 Parity

Bit5 parity type

Bit6 XON character

Bit7 XOF character

Bit8 reserved

PM9-PM16: Parameter mask continued

Bit1 XON/XOFF on input

Bit2 XON/XOFF on output

Bit3 RTR on input

Bit4 RTR on output

Bit5 RTC on input

Bit6 RTC on output

All reserved values are set to 0 (zero) by the sender and ignored by the receiver.

5.4.6.3.10 Remote Line Status Command(RLS)

This command is optional.

This command is used for indicate remote port line status.

During a connection, a device must send the RLS whenever the Remote Port Line Status are changed.

The Remote Line Status command use the following type field octet:

Table 13: Type field octet

Bit	1	2	3	4	5	6	7	8
	EA	C/R	0	0	1	0	1	0

The length byte contains the value 2 and there are two value octets.

Table 14: DLCI octet

Bit No.	1	2	3	4	5	6	7	8
	EA	C/R	DLCI					

The C/R bit in the DLCI octet is not used and always set to 1, the EA bit is according to the description in subclause 5.2.1.2.

Table 15: Remote Line Status Octets

Value Octet	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Bit 8
1	L1	L2	L3	L4	res	res	res	res

A device transmits a remote line status command to the other device with the fields set to the desired value. When the remote line status command is received, the remote device must respond with a Remote Line Status Response containing the values that it received.

The L1-L4 bits indicates the Line Status. If L1 is set to 0, no error have occurred. L1 = 1 indicates the following errors:

L2-L4:

100 Overrun Error - Received character overwrote an unread character

010 Parity Error - Received character's parity was incorrect

001 Framing Error - a character did not terminate with a stop bit

The res bits are set to zero for the sender and ignored by the reciever.

5.4.6.3.11 Service Negotiation Command (SNC)

This command is used to query and set a specific service on a specific DLC. It is for instance used to set specific digital voice types.

In some situations it is not very suitable to mix AT commands and raw data on the same DLC. For those situations, special DLCs can be established and converted to carry a specific data type. Examples of situation where this is especially useful is for voice transportation, where the AT commands controlling the connection (for instance for multiparty) are transported on one DLC and voice data carried by another DLC. This mechanism can be seen as an alternative to sending escape sequences with AT commands in the data flow. If this command is not used, the DLC is by default set to normal AT command mode. If this command is used, the DLC indicated in the DLCI octet, is converted to carry the specific data type. The originator of this command may also query the specific service on each DLCI.

The service negotiation messages use the following format:

Table 16: Service Negotiation Command format

Byte No.	1	2	3	4	5
	Type field code	Length	DLCI	Service Value octet (optional)	Voice Codec Value octet (optional)

The type field octet:

Table 17: Type field octet

Bit	1	2	3	4	5	6	7	8
	EA	C/R	0	0	1	0	1	1

The length byte contains the value 1 or 3 and there are one or three value octets.

Table 18: DLCI octet

Bit No.	1	2	3	4	5	6	7	8
	EA	C/R		D	L	C	I	

The C/R bit in the DLCI octet is always set to 1 and the EA bit is according to the description in subclause 5.2.1.2.

Table 19: Service Value Octets

Value Octet	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Bit 8
1	EA	S1	S2	S3	S4	S5	S6	S7

The EA bit is according to the description in subclause 5.2.1.2.

Table 20: Voice Codec Value Octets

Value Octet	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Bit 8
1	EA	V1	V2	V3	V4	V5	V6	V7

The EA bit is according to the description in subclause 5.2.1.2

Table 21: Service Value Bits

Value Bit	Service
S1	Data
S2	Voice
S3	Reserved
S4	Reserved
S5	Reserved
S6	Reserved
S7	Reserved

Table 22: Voice Codec Value Bits

Value Bit	Service
V1	Voice (coded – GSM 06.21)
V2	Voice (coded - PCM 64 kbit/s U-law)
V3	Voice (coded ADPCM 32kbit/s) ITU-T G.726
V4	Voice (coded halfrate)
V5	Voice (coded - PCM 64kbit/s A-law)
V6	Voice (coded PCM 128kbit/s)
V7	Reserved

The sender transmits a service negotiation command with the fields set to the values for all possible services it may use for the particular DLC. The receiver replies with a service negotiation response with its selected set of values. The following rules must be observed by the receiver in constructing its response:

The DLCI value may not be changed.

The receiver may select a subset of the services proposed by the sender, but not a superset. It is the receiver's selection that is the valid one. If the receiver does not support any of the proposed services, it replies with the service byte set to zero.

The Voice Codec Value Octet is always present even though data service is chosen. In this case, the Voice Codec Value Octet V1-V7 bits are set to zero,

A zero value means standard AT command mode.

If no value bytes are included in the command, it is interpreted as a request, and the receiver shall respond with all possible services.

If the sender considers the response to be acceptable, that is, the service bits match, the sender will start to use the DLC according to the services. If the response is not acceptable the sender may initiate another parameter negotiation command with revised parameters until a final agreement is reached or pass the failure information to a higher layer.

If no service negotiation has been performed on the DLCs, it operates in standard AT mode. In this case, an incoming call is indicated on that DLC.

The sender shall set a reserved bit to value 0. The receiver shall ignore a reserved bit.

5.4.7 Power Control and Wake-up Mechanisms

It is very important in many types of ~~MS~~UE and some TE that the power consumed by the equipment is minimised. This aim is often achieved by entering various power-saving states under conditions of inactivity, for example. The multiplexer system must be able to close down cleanly if either TE or ~~MS~~UE wish to enter a low-power state. This is achieved by the use of the multiplexer control channel.

If either TE or ~~MS~~UE wishes to enter a low-power state a power saving control command message is sent to the other station on the multiplexer control channel. The station receiving the message will complete the transmission of any frames in progress, report a busy or power-down condition to higher layers, freeze all timers and transmit the power saving control response message. When the station that initiated the power saving control message receives the acknowledgement it is then free to enter the reduced-power state.

Either station may send a power saving control command requesting that the other station enters a low power state. The responding station must acknowledge this command with a power saving control response message but need not obey the command to enter a low-power state. If no response is received the commanding station may repeat the command but must first use the wake-up procedure.

Either station may initiate a wake-up from the reduced power state by the transmission of the wake-up signal which consists of continuous flag characters. When the other station receives the flag characters it will wake-up (if necessary) and start sending flag characters. When the first station receives these flag characters it will stop sending flags and start transmitting the first frame. When the second station detects a valid frame it stops sending flags. The stations unfreeze their timers and continue operation as before.

If no response (continuous flags) is received to the wake-up procedure within time T3, an alarm should be raised to the higher layers and transmission of flags stops.

5.4.8 Flow Control

5.4.8.1 RTR Flow Control

Figure 12 shows a DTE connection to a DCE. The flow control scheme defined in this section also applies to DTE - DTE connections. Both ~~07.10~~27.010 entities are configured to use RTR (RFR/CTS) flow control. The flow control signal to the local application is a combination of the RTR signal from the opposite device together with three other flow control signals. The flow control signals labelled FCS1 - FCS3 are defined below:

FCS1	Bit 2 in the Modem Status Command or in the control signal octet in convergence layer type 2. Flow control per DLCI
FCS2	Aggregate flow control in ~~07.10~~27.010 via the control channel commands Fcon and Fcoff (basic option) or XON/XOFF in the advance option.
FCS3	~~07.10~~27.010 internal buffer management (implementation specific)

The flow control signals FCS1-3 are combined with the RTR signal from the opposite ~~07.10~~27.010 instance to create the local RTR input signal. E.g. the expression for the CTS signal for the emulated DTE serial port is:

DTE.CTS=DCE.RTR AND FCS1 AND FCS2 AND FCS3

The flow control emulator duplicates the outgoing RTR signal in bit 2 (FC) and bit 4 (RTR) in the modem status command (when convergence layer 1,3 and 4 is used) or in bit 2 (FC) and bit 4 (RTR) in the control signal octet (when the convergence layer 2 is used).

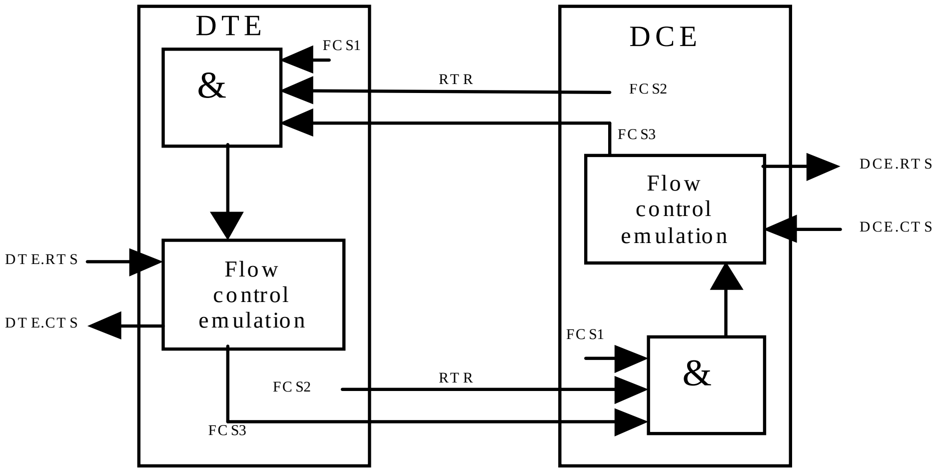


Figure 12: RTR Flow Control

5.4.8.2 XON/XOFF Flow Control

Some ~~07.10~~27.010 instance may detect XON/OFF characters coming from the local application when XON/XOFF is enabled. In this case the characters are acted upon, but not forwarded to the opposite ~~07.10~~27.010 instance i.e. the XON/XOFF characters are filtered out and the flow control signal is transferred as a ~~07.10~~27.010 flow signal, see figure 13.

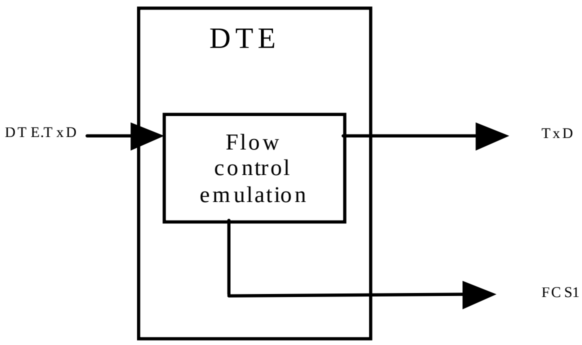


Figure 13: XON/XOFF Flow Control on input

if XON/XOFF flow control is enabled on output then the ~~07.10~~27.010 should use XON/XOFF characters to exercise flow control to the local application i.e XON/XOFF characters are inserted into the data stream depending on the ~~07.10~~27.010 flow control signals, see figure 14.

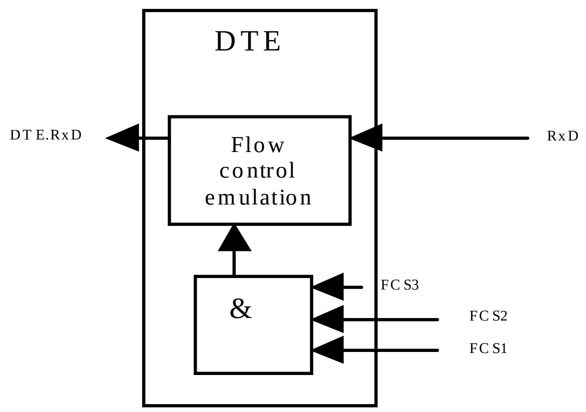


Figure 14: XON/XOFF Flow Control on input

5.5 Convergence Layers

Convergence layers are defined to permit data which has implied structure to be conveyed through the multiplexer without losing the structure or other parameters which are associated with the data stream. Common uses of convergence layers are to carry the state of V.24 control signals through a DLC or to ensure that the boundaries of a coded voice frame are preserved.

Convergence layers apply to data whether it is carried by error recovery mode or non-error recovery mode procedures.

The use of particular convergence layers is implicitly linked to the DLCIs used but may be negotiated away from these defaults by the use of the multiplexer control channel.

5.5.1 Type 1 - Unstructured Octet Stream

Data which consists of an unstructured sequence of octets, for example, 64 kbit/s uncoded voice or normal asynchronous data without V.24 control signals, is inserted directly into the I-field. In this case, it could be said that the convergence layer is null.

Type 1 is the default convergence layer for each DLC.

5.5.2 Type 2 - Unstructured Octet Stream with flow control, break signal handling and transmission of V.24 signal states

If it is desired to convey virtual V.24 control signals associated with a data stream the first octet of each I-field contains a representation of the state of the signals in accordance with Figure 15. The use of the extension bit allows other octets to be added to cater for other circumstances. At present, an optional second octet is defined for handling the transmission of break signals.

The mappings of the V.24 signals to the bits in the control signal octet for the receiver and sender are given in tables 23 and 24, respectively.

Bit No	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Signal	EA	FC	RTC	RTR	reserved 0	reserved 0	IC	DV

Figure 15: Format of control signal octet

Description of the control signal byte:

Bit 1. The EA bit is set to 1 in the last octet of the sequence; in other octets EA is set to 0. If only one octet is transmitted EA is set to 1.

Bit 2. DLC (frame) Flow Control (FC). In non-ERM, it is set to 1 when the device is unable to accept frames . In ERM, it is always set to 0 by the sender and ignored by the receiver.

Bit 3. Ready To Communicate (RTC). The bit is set to 1 when the device is ready to communicate.

Bit 4. Ready To Receive (RTR). The bit is set to 1 when the device is ready to receive data.

Bit 5. Reserved for future use. Set to zero by the sender, ignored by the receiver.

Bit 6. Reserved for future use. Set to zero by the sender, ignored by the receiver.

Bit 7. Incoming call indicator (IC). The bit is set to 1 to indicate an incoming call.

Bit 8. Data valid (DV). The bit is set to 1 to indicate that valid data is being sent.

The control byte is mapped to V.24 signals according to the tables below:

Table 23: Mapping from the control signal octet by a receiving entity

Control Signal Byte	DTE receiving		DCE receiving	
bit number, name	signal	V.24 circuit	signal	V.24 circuit
2, FC	DLC flow control	-	DLC flow control	-
3, RTC	DSR	107	DTR	108/2
4, RTR	CTS	106	RFR (note)	133
7, IC	RI	125	ignored	-
8, DV	DCD	109	ignored	-
NOTE Circuit 133, RFR (Ready for Receiving) is commonly assigned to the connector pin that is alternatively used for circuit 105, RTS. It is sometimes referred to by that name.				

Table 24: Mapping to the control signal octet by a sending entity

Control Signal Byte	DTE sending		DCE sending	
bit number, name	signal	V.24 circuit	signal	V.24 circuit
2, FC	frame flow control	-	frame flow control	-
3, RTC	DTR	108/2	DSR	107
4, RTR	RFR (note)	133	CTS	106
7, IC	always 0	-	RI	125
8, DV	always 1	-	DCD	109
NOTE. Circuit 133, RFR (Ready for Receiving) is commonly assigned to the connector pin that is alternatively used for circuit 105, RTS. It is sometimes referred to by that name.				

In non-error recovery mode, the FC bit provides frame flow control for the DLC.If a station is unable to accept further frames, for example, because of buffer management issues, it shall set FC to 1. When the station is again able to receive frames it shall set FC to 0. If a station receives a frame with FC set to 1 it shall cease transmitting frames until it receives a frame with FC set to 0.

If a station is unable to transmit frames because of flow control but wishes to stop accepting further frames itself, or to signal a change in the control signals or a break condition it may still send frames containing no user data (i.e. containing only the control signal octet and, optionally, the break signal octet).

In error recovery mode the FC bit is not used and shall be set to 0 by the sender and ignored by the receiver. If a station has been prevented from sending I frames, for example, by receiving a RNR frame, it may still send a UI or UIH frame containing no user data if it wishes to signal a change in the control signals or a break condition.

The EA bit is set to 1 in the last octet of the sequence; in other octets EA is set to 0. If only one octet is transmitted EA is set to 1.

Bit No	1	2	3	4	5	6	7	8
Signal	EA	B1	B2	B3	L1	L2	L3	L4

Figure 16: Format of Break signal octet

The break signal octet carries information about a break signal detected in the data stream for the DLC. The meanings of the bits are shown in Table 25

Table 25: Break signal octet meanings

Bit	Value	Meaning
B1	1	Octet encodes a break signal
	0	Octet does not encode a break signal
B2	1	Discard data in buffers
	0	Do not discard data in buffers
B3	1	Transmit break signal onwards as soon as possible
	0	Transmit break signal onwards in sequence
L1-L4	4-bit value	Length of break in units of 200ms

L1 is the least significant bit and L4 is the most significant bit of the break length.

When a station receives a break octet it shall process the information and pass it on in an appropriate way. This is outside the scope of this Specification.

The remaining octets of the I-field contain data for that DLC.

5.5.3 Type 3 - Uninterruptible Framed Data

An example of uninterruptible framed data is coded voice data made up of a sequence of voice frames. It is important that coded voice frames reach the voice decoder with the frame structure intact and with the shortest possible delay. The simplest way of ensuring this is to map one complete voice frame into one I-field. This frame shall not be shortened during transmission even if data of higher priority is waiting.

At the transmitter each frame of data is inserted into the I field of an I frame, UI frame or UIH frame. The data shall not be spread over more than one frame and data from other frames must not be included in the I field. The receiver handles the data as a complete frame and passes it on as a complete frame.

Coded voice data should be transmitted using UI frames or UIH frames because the delays associated with re-transmissions are usually unacceptable.

5.5.4 Type 4 - Interruptible Framed Data

This type of convergence layer is used might be used to convey data which has an implied structure but where the delay is not as important as Type 3. The structured data may be segmented across several frames and re-assembled at the other station. PPP-framed IP data is an example of the type of data that could be carried over a Type 4 convergence layer.

The first octet of every Type 4 frame is a control octet and is defined in Figure 17.

Bit No	1	2	3	4	5	6	7	8
Signal	EA	-	-	-	-	-	B	F

Figure 17: Format of Type 4 octet

The EA bit is for future expansion if more than one octet is needed. It is set to 1 in the case described here.

The B and F bits are used to indicate whether the frame is the first frame in a sequence, a middle frame or the last frame. The meanings of the bits are as shown in Table 26.

Table 26: Meaning of B and F bits

B	F	Meaning
1	0	First frame of a sequence
0	0	Middle frame of a sequence
0	1	Last frame of a sequence
1	1	Data is contained entirely within one frame

NOTE 1: PPP-framed IP data can be carried using a Type 1 convergence layer if other framing structures, such as a layer 2 protocol, have already been included in the data stream.

NOTE 2: If a frame is coded as being the last frame or that all the data is contained within one frame, that frame may then not be shortened because shortening would make the meaning of the header incorrect. It may be advisable to construct the last frame of a sequence such that it contains no data and avoid the use of the 11 code if frame shortening is desired.

5.6 DLCI Values

All DLCs use a type 1 convergence layer by default; the use of other layers may be negotiated using the multiplexer control channel.

Table 27: DLCI Assignments

Usage	DLCI number (decimal)	Priority
Multiplexer control channel	0	0
AT commands (07.07 and 07.05)	1-7	7
AT commands (07.07 and 07.05)	8-15	15
AT commands (07.07 and 07.05)	16-23	23
AT commands (07.07 and 07.05)	24-31	31
AT commands (07.07 and 07.05)	32-39	39
AT commands (07.07 and 07.05)	40-47	47
AT commands (07.07 and 07.05)	48-55	55
AT commands (07.07 and 07.05)	56-61	61
Reserved	62-63	

DLCI value 62 is reserved and must be allocated for ETSI purposes of the BOFC and the EOFC in Basic option.

DLCI value 63 is reserved and must not be allocated for ETSI purposes because of the special meaning in HDLC.

DLCI value 0 is reserved for the control channel.

The priority values in Table 27 apply in the absence of an explicit DLC priority assignment message.

5.7 System Parameters

The following system parameters are defined for the multiplexer. T1, N1, N2 and k may be negotiated by use of the multiplexer control channel or the default values given here should be used. T2 and T3 are set with the AT+CMUX command.

5.7.1 Acknowledgement Timer (T1)

The acknowledgement timer governs the amount of time that a station will wait for an acknowledgement before resorting to other action (e.g. transmitting a frame). The two stations may operate with different values of T1.

The units are hundredths of a second. Times of up to 2.55 seconds may be used.

The default value is 100 ms and the minimum is 10 ms.

5.7.2 Maximum Frame Size (N1)

N1 defines the maximum number of octets that that may be contained in an information field. It does not include octets added for transparency purposes.

The default value is 64 octets when the advanced option activated and 31octets when it is not activated. The range is 1 to 32768 octets.

NOTE: The maximum frame size should be chosen carefully particularly if a Type 2 convergence layer is being used. The frame must be large enough to contain a complete protocol frame.

5.7.3 Maximum number of retransmissions (N2)

N2 defines the maximum number of times that a station re-attempt a procedure requiring a response. The two stations may operate with a different value of N2.

The default value is 3 and the range is 0-255.

5.7.4 Window Size (k)

The window size parameter (k) defines the maximum number of I frames that a DLC can have outstanding (i.e. unacknowledged). Identical values need not be used for each direction. The window size may not be larger than 7.

This parameter is only applicable when Error Recovery Option is activated. See clause 6.

The default value is 2 and the range is 1-7

5.7.5 Response Timer for multiplexer control channel (T2)

The T2 timer is the amount of time the multiplexer control channel waits before re-transmitting a command.

T2 must be greater than T1. The units are hundredths of a second. Times of up to 2.55 seconds may be used.

The default value is 300 ms and minimum 20 ms.

5.7.6 Response Timer for wake-up procedure(T3)

The T3 timer is the amount of time the transmitting station of a power wake-up command waits before raising an alarm when no response is received. The units are seconds. Times of up to 255 seconds may be used.

The default value is 10 s and minimum 1 s.

5.8 Start-up and close-down of multiplexer

5.8.1 Start-up procedure

Multiplexer operation is started by the use of the +CMUX command (see 3G TS~~GSM~~ ~~0~~27.007 [4]). This command instructs the multiplexer to start up the multiplexer control channel (see subclause 5.8.1) using either error recovery mode or non-error recovery mode. The TE multiplexer initiates the establishment of the multiplexer control channel by sending a SABM frame on DLCI 0 using the procedures of subclause 5.4.1.

Once the multiplexer channel is established other DLCs may be established using the procedures of subclause 5.4.1. The multiplexers may negotiate the parameters associated with each DLC prior to establishment of a DLC or may use the defaults.

5.8.2 Close-down procedure

Initiation of the close-down will come from higher layers in either the TE or ~~MS~~UE and is outside the scope of this specification. Once the command to close down is received the multiplexer will close down each DLC in turn using the procedures of subclause 5.4.2. When all DLCs (except the multiplexer control channel - DLCI 0) are closed down (disconnected mode) the multiplexer that initiated close-down procedure will send a close-down message on the multiplexer control channel. When this message is acknowledged both stations will revert to the non-multiplexed mode. If no response is received to the close-down command within time T2, the initiating station may retransmit it but must close down if no response message is received in time T3.

After closing of the multiplexer protocol, the ~~MS~~UE and TE should revert to normal AT mode.

6 Error Recovery Mode Option

When the Advanced option is selected an error recovery mechanism may be used for better security. The error-recovery mode is optional and is intended for those cases where the quality of the TE-~~MS~~UE link can not be guaranteed and/or when the integrity of the data to be transmitted is critical. Some DLCs may use error recovery mode and some use non-error recovery mode on the same link.

error recovery mode uses I frames to carry the data; the procedures used are defined below.

New frames types and procedures are added.

6.1 Frame Types

Table 28: Coding of Control Field

Frame Type	1	2	3	4	5	6	7	8
I (Information)	0	N(S)			P/F	N(R)		
RR (Receive Ready)	1	0	0	0	P/F	N(R)		
RNR (Receive Not Ready)	1	0	1	0	P/F	N(R)		
REJ (Reject)	1	0	0	1	P/F	N(R)		

N(R) and N(S) are receive and send sequence numbers, respectively. They are described later in the present document.

6.1.1 Information transfer, I, command and response

The function of the information, I, command and response shall be to transfer sequentially numbered frames, each containing an information field, across a data link.

The encoding of the I command/response control field shall be as shown in table 28.

The I frame control field shall contain two sequence numbers:

- N(S), send sequence number, which shall indicate the sequence number associated with the I frame; and
- N(R), receive sequence number, which shall indicate the sequence number (as of the time of transmission) of the next expected I frame to be received, and consequently shall indicate that the I frames numbered up to N(R) - 1 inclusive have been received correctly.

6.1.2 Receive ready, RR, command and response

The receive ready, RR, frame shall be used by a station to

a) indicate that it is ready to receive an I frame; and

b) acknowledge previously received I frames numbered up to N(R) - 1 inclusive.

When transmitted, the RR frame shall indicate the clearance of any busy condition that was initiated by the earlier transmission of an RNR frame by the same data station. See subclause 6.2.2.5.1.

6.1.3 Receive not ready, RNR, command and response

The receive not ready, RNR, frame shall be used by a station to indicate a busy condition; i.e., temporary inability to accept subsequent I frames. I frames numbered up to N(R) - 1 inclusive shall be considered as acknowledged. The I frame numbered N(R) and any subsequent I frames received, if any, shall not be considered as acknowledged; the acceptance status of these frames shall be indicated in subsequent exchanges

6.1.4 Reject, REJ, command and response

The reject, REJ, frame shall be used by a station to request retransmission of I frames starting with the frame numbered N(R). I frames numbered N(R) - 1 and below shall be considered as acknowledged. Additional I frames awaiting initial transmission may be transmitted following the retransmitted I frame(s).

With respect to each direction of transmission on the data link, only one REJ exception condition from a given station to another station shall be established at any given time. A REJ frame shall not be transmitted until an earlier REJ exception condition has been cleared as indicated in subclause 6.3.3.5.2.2.

The REJ exception condition shall be cleared (reset) upon the receipt of an I frame with an N(S) equal to the N(R) of the REJ frame.

6.2 Procedure and State

6.2.1 Frame state variables and sequence numbers

6.2.1.1 General

Each station shall maintain an independent send state variable V(S) for the frames it transmits and an independent receive state variable V(R) for the I frames it sends to and receives from another station.

6.2.1.2 Send state variable V(S)

The send state variable denotes the sequence number of the next in-sequence I frame to be transmitted. The send state variable can take the value 0 to 7 inclusive. The value of the send state variable shall be incremented by one with each successive I frame transmission, but shall not exceed N(R) of the last received frame by more than 7.

6.2.1.3 Send sequence number N(S)

Only I frames shall contain N(S), the send sequence number of transmitted frames. Prior to transmission of an I frame, N(S) shall be set equal to the value of the send state variable.

6.2.1.4 Receive state variable V(R)

The receive state variable denotes the sequence number of the next I frame expected to be received. The receive state variable can take the value 0 to 7 inclusive. The value of the receive state variable shall be incremented by one on receipt of an error-free I frame whose send sequence number N(S) equals the receive state variable.

6.2.1.5 Receive sequence number N(R)

All frames which contain N(R) (see Table 28) shall indicate the N(S) sequence number of the next expected I frame. Prior to transmission of a frame containing N(R), the N(R) shall be set equal to the current value of the receive state variable. The N(R) indicates that the station transmitting the N(R) has correctly received all I frames numbered up to N(R) - 1 inclusive.

6.2.1.6 Use of the P/F bit to assist in error recovery

As the P and F bits set to 1 are always exchanged as a pair (for every P bit there shall be one F bit, and another P bit shall not be issued until the previous P bit has been matched with an F bit, and, similarly, another F bit shall not be issued until another P bit is received), the N(R) contained in a received frame with a P bit or F bit set to 1 can be used to detect that I frame retransmission is required. This capability provides early detection of I frames not received by the remote data station and indicates the frame sequence number where retransmission shall begin. This capability is referred to as checkpointing. The N(R) of a correctly received frame shall acknowledge previously transmitted I frames to N(R) - 1 inclusive.

The N(R) of a received I, RR or RNR response frame which has the F bit set to 1 shall cause the receiving station to initiate appropriate error recovery if the N(R) does not acknowledge at least all I frames transmitted by the receiving station previous to, and concurrent with, the last frame which was transmitted by the receiving station with the P bit set to 1.

6.2.2 Exchange of information (I) frames

6.2.2.1 Sending I frames

The control field format shall be as defined in subclause 6.1 for an I frame, with N(S) set to the value of the send state variable V(S) and with N(R) set to the value of the receive state variable V(R). Following data link set-up, both V(S) and V(R) shall be set to zero. The maximum length of the information field in I frames shall be parameter N1 (see subclause 5.7.2). The default value of N1 is 256 octets; other values may be negotiated by use of the multiplexer control channel.

If a station is ready to send an I frame numbered N(S), where N(S) is equal to the last received acknowledgement plus 7, the station shall not send the I frame but shall follow the procedures described in subclause 5.4.5.

The decision whether to send an I frame as a command or as a response, i.e., to use the C/R bit to indicate a P or an F bit, respectively, shall depend on the need to acknowledge a received P bit set to 1 by transmitting a response with the F bit set to 1.

6.2.2.2 Receiving I frames

After a station receives correctly an I frame [i.e., N(S) equals the value of the receive state variable V(R)] that it can accept, the station shall increment its receive state variable V(R), and, at its next opportunity to send, take one of the following actions:

- if information is available for transmission and the other station is ready to receive, it shall act as described in subclause 6.2.2.1 and acknowledge the received I frame(s) by setting N(R) in the control field of the next transmitted I frame to the value of V(R); or

- if information is not available for transmission, but the station is ready to receive I frames, the station shall send an RR frame and acknowledge the received I frame(s) by setting N(R) to the value of V(R); or

- if the station is not ready to receive further I frames, the station may send an RNR frame and acknowledge the received I frame(s) by setting the N(R) to the value of V(R).

If the station is unable to accept the correctly received I frame(s), V(R) shall not be incremented. The station may send an RNR frame with the N(R) set to the value of V(R).

The I or supervisory frame transmitted will be either a command or a response depending on whether a P bit set to 1 or an F bit set to 1 transmission, respectively, is required. If the transmission of a P bit or F bit set to 1 is not required, the acknowledgement frames may be either commands or responses.

6.2.2.3 Reception of incorrect frames

If a frame is received with an incorrect FCS, it shall be discarded.

If an I frame is received with a correct FCS but with an incorrect N(S), the receiving station shall ignore the N(S) field and discard the information field in that frame. This shall continue until the expected I frame is received correctly. The receiving station shall, however, use the P/F and N(R) indications in the discarded I frames. The station shall then acknowledge the expected I frame, when received correctly, as described in subclause 5.4.4.2.

The P/F recovery (checkpointing) shall cause the retransmission of the I frames received incorrectly, as described in subclause 6.2.1.6.

6.2.2.4 Station receiving acknowledgements

A station receiving an I, RR, or RNR frame with a valid N(R) = *x* shall treat as acknowledged all previously transmitted I frames up to and including the I frame transmitted with N(S) equal to *x* - 1.

6.2.2.5 Exception conditions and recovery

The following procedures are available to effect recovery following the detection/occurrence of an exception condition at the data link layer. The exception conditions described are those situations which may occur as the result of transmission errors, data station malfunction or operational situations.

6.2.2.5.1 Busy

The busy condition shall result when a station is temporarily unable to receive, or unable to continue to receive, I frames due to internal constraints; for example, receive buffering limitations. In this case, an RNR frame shall be transmitted with the N(R) number of the next I frame that is expected. Traffic awaiting transmission may be transmitted from the busy data station prior to, or following, the RNR frame. The continued existence of a busy condition shall be reported by retransmission of an RNR frame at each P/F frame exchange.

A data station receiving an RNR frame, when in the process of transmitting, shall stop transmitting I frames at the earliest possible time. The station shall wait for a duration of T2 before resuming transmission.

Indication that a busy condition has cleared and that I frames will now be acceptable shall be reported by the transmission of an RR, REJ, SABM, or UA frame with or without the P/F bit set to 1. Clearance of a busy condition at a station shall also be indicated by the transmission of an I frame with the F bit set to 1.

6.2.2.5.2 N(S) sequence error

An N(S) sequence error exception condition shall occur in the receiver when an I frame that is received error free (no FCS error) contains an N(S) that is not equal to the receive state variable at the receiver. The receiver shall not acknowledge (i.e., not increment its receive state variable) the frame causing the sequence error or any I frames which may follow until an I frame with the correct N(S) is received.

A station which receives one or more I frames having sequence errors, but which are otherwise error free, shall accept the control information contained in the N(R) field and the P/F bit to perform data link control functions; for example, to receive acknowledgement of previously transmitted I frames, or to cause a station to respond (P bit set to 1). Therefore, the retransmitted I frame may contain an N(R) field and/or P/F bit information that are updated and different from those contained in the originally transmitted I frame.

Following the occurrence of a sequence error, the following means are available for initiating the retransmission of lost I frames or those with errors.

6.2.2.5.3 Poll/final (P/F) bit (checkpoint) recovery

When a data station receives a frame with the P/F bit set to 1, it shall initiate retransmission of unacknowledged I frames previously transmitted with sequence numbers that are less than the V(S), send state variable, value that was current at the time of transmission of the last frame with the P/F bit, respectively, set to 1. Retransmission shall start with the oldest numbered unacknowledged I frame. I frames shall be retransmitted sequentially. New I frames may be transmitted if they become available. Such retransmission of I frames as a result of an exchange of P/F bits set to 1 is known as checkpoint retransmission.

Checkpoint retransmission shall not be initiated under the following conditions:

If a REJ command with the P bit set to 0 or 1, or a REJ response with the F bit set to 0, has been received and actioned while a P bit set to 1 was unanswered, checkpoint retransmission shall be inhibited on the next frame received with the F bit set to 1, if it would cause retransmission of the same particular I frame; i.e., same N(R) in same numbering cycle.

If a P/F bit set to 1 is received in an unnumbered format frame (SABM, UA, DISC, DM, UI or UIH), checkpoint retransmission shall be inhibited.

If, after sending a frame with the P/F bit set to 1, a data station receives an acknowledgement to that frame before receiving the corresponding frame with the P/F bit set to 1, checkpoint retransmission on the frame with the P/F bit set to 1 shall be inhibited.

If any frame with the P bit set to 1 is received, checkpoint retransmission shall be inhibited.

6.2.2.5.4 REJ recovery

The REJ command/response shall be used primarily to initiate an exception recovery (retransmission), following the detection of a sequence error, earlier than is possible by checkpoint (P/F bit) recovery; for example, if a REJ frame is immediately transmitted upon detection of a sequence error, then there is no requirement to wait for a frame with the P/F bit set to 1 in order to update V(R).

With respect to each direction of transmission on the data link, only one "sent REJ" exception condition from one station to another data station shall be established at a time. A "sent REJ" exception condition shall be cleared when the requested I frame is received or when the response/command time-out function runs out. When the data station perceives by time-out that the requested I frame has not been received, because either the requested I frame or the REJ frame was in error or lost, the REJ frame may be repeated.

A station receiving a REJ frame shall initiate sequential transmission (or retransmission) of I frames starting with the I frame indicated by the N(R) contained in the REJ frame. New I frames may be transmitted subsequently if they become available.

If retransmission beginning with a particular frame occurs due to checkpointing (see subclause 6.2.2.5.3), and a REJ frame is received which would also start retransmission with the same particular I frame [as identified by the N(R) in the REJ frame], the retransmission resulting from the REJ frame shall be inhibited.

6.2.2.5.5 SABM Command

When this command is actioned, the responsibility for all unacknowledged I frames assigned to data link control reverts to a higher layer. Whether the content of the information field of such unacknowledged I frames is reassigned to data link control for transmission or not is decided at a higher layer.

6.2.2.5.6 DISC Command

When this command is actioned, the responsibility for all unacknowledged I frames assigned to data link control reverts to a higher layer. Whether the content of the information field of such unacknowledged I frames is reassigned to data link control for transmission or not is decided at a higher layer.

Annex A (informative): Advice to TE software implementers

The multiplexing protocol allows a number of virtual channels to be established between a TE and an MT. The TE is normally responsible for establishing and clearing down each virtual channel, although the MT may autonomously clear the entire multiplexing session.

Each channel will start life as an instance of ~~GSM~~ 3G TS 2~~0~~7.007 [4], and will allow the normal AT command procedures for both 3G TS~~GSM~~ 2~~0~~7.007 [4] and ~~GSM~~3G TS 2~~0~~7.005 [3]. Any changes made to the AT register settings will be valid within the virtual channel only. If registers are saved to non-volatile memory then the changes will apply to the defaults for the AT registers and will affect new channels from that point on. Such changes will only affect other active channels if they are reset with ATZ. Changes to the phonebook or to SMS messages will, of course, be on a global basis.

The software in the TE sitting above the multiplexing protocol is recommended to establish a virtual channel and leave it “idle” for the reception of incoming calls according to responses as defined in ~~GSM~~ 3G TS ~~0~~27.007 [4]. When an incoming call arrives the software may then cause an appropriate application to become active in order to receive the incoming call. The previously “idle” channel will then be occupied with this call and so the TE software is recommended to establish an additional channel to take over from the previously-idle channel in preparation for other incoming calls or indications.

Because the ISO HDLC transparency mechanism must be used if it is supported by the ~~MS~~UE, the TE shall always try to configure the multiplexer with this transparency mechanism. If it is not supported by the ~~MS~~UE, the TE shall configure the multiplexer in the basic option.

Annex B (informative): Explanatory notes on the CRC Calculation

R(p)= remainder of p.

Message is k bits long.

$$FCS = OnesComplement\left(R\left(\frac{(x^7 + x^6 + x^5 + x^4 + x^3 + x^2 + x^1 + 1)x^k}{x^8 + x^2 + x^1 + 1} \right) \oplus R\left(\frac{(message)x^8}{x^8 + x^2 + x^1 + 1} \right) \right)$$

B.1 Example

A SABM frame on DLCI 1. Note that bits are written as they are sent on the serial port, LSB bit first and MSB bit last. No start stop bits, transparency bytes, BOFC or EOFC are included in the message. (The length octet is only included in the FCS for UI frames).

BOFC	DLC	Ctrl	FCS	EOFC
10011111	11100000	11111100	To be calculated	10011111

k=8*2=16

message=11100000 11111100

$$FCS = OnesComplement(R(\frac{11111111'00000000'00000000}{100000111})$$
$$\oplus R(\frac{11100000'11111100'00000000}{100000111})) =$$
$$OnesComplement(11010111 \oplus 10111001) = OnesComplement(01101110) = 10010001$$

B.2 Reflected bits

In the example the bits where shown as they was sent on the serial line, this is however not they way the application sees the octets, it will see MSB first and LSB last, so before calculating the FCS the octets bit order must be reversed.

BOFC	DLC	Ctrl	FCS	EOFC
0xF9	0x07	0x3F		0xF9
11111001	00000111	00111111	To be calculated	11111001

1 Reverse all bit in octets

2 Calculate FCS

3 Reverse all bits in FCS

4 Send the reversed FCS

Fortunately there is an easier way of doing the reversing of the bits, when implementing the CRC calculation using table lookup the table can be reversed.

B.3 Implementation

Implementation is very simple because the FCS will be as wide as the lookup table (8 bits). To avoid having to reverse all bits in the octets all the octets in the crc table is reversed instead.

The term $R(\frac{(x^7 + x^6 + x^5 + x^4 + x^3 + x^2 + x^1 + 1)x^k}{x^8 + x^2 + x^1 + 1})$ corresponds to initialising the FCS with 0xFF.

B.3.1 Calculate FCS for the example given earlier

First initiliaze the crc:	FCS=0xFF
Add first byte:	FCS=table[0xFF^0x07]=table[0xF8]=0xBA
Add second byte:	FCS=table[0xBA^0x3F]=table[0x85]=0x76
Ones complement the FCS:	FCS=0xFF-FCS=0xFF-0x76=0x89 (10001001)

Transmit this FCS, this will be the same as the one calculated previous after the uart has reversed the bits.

B.3.2 Check FCS for the example given earlier

First initiliaze the crc:	FCS=0xFF
Add first byte:	FCS=table[0xFF^0x07]=table[0xF8]=0xBA
Add second byte:	FCS=table[0xBA^0x3F]=table[0x85]=0x76
Add FCS:	FCS=table[0x76^0x89]=table[0xFF]=0xCF

0xCF is the reversed order of 11110011, the checksum is valid

B.3.3 The transmitter code

```
/*Init*/
unsigned char FCS=0xFF;
unsigned char len;
unsigned char p;
/*len is the number of bytes in the message, p points to message*/
while (len--) {
FCS=crctable[FCS^*p++];
}
/*Ones complement*/
FCS=0xFF-FCS;
```

B.3.4 The receiver code

```
/*Init*/
unsigned char FCS=0xFF;
unsigned char len;
unsigned char p;
/*len is the number of bytes in the message, p points to message*/
while (len--) {
FCS=crctable[FCS^*p++];
}
/*Ones complement*/
FCS=crctable[FCS^"received FCS"];
/*0xCF is the reversed order of 11110011.*/
if (FCS==0xCF) {
    /*FCS is OK*/
}
else {
    /*FCS is not OK*/
}
```

B.3.5 Reversed CRC table

```
const unsigned char  crctable[256] = {  //reversed, 8-bit, poly=0x07
    0x00, 0x91, 0xE3, 0x72, 0x07, 0x96, 0xE4, 0x75,  0x0E, 0x9F, 0xED, 0x7C, 0x09, 0x98, 0xEA, 0x7B,
    0x1C, 0x8D, 0xFF, 0x6E, 0x1B, 0x8A, 0xF8, 0x69,  0x12, 0x83, 0xF1, 0x60, 0x15, 0x84, 0xF6, 0x67,
    0x38, 0xA9, 0xDB, 0x4A, 0x3F, 0xAE, 0xDC, 0x4D,  0x36, 0xA7, 0xD5, 0x44, 0x31, 0xA0, 0xD2, 0x43,
    0x24, 0xB5, 0xC7, 0x56, 0x23, 0xB2, 0xC0, 0x51,  0x2A, 0xBB, 0xC9, 0x58, 0x2D, 0xBC, 0xCE, 0x5F,

    0x70, 0xE1, 0x93, 0x02, 0x77, 0xE6, 0x94, 0x05,  0x7E, 0xEF, 0x9D, 0x0C, 0x79, 0xE8, 0x9A, 0x0B,
    0x6C, 0xFD, 0x8F, 0x1E, 0x6B, 0xFA, 0x88, 0x19,  0x62, 0xF3, 0x81, 0x10, 0x65, 0xF4, 0x86, 0x17,
    0x48, 0xD9, 0xAB, 0x3A, 0x4F, 0xDE, 0xAC, 0x3D,  0x46, 0xD7, 0xA5, 0x34, 0x41, 0xD0, 0xA2, 0x33,
    0x54, 0xC5, 0xB7, 0x26, 0x53, 0xC2, 0xB0, 0x21,  0x5A, 0xCB, 0xB9, 0x28, 0x5D, 0xCC, 0xBE, 0x2F,

    0xE0, 0x71, 0x03, 0x92, 0xE7, 0x76, 0x04, 0x95,  0xEE, 0x7F, 0x0D, 0x9C, 0xE9, 0x78, 0x0A, 0x9B,
    0xFC, 0x6D, 0x1F, 0x8E, 0xFB, 0x6A, 0x18, 0x89,  0xF2, 0x63, 0x11, 0x80, 0xF5, 0x64, 0x16, 0x87,
    0xD8, 0x49, 0x3B, 0xAA, 0xDF, 0x4E, 0x3C, 0xAD,  0xD6, 0x47, 0x35, 0xA4, 0xD1, 0x40, 0x32, 0xA3,
    0xC4, 0x55, 0x27, 0xB6, 0xC3, 0x52, 0x20, 0xB1,  0xCA, 0x5B, 0x29, 0xB8, 0xCD, 0x5C, 0x2E, 0xBF,

    0x90, 0x01, 0x73, 0xE2, 0x97, 0x06, 0x74, 0xE5,  0x9E, 0x0F, 0x7D, 0xEC, 0x99, 0x08, 0x7A, 0xEB,
    0x8C, 0x1D, 0x6F, 0xFE, 0x8B, 0x1A, 0x68, 0xF9,  0x82, 0x13, 0x61, 0xF0, 0x85, 0x14, 0x66, 0xF7,
    0xA8, 0x39, 0x4B, 0xDA, 0xAF, 0x3E, 0x4C, 0xDD,  0xA6, 0x37, 0x45, 0xD4, 0xA1, 0x30, 0x42, 0xD3,
    0xB4, 0x25, 0x57, 0xC6, 0xB3, 0x22, 0x50, 0xC1,  0xBA, 0x2B, 0x59, 0xC8, 0xBD, 0x2C, 0x5E, 0xCF
};
```

Annex C (informative): Document Change History

TSG	TDoc	VERS	NEW_VERS	CR	REV	PHASE	CAT	WORKITEM	SUBJECT
T#4	TP-99119	2.0.0	3.0.0	New					Creation of 3GPP 27.010 v3.0.0 out of GSM 07.10 v6.3.0
T#4	TP-99124	3.0.0	3.1.0	001			A	MUX MS-TE	Clarification of how to handle the length field in basic mode
T#4	TP-99146	3.0.0	3.1.0	002			A	MUX MS-TE	Editorial corrections
T#5	TP-99177	3.1.0	3.2.0	003			A	TEI	Clarification of CR bit
T#5	TP-99177	3.1.0	3.2.0	004			A	TEI	Correction of the bits in the start and close flags of the frame in the example on Annex B

History

Document history		
V3.0.0	July 1999	TSG-T#4
V3.1.0	July 1999	TSG-T#4
V3.2.0	October 1999	TSG-T#5