3GPP TSG-T (Terminals) Meeting #13
Beijing, China, 19 - 21 September, 2001

Tdoc TP-010193

Agenda Item: 5.2.3

Source: T2

Title: "Terminal Interfaces and Capabilities" Change Requests

Document for: Approval

Spec	CR	Rev	Rel	Subject	Cat	Vers-Curr	Vers-New	T2 Tdoc	Workitem
07.07	A090		R98	Removal of +CGCLOSP and corrections due to IHOSS and OSP removal	F	7.6.0	7.7.0	T2-010706	TEI
21.904	009		R99	Corrections to References List, AMR Specifications	F	3.3.0	3.4.0	T2-010857	TEI
27.005	002		Rel-4	Conversion of GSM to 3GPP references	F	4.0.0	4.1.0	T2-010717	TEI4
27.007	069		R99	Removal of +CGCLOSP and corrections due to IHOSS and OSP removal	A	3.9.0	3.10.0	T2-010707	TEI
27.007	070		Rel-4	Removal of +CGCLOSP and corrections due to IHOSS and OSP removal	A	4.2.0	4.3.0	T2-010708	TI-ATC
27.007	071		R99	Removal of +CGCLPAD and correstions due to X.25 removal	F	3.9.0	3.10.0	T2-010709	TEI
27.007	072		Rel-4	Removal of +CGCLPAD and correstions due to X.25 removal	A	4.2.0	4.3.0	T2-010710	TI-ATC
27.010	006		Rel-4	Conversion of GSM to 3GPP references	F	4.0.0	4.1.0	T2-010716	TEI4

3GPP TSG-T2 #14
Edinburgh, Scotland
3-7 September 2001

T2-010706

CR-Form-v4

CHANGE REQUEST

⌘ **07.07** **CR** **A090** ⌘ ev **-** ⌘ Current version: **7.6.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE **X** Radio Access Network ☐ Core Network ☐

Title:	⌘	Removal of +CGCLOSP and corrections due to IHOSS and OSP removal
Source:	⌘	T2
Work item code:	⌘	TEI
Date:	⌘	2001-08-15
Category:	⌘	**F**
Release:	⌘	R98

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	It was decided at TSG-SA#8 to remove the IHOSS service from R98 and onwards (SP-000197). This CR aligns the targeted specification accordingly.
Summary of change:	⌘	This CR deletes the AT command +CGCLOSP and parameters values in +CGDCONT, +CGDATA and Request GPRS service 'D', which are related to the removed feature. The reference to this commands was already removed from 07.60 (N3-010112)
Consequences if not approved:	⌘	The specification is not aligned with the R98 02.60, 03.60 and 07.60.

Clauses affected:	⌘	3.1, 10.1.1, 10.1.6, 10.1.7, 10.2.1.1
Other specs affected:	⌘	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications
	⌘	
Other comments:	⌘	

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

3.1 Abbreviations

For the purposes of the present document, 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
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

10.1.1 Define PDP Context +CGDCONT

Table 1: +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.

10.1.6 Enter data state +CGDATA

Table 2: +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 GPRS PDP types. This may include performing a GPRS 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 and in more detail in GSM 09.61 and the specifications for the relevant PDPs. 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.

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 +CGDCONT command).

Implementation

Optional if the D (dial) command can be used to specify GPRS operation.

10.1.7 VOID~~Configure local Octet Stream PAD parameters +CGCLOSP~~

~~Table 93: 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.~~

10.2.1.1 Request GPRS service 'D'

Table 4: 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. 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 <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 then 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.

Defined Values

<GPRS_SC>: (GPRS Service Code) a digit string (value 99) which identifies a request to use the GPRS

<called_address>: a string that identifies thecalled 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 to the set command.

NOTE. V.250 (and certain communications software) does not permit arbitrary characters in the dial string. The <L2P> and <called_address> strings are therefore specified as containing digits (0-9) only.

<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 <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.

3GPP TSG-T WG2 Meeting #14
Edinburgh, Scotland, Sept 3, 2001

T2-010857

CR-Form-v4

CHANGE REQUEST

⌘ **21.904** **CR** **009** ⌘ ev **-** ⌘ Current version: **3.3.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☒ Radio Access Network ☐ Core Network ☐

Title:	⌘	Corrections to References List, AMR Specifications
Source:	⌘	T2
Work item code:	⌘	TEI
Date:	⌘	2001-09-03
Category:	⌘	**F**
Release:	⌘	R99

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	Correction of Errors in the list of References for AMR Specfications
Summary of change:	⌘	References 22 and 25 on page 7 are not correct. The spec. numbers and title are corrected.
Consequences if not approved:	⌘	Reader may be misled - Errors in References

Clauses affected:	⌘	2.0
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	Minor Editorial Change

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1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.
2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.
3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

3GPP TR 21.904 V3.3.0 (2000-12)

Technical Report

2 References

[19] 3GPP TS 26.071: "Mandatory Speech Codec speech processing functions AMR Speech Codec; General Description".

[20] 3GPP TS 26.073: "ANSI-C code for the Adaptive Multi Rate speech codec".

[21] 3GPP TS 26.074: "Mandatory Speech Codec speech processing functions; AMR Speech Codec Test Sequences".

[22] 3GPP TS 26.~~071~~090: "Mandatory Speech Codec speech processing functions AMR speech codec; Transcoding functions".

3rd Generation Partnership Project (3GPP); Technical Specification Group (TSG) Terminals; UE capability requirements (Release 1999)

[23] 3GPP TS 26.0~~0~~91: "Mandatory Speech Codec speech processing functions AMR speech codec; Error concealment of lost frames".

[24] 3GPP TS 26.093: "Mandatory Speech Codec speech processing functions AMR Speech Codec; Source Controlled Rate operation".

[25] 3GPP TS 26.~~071~~094: "Mandatory Speech Codec speech processing functions AMR Speech Codec; Voice Activity Detector (VAD)".

[26] 3GPP TS 26.110: "Codec for Circuit Switched Multimedia Telephony Service:General Description".

[27] 3GPP TS 26.111: "Modifications to H.324".

[28] 3GPP TS 26.112: "Call Set Up Requirements".

[29] 3GPP TR 26.911: "Terminal Implementor's Guide".

[30] 3GPP TR 25.926: "UE Radio Access Capabilities".

[31] 3GPP TS 23.146: "Technical realisation of facsimile group 3 non-transparent".

[32] 3GPP TS 27.002: "Terminal Adaptation Functions (TAF) for services using asynchronous bearer capabilities".

[33] 3GPP TS 27.001: "General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".

[34] 3GPP TS 22.071: "Locations Service (LCS); Service description, Stage 1".

[35] 3GPP TS 25.305: "Stage 2 Functional Specification of Location Services in UTRAN".

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Edinburgh, Scotland
3-7 September 2001

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3GPP TS 27.005 v4.0.0 (2001-03)

Technical Specification

3rd Generation Partnership Project; Technical Specification Group Terminals; Use of Data Terminal Equipment - Data Circuit terminating; Equipment (DTE - DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS) (Release 4)

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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;

0 Scope

This Technical Specification (TS) defines three interface protocols for control of SMS functions within a GSM/UMTS mobile telephone from a remote terminal via an asynchronous interface.

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

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

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

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

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

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

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

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

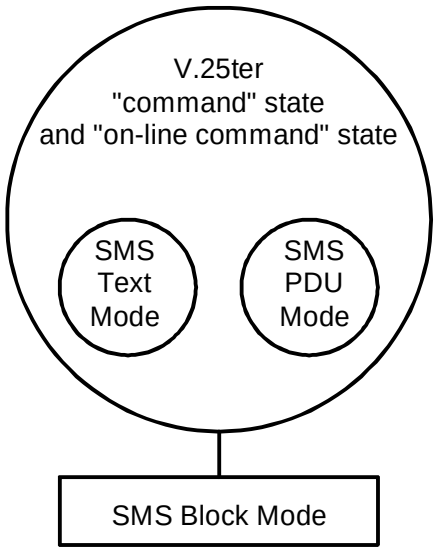


Figure 0.1: Block, Text and PDU modes

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

0.1 References

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

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

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

[2] 3GPP TS 23.038: "Alphabets and language-specific information".

[3] 3GPP TS 23.040: "Technical realization of the Short Message Service (SMS) ".

[4] 3GPP TS 23.041: "Technical realization of the Cell Broadcast Service (CBS)".

[5] GSM 04.083GPP TS 24.008: "Digital cellular telecommunications system (Phase 2+); Mobile Rradio Iinterface Llayer 3 specification; Core Network Protocols; Stage 3".

[6] 3GPP TS 24.011: "Short Message Service (SMS) support on mobile radio interface".

[7] 3GPP TS 24.012: "Cell Broadcast Service(CBS) support on the mobile radio interface".

[8] 3GPP TS 27.001: "General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".

[9] 3GPP TS 27.007: "AT command set for 3GPP User Equipment (UE)".

[10] 3GPP TSGSM 151.011: "Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface".

[11] CCITT Recommendation V.25ter: “Serial Asynchronous Automatic Dialling And Control”

[12] CCITT Recommendation V.24: "List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment".

[13] CCITT Recommendation E.164: "Numbering plan for the ISDN era".

[14] CCITT Recommendation E.163: "Numbering plan for the international telephone service".

[15] 3GPP TR 21.905 "3G Vocabulary"

[16] 3GPP TS 31.102: "Characteristics of the USIM application"

0.2 Abbreviations

Abbreviations used in this specification are listed in GSM 01.04. [1] and 3GPP TR 21.905. [15].

Additionally, the following abbreviation is used:

EVPF Enhanced Validity Period Format

1 Reference configuration

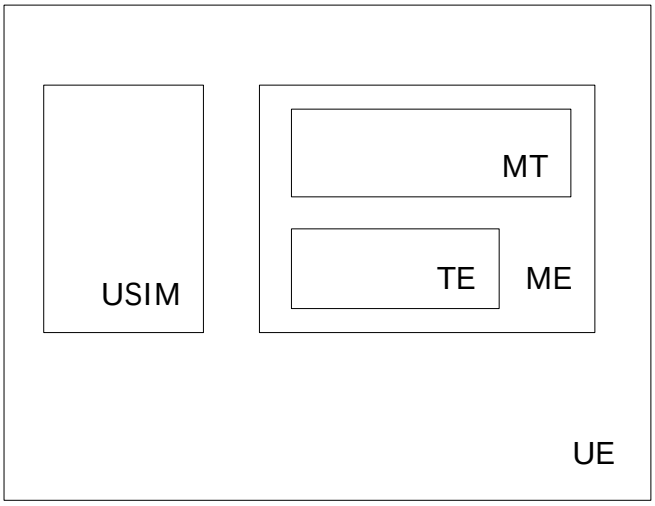


Figure 1: Reference configuration

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

1.1 V.24 Interface Circuits

The operation of the CCITT V.24 blue book interface circuits for SMS is shown in table 1.1.

Table 1.1: Use of V.24 interface circuits

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

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

1.1.1 Circuit definitions for the SMS Block mode

CT103

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

CT104

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

CT105

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

CT106

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

CT107

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

CT108.2

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

CT109

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

1.1.2 Circuit definitions for the SMS Text and PDU modes

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

2 SMS Block Mode

2.1 Beginning and ending of SMS/CBS Block Mode

2.1.1 Beginning SMS/CBS Block Mode

As described in 3GPP TS 27.001 [8], the DTE/DCE interface is normally associated with the terminal adaptation function (TAF), if such a function is available. When no data connection is in progress, and the terminal equipment wishes to enter SMS/CBS mode, the command 'AT+CESP' shall be issued by the TE through the DTE/DCE interface requesting that the Block mode protocol described in this specification is to be used. The syntax of this command is further described in subclause 3.2.4 later. The syntax for these commands is derived from V.25ter, i.e. the command is encoded as an IA5 character string together with delimiters as described in V.25ter.

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

If the mobile termination supports SMS/CBS block mode commands, responses and indications as described in this technical specification, it shall respond with 'OK' (or 0) and enter the SMS/CBS mode.

If the mobile termination does not support SMS/CBS block mode commands, responses and indications as described in this technical specification, it shall respond with 'ERROR' (or 4) and remain in the current mode..

Terminal software shall wait a short time (e.g. 5 seconds) for the ‘OK’ (0) or ‘ERROR’ (4) response. If neither response is received before the timeout then the terminal software shall assume that the block mode has been

entered. The terminal software may then submit its first block mode command. If no response is received to this command then the terminal software shall proceed as described below in subclause 2.2 (i.e. repeat the command 3 times and then exit the block mode).

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

2.1.2 Returning from SMS/CBS Block Mode To Default Mode

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

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

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

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

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

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

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

2.2 Protocol description

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

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

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

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

Figure 2.2.1: Format of DTE/DCE interface messages

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

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

During transmission of the message content and the BCS octets, any occurrence of the value 10 hex (DLE) shall result in an additional 'stuffing' octet of value 00 hex (NUL) being transmitted immediately following the octet containing 10 hex. This is to ensure that the start and end markers are unambiguous. The receiver shall remove stuffing octets by discarding any octet of value 00 hex (NUL) which immediately follows an octet of value 10 hex (DLE).

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

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

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

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

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

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

2.3 Requesting messages already held in the Mobile Termination

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

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

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

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

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

2.3.1 Requesting List Of Messages

The TE may request the MT to provide a list of SMS and CBS messages currently stored in the mobile termination. This is achieved by the LIST REQUEST command (subclause 2.4.1.1). The MT divides the messages stored into groups of 5 (called pages) and transfers the first 5 in a MESSAGE LIST response (subclause 2.4.2.1) containing message

references allocated by the MT, plus the relevant header information described in 3GPP TS 23.040 [3]/24.011 [6] and 3GPP TS 23.041 [4] / 24.012 [7].

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

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

2.3.2 Requesting Transfer Of Messages

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

2.3.2.1 Requesting Transfer Of A Specific Message

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

2.3.2.2 Requesting Transfer Of All Messages

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

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

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

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

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

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

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

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

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

2.3.3 Requesting Diversion Of Incoming Messages

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

2.3.3.1 Requesting SMS Messages

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

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

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

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

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

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

The ACKNOWLEDGE MESSAGE sent from the TE to the MT must not delay the MT sending the RP-ACK defined in 3GPP TS 23.040 [3] (to the SC) for longer than the RP-ACK timeout specified in 3GPP TS 24.008~~GSM 04.08~~ [5].

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

2.3.3.2 Requesting CBS Messages

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

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

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

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

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

2.3.3.3 Requesting indication of message arrival

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

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

After receipt of this command, the MT shall indicate all incoming messages in the specified categories (unless they are directly transferred) with the MESSAGE ARRIVED indication (subclause 2.4.2.5). This indication shall be of the same format as the MESSAGE LIST response described in subclause 2.3.1.

The TE shall acknowledge receipt of the MESSAGE ARRIVED with an ACKNOWLEDGE MESSAGE. (subclause 2.4.1.12). The MT should not send another MESSAGE ARRIVED to the TE whilst it is waiting for an ACKNOWLEDGE MESSAGE.

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

The ACKNOWLEDGE MESSAGE sent from the TE to the MT must not delay the MT sending the RP-ACK defined in 3GPP TS 23.040 [3] (to the SC) for longer than the RP-ACK timeout specified in the 3GPP TS 24.008~~GSM 04.08~~ [5].

The TE requests the cessation of incoming message indication by the INDICATE INC SMS command, with the 'no incoming messages' parameter.

2.3.4 Requesting Transfer Into Mobile Termination

The TE may request transfer of SMS messages into the mobile termination. Cell broadcast messages cannot be transferred in this direction.

The TE shall use the INSERT SMS command (subclause 2.4.1.8) to transfer the message. This command shall indicate whether the message is to be stored in the MT, sent over the air interface or both. The command shall include the full SMS message and header as described in 3GPP TS 23.040 [3], except for the message reference and message type indication (which are allocated by the MT).

Only one INSERT SMS command may be outstanding at any given instant. An INSERT SMS is deemed complete when an INSERT SMS COMPLETE or an INSERT SMS FAILURE indication has been received irrespective of whether an intermediate REQUEST CONFIRMED has been received.

Upon receipt of an INSERT SMS command, the MT shall act in the following way:

If the TE requested the MT to store the message, the MT shall attempt to store the message. If the attempt is successful, the MT shall return an INSERT SMS COMPLETE indication (subclause 2.4.2.6), including the message reference allocated by the MT. If the attempt fails (eg. due to lack of memory), the MT shall return an INSERT SMS FAILURE indication (subclause 2.4.2.7), providing a cause for the failure.

If the TE requested the MT to send the message, the MT shall respond immediately with a REQUEST CONFIRMED message, and attempt to send the message. If the send attempt subsequently succeeds, the MT shall send an INSERT SMS COMPLETE indication, including the message references allocated by the MT. If the send attempt subsequently fails, the MT shall return an INSERT SMS FAILURE indication, providing a cause for the failure.

If the TE requested the MT to store and send the message, the MT shall first attempt to store the message. If no storage is available, the MT shall return an INSERT SMS FAILURE indication (subclause 2.4.2.7) and shall not attempt to send the message. If storage is available, the MT shall store the message and then respond with a REQUEST CONFIRMED message. If the send attempt is successful, the MT shall return an INSERT SMS COMPLETE indication (subclause 2.4.2.6), including the message references allocated by the MT. If the transmission of the message fails, then the MT shall return an INSERT SMS FAILURE indication (subclause 2.4.2.7). This will show that the send attempt failed and provide a cause. After that the MT shall delete the stored message.

2.3.5 Requesting Deletion Of Messages

The TE may request deletion of SMS or CBS messages from the store in the MT. This is achieved by the DELETE MESSAGE command (subclause 2.4.1.9). The command will include a message reference, as defined by the MT and provided in the message list.

Upon receipt of this command, the MT shall attempt to delete the message. If successful, the MT shall return a DELETE MESSAGE COMPLETE indication (subclause 2.4.2.8). If not successful, the MT shall return a DELETE MESSAGE FAILURE indication (subclause 2.4.2.9).

On successful deletion of an SM or CBS message the Page Index (see 2.5.2.10) and the Index Count (see 2.5.2.8) shall be re-assigned so that their values are contiguous (i.e. there are no gaps in either parameter). The original short message Reference values remain unchanged.

2.4 Message functional definitions and contents

This subclause provides an overview of the message structure to be used over the DTE/DCE interface in SMS/CBS block mode. Each message definition includes a brief description of the use of the message, and a table showing all the information elements which may be included in the message. If an entity receives a message containing more information elements than expected then the receiving entity shall ignore the additional information elements. For each information element the following data are provided:

Reference - this indicates where the detailed description of each element can be found.

Presence:

M	Mandatory	must always be present receiver: If not present, consider message erroneous
C	Conditional	presence depending on e.g. a) value of other element b) presence of optional element receiver: If not present when condition met, consider message erroneous
O	Optional	presence is a choice of the sender receiver: present or not, accept message

Format:

T	Type only, fixed length, only IEI
V	Value only, fixed length, no IEI included
TV	Type and value, fixed length, IEI included
LV	Length and value, variable length, no IEI included and Length indicator included
TLV	Type, Length and Value, variable length, IEI and length indicator included

Length - this indicates the length of the information element in octets.

2.4.1 Commands Issued By The Terminal Equipment

Table 2.4.1 summarises the commands which may be issued by the TE.

Table 2.4.1: Commands which may be issued by the TE

	Reference
LIST REQUEST	2.4.1.1
GET MESSAGE	2.4.1.2
GET FIRST MESSAGE	2.4.1.3
GET NEXT MESSAGE	2.4.1.4
TRANSFER INC SMS	2.4.1.5
INDICATE INC SMS	2.4.1.6
TRANSFER INC CBS	2.4.1.7
INSERT SMS	2.4.1.8
DELETE MESSAGE	2.4.1.9
UNABLE TO PROCESS	2.4.1.10
END SMS MODE	2.4.1.11
ACKNOWLEDGE MESSAGE	2.4.1.12

2.4.1.1 List Request

This message is sent by the TE to the MT to request a list of messages stored in the MT.

Information element	Reference	Presence	Format	Length
Message Type	2.5.1	M	V	1
Page Index	2.5.2.10	M	V	1

2.4.1.2 Get Message

This message is sent by the TE to the MT to request transfer of a specific SMS or CBS message stored in the MT.

Information element	Reference	Presence	Format	Length
Message Type	2.5.1	M	V	1
Short Message Reference	2.5.2.1	M	V	1

2.4.1.3 Get First Message

This message is sent by the TE to the MT to request transfer of the first available SMS or CBS message stored in the MT.

Information element	Reference	Presence	Format	Length
Message Type	2.5.1	M	V	1

2.4.1.4 Get Next Message

This message is sent by the TE to the MT to request transfer of the next available SMS or CBS message stored in the MT.

Information element	Reference	Presence	Format	Length
Message Type	2.5.1	M	V	1

2.4.1.5 Transfer Inc SMS

This message is sent by the TE to the MT to request the direct transfer of incoming messages from the air interface to the TE.

Information element	Reference	Presence	Format	Length
Message Type	2.5.1	M	V	1
SMS Transfer Type	2.5.2.2	M	V	1

2.4.1.6 Indicate Inc SMS

This message is sent by the TE to the MT to request that the MT indicates when an incoming message arrives.

Information element	Reference	Presence	Format	Length
Message Type	2.5.1	M	V	1
Indication Type	2.5.2.3	M	V	1

2.4.1.7 Transfer Inc CBS

This message is sent by the TE to the MT to request transfer of all cell broadcast messages directly from the air interface to the DTE/DCE interface.

Information element	Reference	Presence	Format	Length
Message Type	2.5.1	M	V	1
CBS Transfer Type	2.5.2.9	M	V	1

2.4.1.8 Insert SMS

This message is sent by the TE to the MT to request the transfer of an SMS TPU to the MT memory or across the air interface. The TPDU is formatted in exactly the same way as described in 3GPP TS 23.040 [3]. Where the TPDU includes a TP-Message-Reference which is to be incremented by the MT for every outgoing message, the TP-Message-Reference provided by the TE will be overwritten by the MT before transmission of the message. The value provided by the TE is discarded by the MT and has no significance.

Information element	Reference	Presence	Format	Length
Message Type	2.5.1	M	V	1
Insert Type	2.5.2.4	M	V	1
RP-Destination-Address	3GPP TS 24.011 [6]	M	LV	1-12 a)
SMS-TPDU	3GPP TS 23.040 [3]	M	V	max 164

a) If no RP-Destination-Address is to be transferred then the length is set to 0. In this case, the MT inserts the default SC address.

2.4.1.9 Delete message

This message is sent from the TE to the MT to request deletion of a specific SMS or CBS message held in the MT.

Information element	Reference	Presence	Format	Length
Message Type	2.5.1	M	V	1
Short Message Reference	2.5.2.1	M	V	1

2.4.1.10 Unable to process

This response is sent from the TE to the MT to indicate that the MT's message could not be processed.

Information element	Preference	Presence	Format	Length
Message Type	2.5.1	M	V	1
Cause	2.5.2.7	M	V	1

2.4.1.11 End SMS Mode

This message is sent from the TE to the MT to terminate the SMS/CBS mode of the DTE/DCE interface.

Information element	Reference	Presence	Format	Length
Message Type	2.5.1	M	V	1

2.4.1.12 Acknowledge Message

This message is sent from the TE to the MT to acknowledge receipt of a INC MESSAGE or MESSAGE ARRIVED which contains a Short Message (SMS) info element id, (e.g. a Short Message or a Status Report but not a CBS message.

Information element	Reference	Presence	Format	Length
Message Type	2.5.1	M	V	1
SM-Deliver-Ack	2.5.2.14	O	TLV	2 to 160

2.4.2 Responses/Indications Issued By The MT

Table 2.4.2 summarises the responses/indications which may be issued by the MT.

Table 2.4.2: Responses/Indications which may be issued by the MT

	Reference
MESSAGE LIST	2.4.2.1
MESSAGE	2.4.2.2
GET MESSAGE FAILURE	2.4.2.3
INC MESSAGE	2.4.2.4
MESSAGE ARRIVED	2.4.2.5
INSERT SMS COMPLETE	2.4.2.6
INSERT SMS FAILURE	2.4.2.7
DELETE MESSAGE COMPLETE	2.4.2.8
DELETE MESSAGE FAILURE	2.4.2.9
UNABLE TO PROCESS	2.4.2.10
END SMS MODE	2.4.2.11
REQUEST CONFIRMED	2.4.2.12

2.4.2.1 Message List

This response is sent from the MT to the TE on receipt of a LIST REQUEST from the TE.

Information element	Reference	Presence	Format	Length
Message Type	2.5.1	M	V	1
Page Index	2.5.2.10	M	V	1
Index Count	2.5.2.8	M	V	1
Short Message Index (1)	2.5.2.5	O	TLV	8-48
Short Message Index (2)	2.5.2.5	O	TLV	8-48
:	:	:	:	:
Short Message Index (n)	2.5.2.5	O	TLV	8-48

The number of Short Message Indices included in the message may be 0, 1, 2, 3, 4 or 5.

2.4.2.2 Message

This response is sent from the MT to the TE when a short message has been requested.

Information element	Reference	Presence	Format	Length
Message Type	2.5.1	M	V	1
Short Message Data	2.5.2.6	M	TLV	28-181

2.4.2.3 Get Message Failure

This response is sent from the MT to the TE when a request for a short message cannot be fulfilled.

Information element	Reference	Presence	Format	Length
Message Type	2.5.1	M	V	1
Last Short Message	2.5.2.11	M	V	1
Cause	2.5.2.7	M	V	1

2.4.2.4 Inc Message

This indication is sent from the MT to the TE after the MT has been requested to transfer messages of certain categories immediately upon receipt.

Information element	Reference	Presence	Format	Length
Message Type	2.5.1	M	V	1
Short Message Data	2.5.2.6	M	TLV	28-181

2.4.2.5 Message Arrived

This indication is sent from the MT to the TE after the MT has been requested to provide an indication of the receipt of certain categories of incoming message.

Information element	Reference	Presence	Format	Length
Message Type	2.5.1	M	V	1
Short Message Index	2.5.2.5	M	TLV	8-48

2.4.2.6 Insert SMS Complete

This response is sent by the MT to the TE to indicate that the TE's request to insert a message has been completed.

Information element	Reference	Presence	Format	Length
Message Type	2.5.1	M	V	1
Short Message Reference	2.5.2.1	M	V	1
TP-Message Reference	3GPP TS 23.040 [3]	C a)	V	1
SM-Submit-Ack	2.5.2.15	O	TLV	2 to 160

a) The TP-Message Reference is only included if the message had been requested to be transferred over the air interface.

2.4.2.7 Insert SMS Failure

This response is sent from the MT to the TE to indicate that the attempt to insert an SMS message failed.

Information element	Reference	Presence	Format	Length
Message Type	2.5.1	M	V	1
Cause	2.5.2.7	M	V	1-2
TP-Failure Cause	2.5.2.13	O	TLV	4
Short Message Reference	2.5.2.1	O	TV	2

2.4.2.8 Delete Message Complete

This response is sent from the MT to the TE to indicate that the request to delete a message from the MT store has been completed.

Information element	Reference	Presence	Format	Length
Message Type	2.5.1	M	V	1
Short Message Reference	2.5.2.1	M	V	1

2.4.2.9 Delete Message Failure

This response is sent from the MT to the TE to indicate that the request to delete a message from the MT store failed.

Information element	Reference	Presence	Format	Length
Message Type	2.5.1	M	V	1
Short Message Reference	2.5.2.1	M	V	1
Cause	2.5.2.7	M	V	1

2.4.2.10 Unable To Process

This response is sent from the MT to the TE to indicate that the TE's request could not be processed.

Information element	Reference	Presence	Format	Length
Message Type	2.5.1	M	V	1
Cause	2.5.2.7	M	V	1

2.4.2.11 End SMS Mode

This indication is sent from the MT to the TE when the MT autonomously exits from SMS/CBS mode.

Information element	Reference	Presence	Format	Length
Message Type	2.5.1	M	V	1
Cause	2.5.2.7	M	V	1

2.4.2.12 Request Confirmed

This indication is sent from the MT to the TE to indicate that the MT has received the request from the TE and will perform the requested function.

Information element	Reference	Presence	Format	Length
Message Type	2.5.1	M	V	1
Confirm Type	2.5.2.12	M	V	1
Short Message Reference	2.5.2.1	O	TV	2

2.5 General message format and information elements coding

This subclause describes the content of messages for the SMS/CBS mode of the DTE/DCE interface. Within the figures in this subclause, the bit designated "bit 1" is transmitted first, followed by bits 2,3,4 etc. Similarly, the octet shown at the top of each figure is sent first.

2.5.1 Message Type

The purpose of the message type is to identify the function of the message being sent. The message type is coded as shown in figure 2.5.1 and table 2.5.1.

Bit 8 is reserved for possible future use as an extension bit.

8	7	6	5	4	3	2	1	
0	Message Type							octet 1

Figure 2.5.1: Message Type

Table 2.5.1: Message Types

8	7	6	5	4	3	2	1	
0	0	0	-	-	-	-	-	Commands/ Responses issued by TE
0	0	0	0	0	0	0	0	LIST REQUEST
0	0	0	0	0	0	0	1	GET MESSAGE
0	0	0	0	0	0	1	0	GET FIRST MESSAGE
0	0	0	0	0	0	1	1	GET NEXT MESSAGE
0	0	0	0	0	1	0	0	TRANSFER INC SMS
0	0	0	0	0	1	0	1	INDICATE INC SMS
0	0	0	0	0	1	1	0	TRANSFER INC CBS
0	0	0	0	0	1	1	1	INSERT SMS
0	0	0	0	1	0	0	0	DELETE MESSAGE
0	0	0	0	1	0	0	1	UNABLE TO PROCESS
0	0	0	1	1	1	1	0	END SMS MODE
0	0	0	1	1	1	1	1	ACKNOWLEDGE MESSAGE
0	0	1	-	-	-	-	-	Responses/Indications issued by MT
0	0	1	0	0	0	0	0	MESSAGE LIST
0	0	1	0	0	0	0	1	MESSAGE
0	0	1	0	0	0	1	0	GET MESSAGE FAILURE
0	0	1	0	0	0	1	1	INC MESSAGE
0	0	1	0	0	1	0	0	MESSAGE ARRIVED
0	0	1	0	0	1	0	1	INSERT SMS COMPLETE
0	0	1	0	0	1	1	0	INSERT SMS FAILURE
0	0	1	0	0	1	1	1	DELETE MESSAGE COMPLETE
0	0	1	0	1	0	0	0	DELETE MESSAGE FAILURE
0	0	1	0	1	0	0	1	UNABLE TO PROCESS
0	0	1	0	1	0	1	0	REQUEST CONFIRMED
0	0	1	1	1	1	1	1	END SMS MODE

All other values are reserved. If a reserved Message Type is received then the receiving entity shall return "Unable to Process" with Cause "Command not understood".

2.5.2 Other Information Elements

Other information elements follow the general coding principles specified in 3GPP TS 24.008~~GSM 04.08~~ [5], and are described in the following subclauses.

2.5.2.1 Short Message Reference

The Short Message Reference uniquely identifies a short message stored in the MT. It is an 8 bit number and is allocated by the MT.

The Short Message Reference information element is coded as shown in figure 2.5.2 and table 2.5.2.

8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	octet 1
Short Message Reference info element id								
Short Message Reference value								octet 2

Figure 2.5.2: Short Message Reference information element

Table 2.5.2: Short Message Reference information element

Short Message Reference value (octet 2). In the Short Message Reference value field bit 8 of octet 2 is the most significant bit and bit 1 of octet 2 is the least significant bit. Short Message Reference values are allocated by the MT.

2.5.2.2 SMS Transfer Type

The SMS Transfer Type indicates to the MT which SMS messages are required to be transferred to the TE.

The SMS Transfer Type information element is coded as shown in figure 2.5.3 and table 2.5.3.

8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	1	octet 1
	SMS Transfer Type info element ident							
0	0	0	0	0	SMS Txfr Type value			octet 2
	Reserved							

Figure 2.5.3: SMS Transfer Type information element

Table 2.5.3: SMS Transfer Type information element

SMS Txfr Type value (octet 2). The SMS txfr type is coded as follows: bit 2 bit 1 0 0 Transfer no SMS messages 0 1 Transfer SMS messages marked as TE-specific 1 0 Reserved 1 1 Transfer all SMS messages Bit 3 shows whether to transfer SMS-STATUS-REPORTS Bit 3 0 Do not transfer SMS-STATUS-REPORTS 1 Transfer SMS-STATUS-REPORTS A receiving entity shall ignore the setting of bits 8-4. If bit 2 is set to 1 and bit 1 is set to 0 then the receiving entity shall return “Unable to Process” with cause “Command Not Understood”

2.5.2.3 Indication Type

The Indication Type tells the MT when to notify the TE that an incoming message has been received.

The Indication Type information element is coded as shown in figure 2.5.4 and table 2.5.4.

8	7	6	5	4	3	2	1	
0	0	0	0	0	0	1	0	octet 1
	Indication Type info element identifier							
0	0	0	0	Indication Type value				octet 2
	Reserved							

Figure 2.5.4: Indication Type information element

Table 2.5.4: Indication Type information element

Indication Type value (octet 2).

The indication type is coded as follows:

bit 3	bit 2	bit 1	
0	0	0	Indicate no messages
0	0	1	Reserved
0	1	0	Indicate all SMS messages
0	1	1	Indicate SMS messages marked as TE-specific
1	0	0	Indicate all CBS messages
1	0	1	Indicate CBS messages marked as TE-specific
1	1	0	Indicate all CBS and SMS messages
1	1	1	Indicate SMS and CBS messages marked as TE-specific

Bit 4 shows whether or not to indicate SMS reports:

bit 4	
0	Do not indicate SMS reports
1	Indicate SMS reports

A receiving entity shall ignore the setting of bits 8-5. If bits 3 and 2 are set to 0 and bit 1 is set to 1 then the receiving entity shall return "Unable to Process" with cause "Command Not Understood".

2.5.2.4 Insert Type

The Insert Type tells the MT what to do with the short message arriving from the TE.

The Insert Type information element is coded as shown in figure 2.5.5 and table 2.5.5

8	7	6	5	4	3	2	1	
0	0	0	0	0	0	1	1	octet 1
	Insert Type info element identifier							
0	0	0	0	0	0	Insert		octet 2
	Reserved					Type value		

Figure 2.5.5: Insert Type information element

Table 2.5.5: Insert Type information element

Insert Type value (octet 2).

The insert type is coded as follows:

bit 2	bit 1	
0	0	Reserved
0	1	Store the short message in the MT
1	0	Send the short message over the air
1	1	Store the short message in the MT and send it over the air

A receiving entity shall ignore the setting of bits 8-3. If bits 2 and 1 are set to 0 then the receiving entity shall return "Unable to Process" with cause "Command Not Understood"

2.5.2.5 Short Message Index

The Short Message Index provides information about each individual short message currently stored in the MT. Two types of Short Message index are provided; one for SMS and one for CBS.

The Short Message Index (SMS) information element is coded as shown in figure 2.5.6 and table 2.5.6. A Short Message Index may be an SMS-SUBMIT, an SMS-DELIVER or an SMS-STATUS-REPORT.

The Short Message Index (CBS) information element is coded as shown in figure 2.5.7 and table 2.5.7.

8	7	6	5	4	3	2	1	
0	0	0	0	0	1	0	0	octet 1
	Short Message Index (SMS) info element id							
Length of Short Message Index								octet 2
Short Message Reference value								octet 3
Short Message Status								octet 4
Service Centre Address								octets 5-n
Short Message Header (SMS)								octets n+1 - n+31

Figure 2.5.6: Short Message Index (SMS) information element

n can take a value between 5 and 18 (inclusive)

Table 2.5.6: Short Message Index (SMS) information element

Short Message Reference value (octet 3).

The Short Message Reference value is coded as specified in table 2.5.2.

Short Message Status (octet 4).

The Short Message Status is coded as follows:

8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	Not read/not sent
0	0	0	0	0	0	0	1	Read/Sent
0	0	0	0	0	1	0	0	Not Read
0	0	0	0	0	1	0	1	Read
0	0	0	0	0	1	1	0	Not Sent
0	0	0	0	0	1	1	1	Sent

All other values are reserved.

The receiving entity shall ignore the setting of bits 8-4.
In addition, if bit 3 is set to 0 then a receiving entity shall ignore the setting of bit 2. Where bit 3 is set to 0, if the message is mobile originated then bit 1 indicates whether the message has been sent to the network. If the message is mobile terminated then bit 1 indicates whether the message has been read.

Service Centre Address (Octets 5-n).

The Service Centre Address is coded as the RP-Origination or RP-Destination address specified in 3 TS 24.011 [6]. If the short message is mobile originated, the address will be the RP-Destination address. If the short message is mobile terminated, the address will be the RP-Origination address. The address is of variable length, 1-12 octets.

Short Message Header (SMS) (Octets n+1 - n+31).

The Short Message Header (SMS) is coded as a TPDU as described in 3GPP TS 23.040 [3]. In the case of SMS-DELIVER or SMS-SUBMIT, the TP-User-Data is not included, but the TP-User-Data-Length is included. The Short Message Header is of variable length, 6-31 octets.

8	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
0	0	0	0	0	1	0	1	octet 1
	Short Message Index (CBS) info element id							
Short Message Reference value								octet 2
Short Message Header (CBS)								octets 3-8

Figure 2.5.7: Short Message Index (CBS) information element

Table 2.5.7: Short Message Index (CBS) information element

Short Message Reference value (octet 2). The Short Message Reference value is coded as specified in table 2.5.2. Short Message Header (CBS) (Octets 3-8). The Short Message Header (CBS) is coded as described in 3GPP TS 23.041. [4], including SEQUENCE NUMBER, MESSAGE IDENTIFIER, ALPHABET IDENTIFIER and PAGE PARAMETER, but excluding the characters of the message.

2.5.2.6 Short Message Data

The Short Message Data information element is a copy of a short message currently stored in the MT. Two types of Short Message Data information element are provided; one for SMS and one for CBS.

The Short Message Data (SMS) information element is coded as shown in figure 2.5.8 and table 2.5.8. Short Message Data may be an SMS-SUBMIT, an SMS-DELIVER or an SMS-STATUS-REPORT.

The Short Message Data (CBS) information element is coded as shown in figure 2.5.9 and table 2.5.9.

8	7	6	5	4	3	2	1	
0	0	0	0	0	1	1	0	octet 1
	Short Message Data (SMS) info element id							
Length of Short Message Data								octet 2
Short Message Reference value								octet 3
Short Message Status								octet 4
Service Centre Address								octets 5-n
Short Message (SMS)								octets n+1-n+164

Figure 2.5.8: Short Message Data (SMS) information element

n can take a value between 5 and 18 (inclusive)

Table 2.5.8: Short Message (SMS) information element

Short Message Reference value (octet 3).

The Short Message Reference value is coded as specified in table 2.5.2.

Short Message Status (octet 4).

The Short Message Status is coded as follows:

8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	Not read/not sent
0	0	0	0	0	0	0	1	Read/Sent
0	0	0	0	0	1	0	0	Not Read
0	0	0	0	0	1	0	1	Read
0	0	0	0	0	1	1	0	Not Sent
0	0	0	0	0	1	1	1	Sent

All other values are reserved.

The receiving entity shall ignore the setting of bits 8-4.
In addition, if bit 3 is set to 0 then a receiving entity shall ignore the setting of bit 2.

Where bit 3 is set to 0, if the message is mobile originated then bit 1 indicates whether the message has been sent to the network. If the message is mobile terminated then bit 1 indicates whether the message has been read.

Service Centre Address (Octets 5-n).

The Service Centre Address is coded as the RP-Origination-Address or RP-Destination Address specified in 3GPP TS 23.040 [3].
If the short message is mobile originated, the address will be the RP-Destination address. If the short message is mobile terminated, the address will be the RP-Origination Address. The address is of variable length, 1-12 octets.

Short Message (SMS) (Octets n+1 - n+164).

The Short Message (SMS) is coded as a TPDU as described in 3GPP TS 23.040 [3].
The Short Message is of variable length, 6-164 octets.

8	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
0	0	0	0	0	1	1	1	octet 1
	Short Message Data (CBS) info element id							
Short Message Reference value								octet 2
Short Message (CBS)								octets 3-90

Figure 2.5.9: Short Message Data (CBS) information element

Table 2.5.9: Short Message Data (CBS) information element

Short Message Reference value (octet 2). The Short Message Reference value is coded as specified in table 2.5.2. Short Message (CBS) (Octets 3-90). The Short Message (CBS) is coded as described in 3GPP TS 23.041 [4], including SEQUENCE NUMBER, MESSAGE IDENTIFIER, ALPHABET IDENTIFIER, PAGE PARAMETER and CHARACTERS OF THE MESSAGE.

2.5.2.7 Cause

The Cause information element provides more detail as to why an error has occurred.
The Cause information element is coded as shown in figure 2.5.10 and table 2.5.10.

8	7	6	5	4	3	2	1	
0	0	0	0	1	0	0	0	octet 1
	Cause information element identifier							
0 ext	Cause value							octet 2
3GPP TS 24.011 [6] RP-Cause value								octet 3

Figure 2.5.10: Cause information element

Table 2.5.10: Cause information element

Cause value (octet 2).

The cause is coded as follows:

8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	No such message
							-	- no short message exists with the provided shortmessage reference
0	0	0	0	0	0	0	1	No memory
							-	- the short message cannot be stored due to lack of memory
0	0	0	0	0	0	1	0	No air interface
							-	- submission of the short message cannot be attempted because the mobile is out of coverage
0	0	0	0	0	0	1	1	Receiving entity busy
							-	- the request was not fulfilled because the Receiving entity is busy on another task
0	0	0	0	0	1	0	0	Command not understood
							-	- error in the coding of the command, or command belongs to higher version of protocol of protocol than that implemented
0	0	0	0	0	1	0	1	Incoming data call
							-	- Incoming data call forces MT to exit from SMS mode
0	0	0	0	0	1	1	0	User-invoked exit
							-	- User has taken MT out of SMS by MMI
0	0	0	0	0	1	1	1	Other error
							-	- Any other error not covered here1 0 0 0 0 1 1 1 Message Transfer failed
							-	- The SMS transfer to the SC failed and the 3GPP TS 24.011 [6] error cause is provided in octet 3

All other values are reserved.
A receiving entity shall treat any reserved codings as “other error”.

3GPP TS 24.011 [6] RP-Cause value (octet 3)

If this element is included then bit 8 of octet 2 is set to '1'. The error cause included in the RP-Cause over the air interface is directly mapped into this element. This element is only included if the MT attempts to send a short message to the network and that send attempt fails.

2.5.2.8 Index Count

The Index Count identifies the number of short message indices contained in a MESSAGE LIST response from the MT to the TE. It is an 8 bit number.

The Index Count information element is coded as shown in figure 2.5.11 and table 2.5.11.

8	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
0	0	0	0	1	0	0	1	octet 1
Index Count information element ident								
Index Count value								octet 2

Figure 2.5.11: Index Count information element

Table 2.5.11: Index Count information element

Index Count value (octet 2). In the Index Count field bit 8 of octet 2 is the most significant bit and bit 1 of octet 2 is the least significant bit.

2.5.2.9 CBS Transfer Type

The CBS Transfer Type indicates to the MT which CBS messages are required to be transferred to the TE.

The CBS Transfer Type information element is coded as shown in figure 2.5.12 and table 2.5.12.

8	7	6	5	4	3	2	1	
0	0	0	0	1	0	1	0	octet 1
	CBS Transfer Type info element ident							
0	0	0	0	0	0	CBS Txfr Type value		octet 2
	Reserved							

Figure 2.5.12: CBS Transfer Type information element

Table 2.5.12: CBS Transfer Type information element

CBS Txfr Type value (octet 2). The CBS txfr type is coded as follows: bit 2 bit 1 0 0 Transfer no CBS messages 0 1 Transfer CBS messages marked as TE-specific 1 0 Reserved 1 1 Transfer all CBS messages A receiving entity shall ignore the setting of bits 8-3. If bit 2 is set to 1 and bit 1 is set to 0 then the receiving entity shall return "Unable to Process" with cause "Command Not Understood"

2.5.2.10 Page Index

The Page Index indicates to the MT which Page of SMS Indices is required to be transferred. It also indicates to the TE which Page of SMS Indices is being transferred.

The Page Index information element is coded as shown in figure 2.5.13 and table 2.5.13.

8	7	6	5	4	3	2	1	
0	0	0	0	1	0	1	1	octet 1
	Page Index info element ident							
0	0	Page Index value						octet 2
Reserved								

Figure 2.5.13: Page Index information element

Table 2.5.13: Page Index information element

Page Index value (octet 2). In the Page Index field bit 6 of octet 2 is the most significant bit and bit 1 of octet 2 is the least significant bit. The Page Index can have a value from 1 to 51. A receiving entity shall ignore the setting of bits 8 and 7. If the Page Index field has a value of 0 or a value greater than 51 then the receiving entity shall return "Unable to Process" with cause "Command Not Understood"

2.5.2.11 Last Short Message

The Last Short Message field indicates to the TE the highest value of Short Message Reference which points to a valid message stored in the MT. The value 0 signifies that there are no short messages stored in the MT.

The Last Short Message information element is coded as shown in figure 2.5.14 and table 2.5.14.

8	7	6	5	4	3	2	1	
0	0	0	0	1	1	0	0	octet 1
	Last Short Message info element ident							
Last Short Message value								octet 2

Figure 2.5.14: Last Short Message information element

Table 2.5.14: Last Short Message information element

Last Short Message value (octet 2). In the Last Short Message field bit 8 of octet 2 is the most significant bit and bit 1 of octet 2 is the least significant bit. The Last Short Message can have a value from 0 to 255.

2.5.2.12 Confirm Type

The Confirm Type field indicates the message to which the REQUEST CONFIRM is a response.

The Confirm Type information element is coded as shown in figure 2.5.15 and table 2.5.15.

8	7	6	5	4	3	2	1	
0	0	0	0	1	1	0	1	octet 1
	Confirm Type info element ident							
Confirm Type value								octet 2

Figure 2.5.15: Confirm Type information element

Table 2.5.15: Confirm Type information element

Confirm Type value (octet 2).

The Confirm Type is coded as follows:

8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	Reserved
0	0	0	0	0	0	0	1	Confirm request to transfer incoming SMS messages
0	0	0	0	0	0	1	0	Confirm request to transfer incoming CBS messages
0	0	0	0	0	0	1	1	Confirm request to indicate arrival of messages in MT
0	0	0	0	0	1	0	0	Confirm request to attempt to send short message (actual send is confirmed later: see subclause 3.3)

All other values are reserved. If any reserved value is received then the receiving entity shall return "Unable to Process" with cause value "Command Not Understood".

2.5.2.13 TP-Failure Cause

This optional field is present if provided by the Relay Layer. The TP-Failure Cause is provided from the Service Centre and indicates to the TE the reason why the delivery of the message was unsuccessful. The TP-Failure cause information element is coded as shown in figure 2.5.16 and table 2.5.16.

8	7	6	5	4	3	2	1	
0	0	0	0	1	1	1	0	octet 1
Cause information element identifier								
Length of Failure cause field								octet 2
Failure cause								octets 3-4

Figure 2.5.16: TP-Failure Cause information element

Table 2.5.16: TP-Failure Cause information element

Failure cause (octet 3-4)

The failure cause contained in this field is directly mapped from the TP-Failure Cause (TP-FCS) field of the SMS-SUBMIT-REPORT message defined in 3GPP TS 23.040 [3].

2.5.2.14 SM-Deliver-Ack

This optional field is sent from the TE to the MT to convey the information to be inserted into the SMS-DELIVER-REPORT RP-ACK TPDU sent by the MT to the SC as defined in 3GPP TS 23.040 [3].

8	7	6	5	4	3	2	1	
0	0	0	0	1	1	1	1	octet 1
SM-DELIVER-ACK information element identifier								
Length of SMS-DELIVER-REPORT RP-ACK Field								octet 2
03.40 SMS-DELIVER-REPORT RP-ACK								octets 3-166

2.5.2.15 SM-Submit-Ack

This optional field is sent from the MT to the TE to convey the information to be inserted into the SMS-SUBMIT-REPORT RP-ACK TPDU sent by the SC to the MT as defined in 3GPP TS 23.040 [3].

8	7	6	5	4	3	2	1	
0	0	0	1	0	0	0	0	octet 1
	SM-SUBMIT-ACK information element identifier							
Length of SMS-SUBMIT-REPORT RP-ACK Field								octet 2
03.40 SMS-SUBMIT-REPORT RP-ACK								octets 3-166

3 Text Mode

3.1 Parameter Definitions

The following parameters are used in the subsequent clauses which describe all commands. The formats of integer and string types referenced here are defined in V.25ter. The default values are for command parameters, not for result code parameters.

Message Storage Parameters

<index> integer type; value in the range of location numbers supported by the associated memory

<mem1> string type; memory from which messages are read and deleted (commands List Messages +CMGL, Read Message +CMGR and Delete Message +CMGD); defined values (others are manufacturer specific):

"BM" broadcast message storage

"ME" ME message storage

"MT" any of the storages associated with ME

"SM" (U)SIM message storage

"TA" TA message storage

"SR" status report storage

<mem2> string type; memory to which writing and sending operations are made (commands Send Message from Storage +CMSS and Write Message to Memory +CMGW)); refer <mem1> for defined values

<mem3> string type; memory to which received SMs are preferred to be stored (unless forwarded directly to TE; refer command New Message Indications +CNMI); refer <mem1> for defined values; received CBMs are always stored in "BM" (or some manufacturer specific storage) unless directly forwarded to TE; received status reports are always stored in "SR" (or some manufacturer specific storage) unless directly forwarded to TE

<stat> integer type in PDU mode (default 0), or string type in text mode (default "REC UNREAD"); indicates the status of message in memory; defined values:

0 "REC UNREAD" received unread message (i.e. new message)

1 "REC READ" received read message

2 "STO UNSENT" stored unsent message (only applicable to SMs)

3 "STO SENT" stored sent message (only applicable to SMs)

4 "ALL" all messages (only applicable to +CMGL command)

<total1> integer type; total number of message locations in <mem1>

<total2> integer type; total number of message locations in <mem2>

<total3> integer type; total number of message locations in <mem3>

<used1> integer type; number of messages currently in <mem1>

<used2> integer type; number of messages currently in <mem2>

<used3>integer type; number of messages currently in <mem3>

Message Data Parameters

<ackpdu> 3GPP TS 23.040 [3] RP-User-Data element of RP-ACK PDU; format is same as for <pdu> in case of SMS, but without 3GPP TS 24.011 [6] SC address field and parameter shall be bounded by double quote characters like a normal string type parameter

<alpha> string type alphanumeric representation of <da> or <oa> corresponding to the entry found in MT phonebook; implementation of this feature is manufacturer specific; used character set should be the one selected with command Select TE Character Set +CSCS (see definition of this command in 3GPP TS 27.007 [9])

<cdata> 3GPP TS 23.040 [3] TP-Command-Data in text mode responses; 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))

<ct> 3GPP TS 23.040 [3] TP-Command-Type in integer format (default 0)

<da> 3GPP TS 23.040 [3] TP-Destination-Address Address-Value field in string format; BCD numbers (or GSM 7 bit default alphabet characters) are converted to characters of the currently selected TE character set (refer command +CSCS in3GPP TS 27.007 [9]); type of address given by <toda>

<data> In the case of SMS: 3GPP TS 23.040 [3] TP-User-Data in text mode responses; format:

- if <dcs> indicates that 3GPP TS 23.038 [2] GSM 7 bit default alphabet is used and <fo> indicates that 3GPP TS 23.040 [3] TP-User-Data-Header-Indication is not set:
  - if TE character set other than "HEX" (refer command Select TE Character Set +CSCS in 3GPP TS 27.007 [9]): ME/TA converts GSM alphabet into current TE character set according to rules of Annex A
  - if TE character set is "HEX": ME/TA converts each 7-bit character of GSM 7 bit default alphabet into two IRA character long hexadecimal number (e.g. character Π (GSM 7 bit default alphabet 23) is presented as 17 (IRA 49 and 55))
- if <dcs> indicates that 8-bit or UCS2 data coding scheme is used, or <fo> indicates that 3GPP TS 23.040 [3] TP-User-Data-Header-Indication is set: 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))

In the case of CBS: 3GPP TS 23.041 [4] CBM Content of Message in text mode responses; format:

- if <dcs> indicates that 3GPP TS 23.038 [2] GSM 7 bit default alphabet is used:
  - if TE character set other than "HEX" (refer command +CSCS in 3GPP TS 27.007 [9]): ME/TA converts GSM alphabet into current TE character set according to rules of Annex A
  - if TE character set is "HEX": ME/TA converts each 7-bit character of the GSM 7 bit default alphabet into two IRA character long hexadecimal number
- if <dcs> indicates that 8-bit or UCS2 data coding scheme is used: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number

<dcs> depending on the command or result code: 3GPP TS 23.038 [2] SMS Data Coding Scheme (default 0), or Cell Broadcast Data Coding Scheme in integer format

<dt> 3GPP TS 23.040 [3] TP-Discharge-Time in time-string format: “yy/MM/dd,hh:mm:ss±zz”, where characters indicate year (two last digits), month, day, hour, minutes, seconds and time zone. E.g. 6th of May 1994, 22:10:00 GMT+2 hours equals to “94/05/06,22:10:00+08”

<fo> depending on the command or result code: first octet of 3GPP TS 23.040 [3] SMS-DELIVER, SMS-SUBMIT (default 17), SMS-STATUS-REPORT, or SMS-COMMAND (default 2) in integer format

<length> integer type value indicating in the text mode (+CMGF=1) the length of the message body <data> > (or <cdata>) in characters; or in PDU mode (+CMGF=0), the length of the actual TP data unit in octets (i.e. the RP layer SMSC address octets are not counted in the length)

<mid> 3GPP TS 23.041 [4] CBM Message Identifier in integer format

<mn> 3GPP TS 23.040 [3] TP-Message-Number in integer format

<mr> 3GPP TS 23.040 [3] TP-Message-Reference in integer format

<oa> 3GPP TS 23.040 [3] TP-Originating-Address Address-Value field in string format; BCD numbers (or GSM 7 bit default alphabet characters) are converted to characters of the currently selected TE character set (refer command +CSCS in TS 07.07); type of address given by <tooa>

<page> 3GPP TS 23.041 [4] CBM Page Parameter bits 4-7 in integer format

<pages> 3GPP TS 23.041 [4] CBM Page Parameter bits 0-3 in integer format

<pdu> In the case of SMS: 3GPP TS 24.011 [6] SC address followed by 3GPP TS 23.040 [3] TPDU in hexadecimal format: ME/TA converts each octet of TP data unit 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))

In the case of CBS: 3GPP TS 23.041 [4] TPDU in hexadecimal format

<pid> 3GPP TS 23.040 [3] TP-Protocol-Identifier in integer format (default 0)

<ra> 3GPP TS 23.040 [3] TP-Recipient-Address Address-Value field in string format; BCD numbers (or GSM 7 bit default alphabet characters) are converted to characters of the currently selected TE character set (refer command +CSCS in 3GPP TS 27.007 [9]); type of address given by <tora>

<sca> 3GPP TS 24.011 [6] RP SC address Address-Value field in string format; BCD numbers (or GSM 7 bit default alphabet characters) are converted to characters of the currently selected TE character set (refer command +CSCS in 3GPP TS 27.007 [9]); type of address given by <tosca>

<scts> 3GPP TS 23.040 [3] TP-Service-Centre-Time-Stamp in time-string format (refer <dt>)

<sn> 3GPP TS 23.041 [4] CBM Serial Number in integer format

<st> 3GPP TS 23.040 [3] TP-Status in integer format

<toda> 3GPP TS 24.011 [6] TP-Destination-Address Type-of-Address octet in integer format (when first character of <da> is + (IRA 43) default is 145, otherwise default is 129)

<tooa> 3GPP TS 24.011 [6] TP-Originating-Address Type-of-Address octet in integer format (default refer <toda>)

<tora> 3GPP TS 24.011 [6] TP-Recipient-Address Type-of-Address octet in integer format (default refer <toda>)

<tosca> 3GPP TS 24.011 [6] RP SC address Type-of-Address octet in integer format (default refer <toda>)

<vp> depending on SMS-SUBMIT <fo> setting: 3GPP TS 23.040 [3] TP-Validity-Period either in integer format (default 167) or in time-string format (refer <dt>)

<vp> depending on SMS-SUBMIT <fo> setting: 3GPP TS 23.040 [3] TP-Validity-Period either in integer format (default 167), in time-string format (refer <dt>), or if EVPF is supported, in enhanced format (hexadecimal coded string with double quotes)

3.2 General Configuration Commands

3.2.1 Select Message Service +CSMS

Parameter Command Syntax

Command	Possible response(s)
+CSMS=<service>	+CSMS: <mt>,<mo>,<bm> *+CMS ERROR: <err>*
+CSMS?	+CSMS: <service>,<mt>,<mo>,<bm>
+CSMS=?	+CSMS: (list of supported <service>s)

Description

Set command selects messaging service <service>. It returns the types of messages supported by the ME: <mt> for mobile terminated messages, <mo> for mobile originated messages and <bm> for broadcast type messages. If chosen service is not supported by the ME (but is supported by the TA), final result code +CMS ERROR: <err> shall be returned. See chapter Message Service Failure Result Code for a list of <err> values.

Also read command returns supported message types along the current service setting.

Test command returns a list of all services supported by the TA.

Defined Values

<service>:

0 3GPP TS 23.040 [3] and 3GPP TS 23.041 [4]

1 3GPP TS 23.040 [3] and 3GPP TS 23.041 [4]the requirement of <service> setting 1 is mentioned under corresponding command descriptions)

2...127 reserved

128... manufacturer specific

<mt>, <mo>, <bm>:

0 type not supported

1 type supported

Implementation

Mandatory.

3.2.2 Preferred Message Storage +CPMS

Parameter Command Syntax

Command	Possible response(s)
+CPMS=<mem1>[,<mem2>[,<mem3>]]	+CPMS: <used1>,<total1>,<used2>,<total2>,<used3>,<total3> *+CMS ERROR: <err>*
+CPMS?	+CPMS: <mem1>,<used1>,<total1>,<mem2>,<used2>,<total2>,<mem3>,<used3>,<total3> *+CMS ERROR: <err>*
+CPMS=?	+CPMS: (list of supported <mem1>s),(list of supported <mem2>s),(list of supported <mem3>s)

Description

Set command selects memory storages <mem1>, <mem2> and <mem3> to be used for reading, writing, etc. If chosen storage is not appropriate for the ME (but is supported by the TA), final result code +CMS ERROR: <err> shall be returned. See chapter Message Service Failure Result Code for a list of possible <err> values.

Test command returns lists of memory storages supported by the TA.

Implementation

Mandatory.

3.2.3 Message Format +CMGF

Parameter Command Syntax

Command	Possible response(s)
+CMGF=[<mode>]	
+CMGF?	+CMGF: <mode>
+CMGF=?	+CMGF: (list of supported <mode>s)

Description

Set command tells the TA, which input and output format of messages to use. <mode> indicates the format of messages used with send, list, read and write commands and unsolicited result codes resulting from received messages. Mode can be either PDU mode (entire TP data units used) or text mode (headers and body of the messages given as separate parameters). Text mode uses the value of parameter <chset> specified by command Select TE Character Set +CSCS to inform the character set to be used in the message body in the TA-TE interface.

Test command returns supported modes as a compound value.

Defined Values

<mode>:

0 PDU mode (default when implemented)

1 text mode

Implementation

Mandatory also when only one mode implemented.

3.2.4 Enter SMS Block Mode Protocol +CESP

Action Command Syntax

Command	Possible response(s)
+CESP	
+CESP=?	

Description

Execution command sets the TA in SMS block protocol mode. The TA shall return OK (or 0) to confirm acceptance of the command prior to entering the block mode (see subclause 2.1.1). The final result code OK (or 0) shall be returned when the block mode is exited.

NOTE: Commands following +CESP in the AT command line must not be processed by the TA.

Implementation

Mandatory when block mode implemented.

3.2.5 Message Service Failure Result Code +CMS ERROR

Final result code +CMS ERROR: <err> indicates an error related to mobile equipment or network. The operation is similar to ERROR result code. None of the following commands in the same command line is executed. Neither ERROR nor OK result code shall be returned. ERROR is returned normally when error is related to syntax or invalid parameters.

Defined Values

<err> values used by common messaging commands:

0...127	3GPP TS 24.011 [6] Annex E-2 values
128...255	3GPP TS 23.040 [3] subclause 9.2.3.22 values.
300	ME failure
301	SMS service of ME reserved
302	operation not allowed
303	operation not supported
304	invalid PDU mode parameter
305	invalid text mode parameter
310	(U)SIM not inserted
311	(U)SIM PIN required
312	PH-(U)SIM PIN required
313	(U)SIM failure
314	(U)SIM busy
315	(U)SIM wrong
316	(U)SIM PUK required
317	(U)SIM PIN2 required
318	(U)SIM PUK2 required
320	memory failure
321	invalid memory index
322	memory full
330	SMSC address unknown
331	no network service
332	network timeout
340	no +CNMA acknowledgement expected
500	unknown error
...511	other values in range 256...511 are reserved
512...	manufacturer specific

Implementation

Mandatory.

3.2.6 Informative Examples

Setting up a TA supporting SMS:

```
AT+CSMS=?                       (inquiry of available services in TA)
+CSMS: (0)                      OK
AT+CSMS=0;+CPMS=?               (set  SMS; query available memories)
+CSMS: 1,1,1                (all MT, MO and CBM supported)
+CPMS: ("BM","ME","SM"),("ME","SM"),("ME","SM") (CBM, ME and (U)SIM memories
OK                               for reading, ME and (U)SIM memories for writing)
AT+CPMS="ME","ME","ME";+CMGF=?      (set ME memory; query available message formats)
+CPMS: "ME",5,99,"ME",5,99,"ME",5,99 (five messages in ME, 99 total space)
+CMGF: (0,1)                        (both text and PDU mode implemented)
OK
AT+CMGF=1;+CSCS=?               (select text mode; query available TE character sets)
+CSCS: ("IRA","PCCP437","8859-1")
OK
AT+CSCS="PCCP437"               (select PC code page 437)
OK
```

3.3 Message Configuration Commands

3.3.1 Service Centre Address +CSCA

Parameter Command Syntax

Command	Possible response(s)
+CSCA=<sca>[,<tosca>]	
+CSCA?	+CSCA: <sca>,<tosca>
+CSCA=?	

Description

Set command updates the SMSC address, through which mobile originated SMs are transmitted. In text mode, setting is used by send and write commands. In PDU mode, setting is used by the same commands, but only when the length of the SMSC address coded into <pdu> parameter equals zero.

Implementation
Mandatory.

3.3.2 Set Text Mode Parameters +CSMP

Parameter Command Syntax

Command	Possible response(s)
+CSMP=[<fo>[,<vp>[,<pid>[,<dcs>]]]]	
+CSMP?	+CSMP: <fo>,<vp>,<pid>,<dcs>
+CSMP=?	

Description

Set command is used to select values for additional parameters needed when SM is sent to the network or placed in a storage when text format message mode is selected. It is possible to set the validity period starting from when the SM is received by the SMSC (<vp> is in range 0... 255) or define the absolute time of the validity period termination (<vp> is a string). The format of <vp> is given by <fo>. If TA supports the EVPF, see 3GPP TS 23.040 [3], it shall be given as a hexadecimal coded string (refer e.g. <pdu>) with double quotes.

NOTE: When storing a SMS-DELIVER from the TE to the preferred memory storage in text mode (refer command Write Message to Memory +CMGW), <vp> field can be used for <scts>.

Implementation
Mandatory when text mode implemented.

3.3.3 Show Text Mode Parameters +CSDH

Parameter Command Syntax

Command	Possible response(s)
+CSDH=[<show>]	
+CSDH?	+CSDH: <show>
+CSDH=?	+CSDH: (list of supported <show>s)

Description

Set command controls whether detailed header information is shown in text mode result codes.

Test command returns supported values as a compound value.

Defined Values

<show>:

0 do not show header values defined in commands +CSCA and +CSMP (<sca>, <tosca>, <fo>, <vp>, <pid> and <dcs>) nor <length>, <toda> or <tooa> in +CMT, +CMGL, +CMGR result codes for SMS-DELIVERs and SMS-SUBMITs in text mode; for SMS-COMMANDs in +CMGR result code, do not show <pid>, <mn>, <da>, <toda>, <length> or <cdata>

1 show the values in result codes

Implementation

Mandatory when text mode implemented.

3.3.4 Select Cell Broadcast Message Types +CSCB

Parameter Command Syntax

Command	Possible response(s)
+CSCB=[<mode>[,<mids>[,<dcss>]]]	
+CSCB?	+CSCB: <mode>,<mids>,<dcss>
+CSCB=?	+CSCB: (list of supported <mode>s)

Description

Set command selects which types of CBMs are to be received by the ME.

Test command returns supported modes as a compound value.

Defined Values

<mode>:

0 message types specified in <mids> and <dcss> are accepted

1 message types specified in <mids> and <dcss> are not accepted

<mids>: string type; all different possible combinations of CBM message identifiers (refer <mid>) (default is empty string); e.g. "0,1,5,320-478,922"

<dcss>: string type; all different possible combinations of CBM data coding schemes (refer <dcs>) (default is empty string); e.g. "0-3,5"

Implementation

Optional.

3.3.5 Save Settings +CSAS

Action Command Syntax

Command	Possible response(s)
+CSAS[=<profile>]	*+CMS ERROR: <err>*
+CSAS=?	+CSAS: (list of supported <profile>s)

Description

Execution command saves active message service settings to a non-volatile memory. A TA can contain several profiles of settings. Settings specified in commands Service Centre Address +CSCA, Set Message Parameters +CSMP and Select Cell Broadcast Message Types +CSCB (if implemented) are saved. Certain settings may not be supported by the storage (e.g. (U)SIM SMS parameters) and therefore can not be saved. See chapter Message Service Failure Result Code for <err> values.

Test command shall display the supported profile numbers for reading and writing of settings.

Defined Values

<profile>:

0...255 manufacturer specific profile number where settings are to be stored

Implementation

Optional.

3.3.6 Restore Settings +CRES

Action Command Syntax

Command	Possible response(s)
+CRES[=<profile>]	*+CMS ERROR: <err>*
+CRES=?	+CRES: (list of supported <profile>s)

Description

Execution command restores message service settings from non-volatile memory to active memory. A TA can contain several profiles of settings. Settings specified in commands Service Centre Address +CSCA, Set Message Parameters +CSMP and Select Cell Broadcast Message Types +CSCB (if implemented) are restored. Certain settings may not be supported by the storage (e.g. (U)SIM SMS parameters) and therefore can not be restored. See chapter Message Service Failure Result Code for <err> values.

Defined Values

<profile>:

0...255 manufacturer specific profile number from where settings are to be restored

Implementation

Optional.

3.3.7 Informative Examples

Figure 1 illustrates an example setup of a TE-TA-ME system for SMS. Location of volatile and non-volatile parameter memories, and the operations to change the parameter values are shown. +CSMP is used to set the text mode header values of SMS-SUBMIT (or SMS-DELIVER when received message is written from TE to a storage). The volatile memory may as well be in the ME, or when no volatile memory is used, +CSMP, +CSCA and +CSCB settings are stored directly to non-volatile memory of ME.

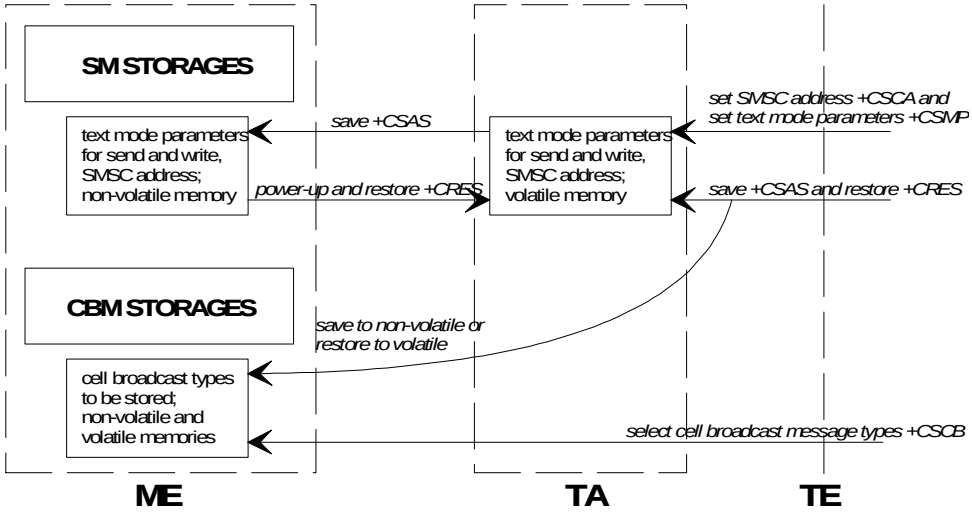


Figure 1: Message service parameter procedures

In this example, the volatile parameter settings of TA are used to construct messages in text mode. SMSC address setting is used also in PDU mode. The next example illustrates a session to restore the message parameters from the ME to the TA, and to set up the CBM identifiers (and languages) which are wanted to be received:

```
AT+CRES                     (restore settings from non-volatile memory to volatile memory)
OK
AT+CSMP?;+CSCA?             (query SM parameters)
+CSMP: 17,167,0,0           (default values for SMS-SUBMIT)
+CSCA: "+358501234567",145  (SMSC address)
OK
AT+CSDH=1                   (show all headers in text mode)
OK
AT+CSCB=1                   (all CBMs are accepted)
OK
```

3.4 Message Receiving and Reading Commands

3.4.1 New Message Indications to TE +CNMI

Parameter Command Syntax

Command	Possible response(s)
+CNMI=[<mode>[,<mt>[,<bm>[,<ds>[,<bfr>]]]]]	*+CMS ERROR: <err>*
+CNMI?	+CNMI: <mode>,<mt>,<bm>,<ds>,<bfr>
+CNMI=?	+CNMI: (list of supported <mode>s),(list of supported <mt>s),(list of supported <bm>s),(list of supported <ds>s),(list of supported <bfr>s)

Description

Set command selects the procedure, how receiving of new messages from the network is indicated to the TE when TE is active, e.g. DTR signal is ON. If TE is inactive (e.g. DTR signal is OFF), message receiving should be done as specified in 3GPP TS 23.038 [2].

NOTE: When DTR signal is not available or the state of the signal is ignored (V.25ter command &D0), reliable message transfer can be assured by using +CNMA acknowledgement procedure.

<mode> controls the processing of unsolicited result codes specified within this command, <mt> sets the result code indication routing for SMS-DELIVERs, <bm> for CBMs and <ds> for SMS-STATUS-REPORTs. <bfr> defines the handling method for buffered result codes when <mode> 1, 2 or 3 is enabled. If ME does not support requested item (although TA does), final result code +CMS ERROR: <err> is returned. See chapter Message Service Failure Result Code for a list of <err> values.

Test command gives the settings supported by the TA as compound values.

NOTE**:** Command Select Message Service +CSMS should be used to detect ME support of mobile terminated SMs and CBMs, and to define whether a message routed directly to TE should be acknowledged or not (refer command +CNMA).

Defined Values

<mode> (refer figure 2;

NOTE: The buffering mechanism may as well be located in the ME; the setting affects only to unsolicited result codes specified within this command):

0 Buffer unsolicited result codes in the TA. If TA result code buffer is full, indications can be buffered in some other place or the oldest indications may be discarded and replaced with the new received indications.

1 Discard indication and reject new received message 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.

NOTE: It is possible that ME/TA result code buffer is in volatile memory. In this case messages may get lost if the power of ME/TA is switched off before codes are sent to TE. Thus, it is not recommended to use direct message routing (<mt>=2 or 3, <bm>=2 or 3, or <ds>=1) with <mode> value 0 or 2.

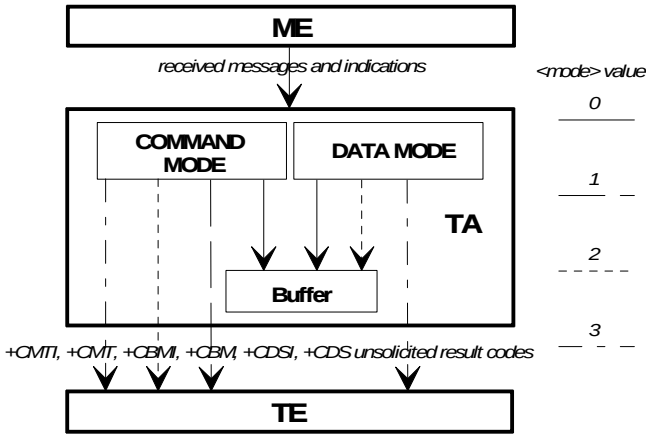


Figure 2: <mode> parameter

<mt> (the rules for storing received SMs depend on its data coding scheme (refer 3GPP TS 23.038 [2]), preferred memory storage (+CPMS) setting and this value; refer table 1;

NOTE: If AT command interface is acting as the only display device, the ME must support storing of class 0 messages and messages in the message waiting indication group (discard message); refer table 2):

0 No SMS-DELIVER indications are routed to the TE.

1 If SMS-DELIVER is stored into ME/TA, indication of the memory location is routed to the TE using unsolicited result code:

+CMTI: <mem>,<index>

2 SMS-DELIVERs (except class 2 messages and messages in the message waiting indication group (store message)) are routed directly to the TE using unsolicited result code:

+CMT: [<alpha>],<length><CR><LF><pdu> (PDU mode enabled)

or

+CMT: <oa>, [<alpha>],<scts>*[,<tooa>,<fo>,<pid>,<dcs>,<sca>,<tosca>,<length>]*<CR><LF><data> (text mode enabled; about parameters in italics, refer command Show Text Mode Parameters +CSDH)

If ME has its own display device then class 0 messages and messages in the message waiting indication group (discard message) may be copied to both ME display and to TE. In this case, ME shall send the acknowledgement to the network (refer table 2).

Class 2 messages and messages in the message waiting indication group (store message) result in indication as defined in <mt>=1.

3 Class 3 SMS-DELIVERs are routed directly to TE using unsolicited result codes defined in <mt>=2. Messages of other data coding schemes result in indication as defined in <mt>=1.

Table 1: <mt> parameter

<mt>	Receiving procedure for different message data coding schemes (refer 3GPP TS 23.038 [2])
0	no class: as in 3GPP TS 23.038 [2], but use <mem3> as preferred memory class 0: as in 3GPP TS 23.038 [2], but use <mem3> as preferred memory if message is tried to be stored class 1: as in 3GPP TS 23.038 [2], but use <mem3> as preferred memory class 2: as in 3GPP TS 23.038 [2] class 3: as in 3GPP TS 23.038 [2], but use <mem3> as preferred memory message waiting indication group (discard message): as in 3GPP TS 23.038 [2], but use <mem3> as preferred memory if message is tried to be stored message waiting indication group (store message): as in 3GPP TS 23.038 [2], but use <mem3> as preferred memory
1	as <mt>=0 but send indication if message stored successfully
2	no class: route message to TE class 0: as in 3GPP TS 23.038 [2], but also route message to TE and do not try to store it in memory class 1: route message to TE class 2: as <mt>=1 class 3: route message to TE message waiting indication group (discard message): as in 3GPP TS 23.038 [2], but also route message to TE and do not try to store it in memory message waiting indication group (store message): as <mt>=1
3	class 3: route message to TE others: as <mt>=1

Table 2: SMS-DELIVER result code and acknowledgement summary

<mt>	no class or class 1	class 0 or message waiting indication group (discard)	class 2 or message waiting indication group (store)	class 3
1	+CMTI	[+CMTI[1)]]	+CMTI	+CMTI
2	+CMT & +CNMA[3)]	+CMT [& +CNMA[2)]]	+CMTI	+CMT & +CNMA[3)]
3	+CMTI	[+CMTI[1)]]	+CMTI	+CMT & +CNMA[3)]

1) result code is sent when ME does not have other display device than AT interface
2) acknowledgement command must be sent when +CSMS <service> value equals 1 and ME does not have other display device than AT interface
3) acknowledgement command must be sent when +CSMS <service> value equals 1

<bm> (the rules for storing received CBMs depend on its data coding scheme (refer 3GPP TS 23.038 [2]), the setting of Select CBM Types (+CSCB) and this value; refer table 3):

0 No CBM indications are routed to the TE.

1 If CBM is stored into ME/TA, indication of the memory location is routed to the TE using unsolicited result code:

+CBMI: <mem>,<index>

2 New CBMs are routed directly to the TE using unsolicited result code:

+CBM: <length><CR><LF><pdu> (PDU mode enabled)

or

+CBM: <sn>,<mid>,<dcs>,<page>,<pages><CR><LF><data> (text mode enabled)

If ME supports data coding groups which define special routing also for messages other than class 3 (e.g. (U)SIM specific messages), ME may choose not to route messages of such data coding schemes into TE (indication of a stored CBM may be given as defined in <bm>=1).

3 Class 3 CBMs are routed directly to TE using unsolicited result codes defined in <bm>=2. If CBM storage is supported, messages of other classes result in indication as defined in <bm>=1.

Table 3: <bm> parameter

<bm>	Receiving procedure for different message data coding schemes (refer 3GPP TS 23.038 [2])
0	all schemes: as in 3GPP TS 23.038 [2]; if CBM storage is supported, store message to "BM" (or some manufacturer or data coding scheme specific memory)
1	all schemes: as <bm>=0 but send indication if message stored successfully
2	all schemes: route message to TE unless ME has detected a special routing to somewhere else (e.g. to (U)SIM; an indication may be sent if message stored successfully)
3	class 3: route message to TE others: as <bm>=1 (if CBM memory storage is supported)

<ds>:

0 No SMS-STATUS-REPORTs are routed to the TE.

1 SMS-STATUS-REPORTs are routed to the TE using unsolicited result code:

+CDS: <length><CR><LF><pdu> (PDU mode enabled)

or

+CDS: <fo>,<mr>,[<ra>],[<tora>],<scts>,<dt>,<st> (text mode enabled)

2 If SMS-STATUS-REPORT is stored into ME/TA, indication of the memory location is routed to the TE using unsolicited result code:

+CDSI: <mem>,<index>

Table 4: SMS-STATUS-REPORT result code and acknowledgement summary

<ds>	result codes and commands
1	+CDS & +CNMA[1)]
2	+CDSI
[1)] acknowledgement command must be sent when +CSMS <service> value equals 1	

<bfr>:

0 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).

1 TA buffer of unsolicited result codes defined within this command is cleared when <mode> 1...3 is entered.

Implementation

Mandatory when any of the new message indications implemented.

3.4.2 List Messages +CMGL

Action Command Syntax

Command	Possible response(s)
+CMGL[=<stat>]	**if text mode (+CMGF=1), command successful and SMS-SUBMITs and/or SMS-DELIVERs:** +CMGL: <index>,<stat>,<oa/da>,[<alpha>],[<scts>]*[,<tooa/toda>,<length>]*<CR><LF><data>[<CR><LF> +CMGL: <index>,<stat>,<da/oa>,[<alpha>],[<scts>]*[,<tooa/toda>,<length>]*<CR><LF><data>[...]] **if text mode (+CMGF=1), command successful and SMS-STATUS-REPORTs:** +CMGL: <index>,<stat>,<fo>,<mr>,[<ra>],[<tora>],<scts>,<dt>,<st> [<CR><LF> +CMGL: <index>,<stat>,<fo>,<mr>,[<ra>],[<tora>],<scts>,<dt>,<st> [...]] **if text mode (+CMGF=1), command successful and SMS-COMMANDs:** +CMGL: <index>,<stat>,<fo>,<ct>[<CR><LF> +CMGL: <index>,<stat>,<fo>,<ct>[...]] **if text mode (+CMGF=1), command successful and CBM storage:** +CMGL: <index>,<stat>,<sn>,<mid>,<page>,<pages> <CR><LF><data>[<CR><LF> +CMGL: <index>,<stat>,<sn>,<mid>,<page>,<pages> <CR><LF><data>[...]] **otherwise:** *+CMS ERROR: <err>*
+CMGL=?	+CMGL: (list of supported <stat>s)

Description

Execution command returns messages with status value <stat> from message storage <mem1> to the TE. About text mode parameters in italics, refer command Show Text Mode Parameters +CSDH. If status of the message is 'received unread', status in the storage changes to 'received read'. If listing fails, final result code +CMS ERROR: <err> is returned. See chapter Message Service Failure Result Code for <err> values.

NOTE: If the selected <mem1> can contain different types of SMs (e.g. SMS-DELIVERs, SMS-SUBMITs, SMS-STATUS-REPORTs and SMS-COMMANDs), the response may be a mix of the responses of different SM types. TE application can recognize the response format by examining the third response parameter.

Test command shall give a list of all status values supported by the TA.

Implementation

Optional.

3.4.3 Read Message +CMGR

Action Command Syntax

Command	Possible response(s)
+CMGR=<index>	**if text mode (+CMGF=1), command successful and SMS-DELIVER:** +CMGR: <stat>,<oa>,[<alpha>],<scts>*[,<tooa>,<fo>,<pid>,<dcs>,<sca>,<tosca>,<length>]*<CR><LF><data> **if text mode (+CMGF=1), command successful and SMS-SUBMIT:** +CMGR: <stat>,<da>,[<alpha>]*[,<toda>,<fo>,<pid>,<dcs>,[<vp>],<sca>,<tosca>,<length>]*<CR><LF><data> **if text mode (+CMGF=1), command successful and SMS-STATUS-REPORT:** +CMGR: <stat>,<fo>,<mr>,[<ra>],[<tora>],<scts>,<dt>,<st> **if text mode (+CMGF=1), command successful and SMS-COMMAND:** +CMGR: <stat>,<fo>,<ct>*[,<pid>,[<mn>],[<da>],[<toda>],<length><CR><LF><cdata>]* **if text mode (+CMGF=1), command successful and CBM storage:** +CMGR: <stat>,<sn>,<mid>,<dcs>,<page>,<pages><CR><LF><data> **otherwise:** *+CMS ERROR: <err>*
+CMGR=?	

Description

Execution command returns message with location value <index> from message storage <mem1> to the TE. About text mode parameters in italics, refer command Show Text Mode Parameters +CSDH. If status of the message is 'received unread', status in the storage changes to 'received read'. If reading fails, final result code +CMS ERROR: <err> is returned. See chapter Message Service Failure Result Code for <err> values.

Implementation

Optional.

3.4.4 New Message Acknowledgement to ME/TA +CNMA

Action Command Syntax

Command	Possible response(s)
if text mode (+CMGF=1): +CNMA	*+CMS ERROR: <err>*
+CNMA=?	

Description

Execution command confirms correct reception of a new message (SMS-DELIVER or SMS-STATUS-REPORT) which is routed directly to the TE (refer command +CNMI tables 2 and 4). This acknowledgement command (causing ME to send RP-ACK to the network) shall be used when +CSMS parameter <service> equals 1. TA shall not send another +CMT or +CDS result code to TE before previous one is acknowledged.

If ME does not get acknowledgement within required time (network timeout), ME should send RP-ERROR to the network. ME/TA shall automatically disable routing to TE by setting both <mt> and <ds> values of +CNMI to zero.

If command is executed, but no acknowledgement is expected, or some other ME related error occurs, final result code +CMS ERROR: <err> is returned. See chapter Message Service Failure Result Code for a list of <err> values.

NOTE: In case that a directly routed message must be buffered in ME/TA (possible when +CNMI parameter <mode> equals 0 or 2) or AT interpreter remains too long in a state where result codes cannot be sent to TE (e.g. user is entering a message using +CMGS), acknowledgement (RP-ACK) must be sent to the network without waiting +CNMA command from TE. Later, when buffered result codes are flushed to TE, TE must send +CNMA acknowledgement for each result code. In this way, ME/TA can determine if message should be placed in non-volatile memory and routing to TE disabled (+CNMA not received). Refer command +CNMI for more details how to use <mode> parameter reliably.

Implementation
Mandatory when <service> value 1 of command Select Message Service +CSMS is supported.

3.4.5 Informative Examples

Message forwarding is done as illustrated in figure 3. Optional +CNMA acknowledgement procedure is not presented. In this example, there is no TA memory for messages and result code buffer is situated in TA. The routing of message waiting indication group (discard message) SMS-DELIVERs equal to class 0 messages, and the routing of message waiting indication group (store message) SMS-DELIVERs equal to class 2 messages.

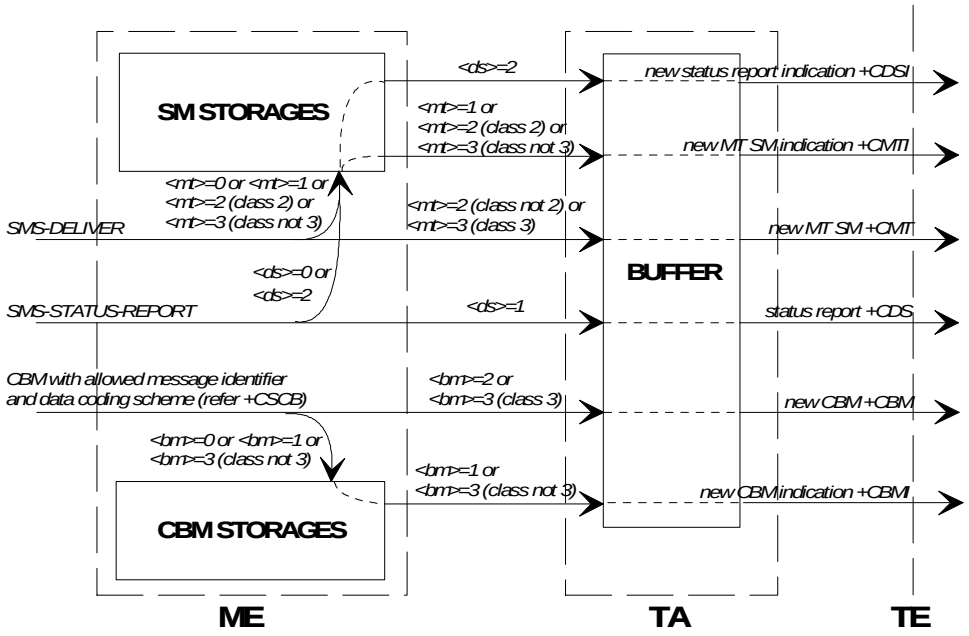


Figure 3: Message receiving procedures

Setting new message indications:

```
AT+CNMI=?           (query new message unsolicited result code modes)
+CNMI: (0-2),(0-3),(0-3),(0,1),(0,1)
OK
AT+CNMI=2,1,0,1,0   (send SM and status report indications to TE
OK                   when TA in command mode, otherwise buffer)
```

In this example, the TA is set so that it should send an unsolicited result code +CMTI: <mem>,<index> to the TE when a new SMS-DELIVER is received from the network and stored successfully to storage <mem>, and an unsolicited result code +CDS:... when a SMS-STATUS-REPORT is received. These result codes are routed to the TE when TA is in command mode, but buffered when in on-line data mode. Now, if new SM is received, it can be read as follows (text mode with no detailed header information; GSM 7 bit default alphabet used in message body):

```
+CMTI: "ME",2       (new message received in index 2)
AT+CMGR=2           (read the message)
+CMGR: "REC UNREAD","+358507654321","Mr. Jones","95/07/03,17:38:15+04"
This is the Mr. Jones testing
OK
```

In the next example all messages of storage <mem1> are listed (text mode with no detailed header information; GSM 7 bit default alphabet used in message bodies):

```
AT+CMGL="ALL"       (read all SMs)
+CMGL: 1,"REC READ","+358501234567","Mr. Smith","95/07/03,17:45:03+04"
This is the body of the message.
+CMGL: 2,"STO UNSENT","+358501234567","Mr. Smith",
This is the body of the reply.
OK
```

The next example shows a method to read new CBMs received from the network (text mode; GSM 7 bit default alphabet used in message bodies):

```
AT+CNMI=2,,2,,0                    (CBMs will be sent to the TE)
OK
AT+CPMS="BM";+CMGL  (select CBM memory for reading; list all unread CBMs)
+CMGL: 1,"REC UNREAD",100,40,1,3    (first page of three page weather information)
Weather in Finland 3rd of July 1995
+CMGL: 2,"REC UNREAD",100,40,2,3    (second page of three page weather information)
Helsinki: cloudy, snow storms, -20 degrees Celsius, wind -14 m/s NE
+CMGL: 3,"REC UNREAD",100,40,3,3    (third page of three page weather information)
Tampere: sunny, 40 degrees Celsius, wind 1 m/s SW
OK
```

3.5 Message Sending and Writing Commands

3.5.1 Send Message +CMGS

Action Command Syntax

Command	Possible response(s)
if text mode (+CMGF=1): +CMGS=<da>[,<toda>]<CR> ***text is entered***<ctrl-Z/ESC>	**if text mode (+CMGF=1) and sending successful:** +CMGS: <mr>[,<scts>] **if sending fails:** *+CMS ERROR: <err>*
+CMGS=?	

Description

Execution command sends message from a TE to the network (SMS-SUBMIT). Message reference value <mr> is returned to the TE on successful message delivery. Optionally (when +CSMS <service> value is 1 and network supports) <scts> is returned. Values can be used to identify message upon unsolicited delivery status report result code. If sending fails in a network or an ME error, final result code +CMS ERROR: <err> is returned. See chapter Message Service Failure Result Code for a list of <err> values. This command should be abortable.

Description

Execution command sends message from a TE to the network (SMS-SUBMIT). Message reference value <mr> is returned to the TE on successful message delivery. Value can be used to identify message upon unsolicited delivery status report result code. If sending fails in a network or an ME error, final result code +CMS ERROR: <err> is returned. See chapter Message Service Failure Result Code for a list of <err> values. This command should be abortable.

- entered text (3GPP TS 23.040 [3] TP-Data-Unit) is sent to address <da> and all current settings (refer Set Text Mode Parameters +CSMP and Service Centre Address +CSCA) are used to construct the actual PDU in ME/TA
- the TA shall send a four character sequence <CR><LF><greater_than><space> (IRA 13, 10, 62, 32) after command line is terminated with <CR>; after that text can be entered from TE to ME/TA
- the DCD signal shall be in ON state while text is entered
- the echoing of entered characters back from the TA is controlled by V.25ter echo command E
- the entered text should be formatted as follows:
  - if <dcs> (set with +CSMP) indicates that 3GPP TS 23.038 [2] GSM 7 bit default alphabet is used and <fo> indicates that 3GPP TS 23.040 [3] TP-User-Data-Header-Indication is not set:
    - if TE character set other than "HEX" (refer command Select TE Character Set +CSCS in 3GPP TS 27.007 [9]): ME/TA converts the entered text into the GSM 7 bit default alphabet according to rules of Annex A; backspace can be used to delete last character and carriage returns can be used (previously mentioned four character sequence shall be sent to the TE after every carriage return entered by the user)
    - if TE character set is "HEX": the entered text should consist of two IRA character long hexadecimal numbers which ME/TA converts into the GSM 7 bit default alphabet characters. (e.g. 17 (IRA 49 and 55) will be converted to character Π (GSM 7 bit default alphabet 23))

- if <dcs> indicates that 8-bit or UCS2 data coding scheme is used or <fo> indicates that 3GPP TS 23.040 [3] TP-User-Data-Header-Indication is set: the entered text should consist of two IRA character long hexadecimal numbers which ME/TA converts into 8-bit octet (e.g. two characters 2A (IRA 50 and 65) will be converted to an octet with integer value 42)

- sending can be cancelled by giving <ESC> character (IRA 27)

- <ctrl-Z> (IRA 26) must be used to indicate the ending of the message body

Implementation

Optional.

3.5.2 Send Message from Storage +CMSS

Action Command Syntax

Command	Possible response(s)
+CMSS=<index>[,<da>[,<toda>]]	**if text mode (+CMGF=1) and sending successful:** +CMSS: <mr>[,<scts>] **if sending fails:** *+CMS ERROR: <err>*
+CMSS=?	

Description

Execution command sends message with location value <index> from preferred message storage <mem2> to the network (SMS-SUBMIT or SMS-COMMAND). If new recipient address <da> is given given for SMS-SUBMIT, it shall be used instead of the one stored with the message. Reference value <mr> is returned to the TE on successful message delivery. Optionally (when +CSMS <service> value is 1 and network supports) <scts> is returned. Values can be used to identify message upon unsolicited delivery status report result code. If sending fails in a network or an ME error, final result code +CMS ERROR: <err> is returned. See chapter Message Service Failure Result Code for a list of <err> values. This command should be abortable.

Implementation

Optional.

3.5.3 Write Message to Memory +CMGW

Action Command Syntax

Command	Possible response(s)
if text mode (+CMGF=1): +CMGW[=<oa/da>[,<tooa/toda>[,<stat>]]]<CR> ***text is entered***<ctrl-Z/ESC>	+CMGW: <index> *+CMS ERROR: <err>*
+CMGW=?	

Description

Execution command stores message (either SMS-DELIVER or SMS-SUBMIT) to memory storage <mem2>. Memory location <index> of the stored message is returned. By default message status will be set to 'stored unsent', but parameter <stat> allows also other status values to be given. The entering of text is done similarly as specified in command Send Message +CMGS. If writing fails, final result code +CMS ERROR: <err> is returned. See chapter Message Service Failure Result Code for <err> values.

NOTE: SMS-COMMANDs and SMS-STATUS-REPORTs can not be stored in text mode.

Implementation

Optional.

3.5.4 Delete Message +CMGD

Action Command Syntax

Command	Possible response(s)
+CMGD=<index> [,<delflag>]	*+CMS ERROR: <err>*
+CMGD=?	+CMGD: (list of supported <index>s)[,(list of supported <delflag>s)]

Description

Execution command deletes message from preferred message storage <mem1> location <index>. If <delflag> is present and not set to 0 then the ME shall ignore <index> and follow the rules for <delflag> shown below. If deleting fails, final result code +CMS ERROR: <err> is returned. See chapter Message Service Failure Result Code for <err> values.

Test command shows the valid memory locations and optionally the supported values of <delflag>.

<delflag>: an integer indicating multiple message deletion request as follows:

0 (or omitted)	Delete the message specified in <index>
1	Delete all read messages from preferred message storage, leaving unread messages and stored mobile originated messages (whether sent or not) untouched
2	Delete all read messages from preferred message storage and sent mobile originated messages, leaving unread messages and unsent mobile originated messages untouched
3	Delete all read messages from preferred message storage, sent and unsent mobile originated messages leaving unread messages untouched.
4	Delete all messages from preferred message storage including unread messages.

Implementation

Optional.

3.5.5 Send Command +CMGC

Action Command Syntax

Command	Possible response(s)
if text mode (+CMGF=1): +CMGC=<fo>,<ct>[,<pid>[,<mn>[,<da>[,<toda>]]]]<CR> ***text is entered***<ctrl-Z/ESC>	**if text mode (+CMGF=1) and sending successful:** +CMGC: <mr>[,<scts>] **if sending fails:** *+CMS ERROR: <err>*
+CMGC=?	

Description

Execution command sends a command message from a TE to the network (SMS-COMMAND). The entering of text (3GPP TS 23.040 [3] TP-Command-Data) is done similarly as specified in command Send Message +CMGS, but the format is fixed to be a sequence of two IRA character long hexadecimal numbers which ME/TA converts into 8-bit octets (refer +CMGS). Message reference value <mr> is returned to the TE on successful message delivery. Optionally (when +CSMS <service> value is 1 and network supports) <scts> is returned. Values can be used to identify message upon unsolicited delivery status report result code. If sending fails in a network or an ME error, final result code +CMS ERROR: <err> is returned. See chapter Message Service Failure Result Code for a list of <err> values. This command should be abortable.

Implementation
Optional.

3.5.6 More Messages to Send +CMMS

Parameter Command Syntax

Command	Possible response(s)
+CMMS=[<n>]	
+CMMS?	+CMMS: <n>
+CMMS=?	+CMMS: (list of supported <n>s)

Description

Set command controls the continuity of SMS relay protocol link. When feature is enabled (and supported by network) multiple messages can be sent much faster as link is kept open.

Test command returns supported values as a compound value.

Defined Values

<n>:

0 disable

1 keep enabled until the time between the response of the latest message send command (+CMGS, +CMSS, etc.) and the next send command exceeds 1-5 seconds (the exact value is up to ME implementation), then ME shall close the link and TA switches <n> automatically back to 0

2 enable (if the time between the response of the latest message send command and the next send command exceeds 1-5 seconds (the exact value is up to ME implementation), ME shall close the link but TA shall not switch automatically back to <n>=0)

Implementation
Optional.

3.5.7 Informative Examples

Figure 4 is an example of a TE-TA-ME setup when messages are sent to network or stored to ME. The volatile memory may as well be in the ME, or a non-volatile memory may be used instead when constructing messages.

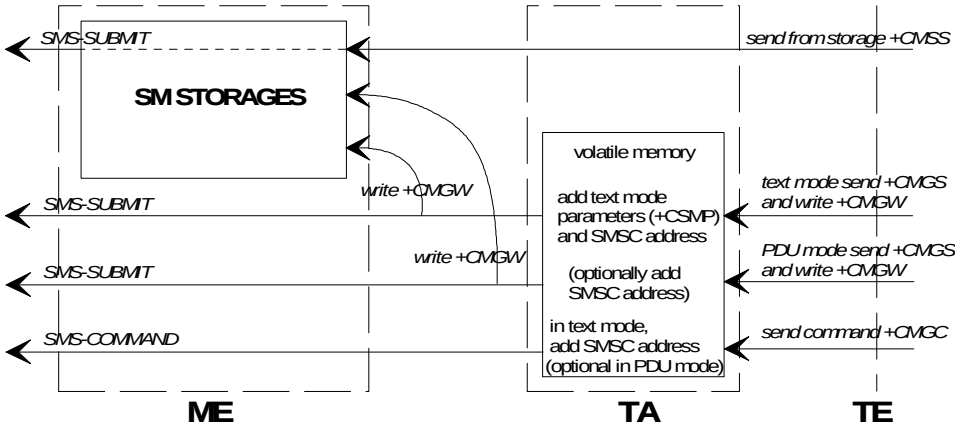


Figure 4: Message service send and write procedures

An example of sending a GSM 7 bit default alphabet message in text mode and a SMS-STATUS-REPORT is wanted:

```
AT+CNMI?                    (check that status reports are routed to TE)
+CNMI: 2,1,0,1,0
OK
AT+CSMP=32,167,0,0          (status report wanted; otherwise default settings)
```

```
OK
AT+CMGS="+358501234567"     (start editing a message)
> This the first line.      (edit first line and press carriage return)
> This is the last line.^Z  (edit second line and send message by pressing control-Z)
+CMGS: 10                   (success: message reference 10 returned from SMSC)
OK
+CDS: 2,10,"+358501234567",145,"95/07/04/13:12:14+04",
"95/07/04/13:12:20+04",0    (status report of successful message delivery received)
```

Storing an unsent message in memory, sending it from there, and deleting it:

```
AT+CPMS?                (check memory settings)
+CPMS: "ME",4,10,"ME",4,10,"ME",4,10
OK
AT+CMGW="9501231234"    (write message)
> This is the message body^Z
+CMGW: 7                (index number in storage returned)
OK
AT+CMSS=7               (send from storage)
+CMSS: 12               (success: reference value 12 sent from SC)
OK
AT+CMGD=7               (delete message)
OK
```

4 PDU Mode

The PDU mode uses the same commands and responses as the Text Mode described in clause 3. However, the following commands and responses have a different format. In the PDU mode, a complete SMS Message including all header information is passed as a binary string. This binary string is composed of hexadecimal IA5 characters as defined in clause 3 above under "Message Data Parameters".

4.1 List Messages +CMGL

Action Command Syntax

Command	Possible response(s)
+CMGL[=<stat>]	**if PDU mode (+CMGF=0) and command successful:** +CMGL: <index>,<stat>,[<alpha>],<length><CR><LF><pdu> [<CR><LF>+CMGL:<index>,<stat>,[<alpha>],<length><CR><LF><pdu> [...]] **otherwise:** *+CMS ERROR: <err>*
+CMGL=?	+CMGL: (list of supported <stat>s)

Description

Execution command returns messages with status value <stat> from preferred message storage <mem1> to the TE. Entire data units <pdu> are returned. If status of the message is 'received unread', status in the storage changes to 'received read'. If listing fails, final result code +CMS ERROR: <err> is returned. See chapter Message Service Failure Result Code for <err> values.

Test command shall give a list of all status values supported by the TA.

Implementation

Optional.

4.2 Read Message +CMGR

Action Command Syntax

Command	Possible response(s)
+CMGR=<index>	**if PDU mode (+CMGF=0) and command successful:** +CMGR: <stat>,[<alpha>],<length><CR><LF><pdu> **otherwise:** *+CMS ERROR: <err>*
+CMGR=?	

Description

Execution command returns message with location value <index> from preferred message storage <mem1> to the TE. Status of the message and entire message data unit <pdu> is returned. If status of the message is 'received unread', status in the storage changes to 'received read'. If reading fails, final result code +CMS ERROR: <err> is returned. See chapter Message Service Failure Result Code for <err> values.

Implementation

Optional.

4.3 Send Message +CMGS

Action Command Syntax

Command	Possible response(s)
if PDU mode (+CMGF=0): +CMGS=<length><CR> ***PDU is given***<ctrl-Z/ESC>	**if PDU mode (+CMGF=0) and sending successful:** +CMGS: <mr>[,<ackpdu>] **if sending fails:** *+CMS ERROR: <err>*
+CMGS=?	

Description

Execution command sends message from a TE to the network (SMS-SUBMIT). Message reference value <mr> is returned to the TE on successful message delivery. Optionally (when +CSMS <service> value is 1 and network supports) <ackpdu> is returned. Values can be used to identify message upon unsolicited delivery status report result code. If sending fails in a network or an ME error, final result code +CMS ERROR: <err> is returned. See chapter Message Service Failure Result Code for a list of <err> values. This command should be abortable.

- <length> must indicate the number of octets coded in the TP layer data unit to be given (i.e. SMSC address octets are excluded)
- the TA shall send a four character sequence <CR><LF><greater_than><space> (IRA 13, 10, 62, 32) after command line is terminated with <CR>; after that PDU can be given from TE to ME/TA
- the DCD signal shall be in ON state while PDU is given
- the echoing of given characters back from the TA is controlled by V.25ter echo command E
- the PDU shall be hexadecimal format (similarly as specified for <pdu>) and given in one line; ME/TA converts this coding into the actual octets of PDU
- when the length octet of the SMSC address (given in the PDU) equals zero, the SMSC address set with command Service Centre Address +CSCA is used; in this case the SMSC Type-of-Address octet shall not be present in the PDU, i.e. TPDU starts right after SMSC length octet
- sending can be cancelled by giving <ESC> character (IRA 27)
- <ctrl-Z> (IRA 26) must be used to indicate the ending of PDU

Implementation

Optional.

4.4 Write Message to Memory +CMGW

Action Command Syntax

Command	Possible response(s)
if PDU mode (+CMGF=0): +CMGW=<length>[,<stat>]<CR>***PDU is given***<ctrl-Z/ESC>	+CMGW: <index> *+CMS ERROR: <err>*
+CMGW=?	

Description

Execution command stores a message to memory storage <mem2>. Memory location <index> of the stored message is returned. By default message status will be set to 'stored unsent', but parameter <stat> allows also other status values to be given. (ME/TA manufacturer may choose to use different default <stat> values for different message types.) The entering of PDU is done similarly as specified in command Send Message +CMGS. If writing fails, final result code +CMS ERROR: <err> is returned. See chapter Message Service Failure Result Code for <err> values.

Implementation

Optional.

4.5 Send Command +CMGC

Action Command Syntax

Command	Possible response(s)
if PDU mode (+CMGF=0): +CMGC=<length><CR> ***PDU is given***<ctrl-Z/ESC>	**if PDU mode (+CMGF=0) and sending successful:** +CMGC: <mr>[,<ackpdu>] **if sending fails:** *+CMS ERROR: <err>*
+CMGC=?	

Description

Execution command sends a command message from a TE to the network (SMS-COMMAND). The entering of PDU is done similarly as specified in command Send Message +CMGS. Message reference value <mr> is returned to the TE on successful message delivery. Optionally (when +CSMS <service> value is 1 and network supports) <ackpdu> is returned. Values can be used to identify message upon unsolicited delivery status report result code. If sending fails in a network or an ME error, final result code +CMS ERROR: <err> is returned. See chapter Message Service Failure Result Code for a list of <err> values. This command should be abortable.

Implementation

Optional.

4.6 New Message Acknowledgement to ME/TA +CNMA

Action Command Syntax

Command	Possible response(s)
if PDU mode (+CMGF=0): +CNMA[=<n>[,<length>[<CR> ***PDU is given***<ctrl-Z/ESC>]]]	*+CMS ERROR: <err>*
+CNMA=?	**if PDU mode (+CMGF=0):** +CNMA: (list of supported <n>s)

Description

Execution command confirms reception of a new message (SMS-DELIVER or SMS-STATUS-REPORT) which is routed directly to the TE (refer command +CNMI tables 2 and 4). This acknowledgement command shall be used when +CSMS parameter <service> equals 1. In PDU mode, it is possible to send either positive (RP-ACK) or negative (RP-ERROR) acknowledgement to the network. Parameter <n> defines which one will be sent. Optionally (when <length> is greater than zero) an acknowledgement TPDU (SMS-DELIVER-REPORT for RP-ACK or RP-ERROR) may be sent to the network. The entering of PDU is done similarly as specified in command Send Message +CMGS, except that the format of <ackpdu> is used instead of <pdu> (i.e. SMSC address field is not present). PDU shall not be bounded by double quotes. TA shall not send another +CMT or +CDS result code to TE before previous one is acknowledged.

If ME does not get acknowledgement within required time (network timeout), ME should send RP-ERROR to the network. ME/TA shall automatically disable routing to TE by setting both <mt> and <ds> values of +CNMI to zero.

If command is executed, but no acknowledgement is expected, or some other ME related error occurs, final result code +CMS ERROR: <err> is returned. See chapter Message Service Failure Result Code for a list of <err> values.

NOTE: In case that a directly routed message must be buffered in ME/TA (possible when +CNMI parameter <mode> equals 0 or 2) or AT interpreter remains too long in a state where result codes cannot be sent to TE (e.g. user is entering a message using +CMGS), acknowledgement (RP-ACK) must be sent to the network without waiting +CNMA command from TE. Later, when buffered result codes are flushed to TE, TE must send +CNMA[=0] acknowledgement for each result code. In this way, ME/TA can determine if message should be placed in non-volatile memory and routing to TE disabled (+CNMA[=0] not received). Refer command +CNMI for more details how to use <mode> parameter reliably.

Test command returns a list of supported <n> values. If the only value supported is 0, the device does not support sending of TPDU.

Defined Values

<n>:

0 command operates similarly as defined for the text mode

1 send RP-ACK (or buffered result code received correctly)

2 send RP-ERROR (if PDU is not given, ME/TA shall send SMS-DELIVER-REPORT with 3GPP TS 23.040 [3] TP-FCS value set to 'FF' (unspecified error cause))

Implementation

Mandatory when <service> value 1 of command Select Message Service +CSMS is supported.

4.7 Send Message from Storage +CMSS

Action Command Syntax

Command	Possible response(s)
+CMSS=<index>[,<da>[,<toda>]]	**if PDU mode (+CMGF=0) and sending successful:** +CMSS: <mr>[,<ackpdu>] **if sending fails:** *+CMS ERROR: <err>*
+CMSS=?	

Description

Execution command sends message with location value <index> from message storage <mem2> to the network (SMS-SUBMIT or SMS-COMMAND). If new recipient address <da> is given for SMS-SUBMIT, it shall be used instead of the one stored with the message. Reference value <mr> is returned to the TE on successful message delivery. Optionally (when +CSMS <service> value is 1 and network supports) <ackpdu> is returned. Values can be used to identify message upon unsolicited delivery status report result code. If sending fails in a network or an ME error, final result code +CMS ERROR: <err> is returned. See chapter Message Service Failure Result Code for a list of <err> values. This command should be abortable.

Implementation

Optional.

Annex A (Normative): Character Set Conversions for SMS Text Mode

The following conversions to and from 3GPP TS 23.038 [2] GSM 7 bit default alphabet are defined:

TE char set	bits/char	Commands
PC Code Page 437	8	+CMGF=1;+CSCS="PCCP437"
PC Danish/Norwegian	8	+CMGF=1;+CSCS="PCDN"
ISO 8859 Latin 1	8	+CMGF=1;+CSCS="8859-1"
IRA	7	+CMGF=1;+CSCS="IRA"
GSM 7 bit default alphabet	7	+CMGF=1;+CSCS="GSM"

The tables below show which GSM 7 bit default alphabet value corresponds to the 7 or 8 bit value of external character set. The TE character set value is computed by adding column value, 00H through F0H (70H for 7 bits/char), with the row value (00H through 0FH). All values are in hexadecimal, but the H suffix is not used. When text mode is implemented, it is mandatory for a TA to have at least one conversion which include the conversion table of IRA (e.g. PC Code Page 437 does). Additional conversions can be defined by manufacturers. It is manufacturer specific if the TE set is actually converted to GSM 7 bit default alphabet set in the TA or in the ME, and if the TE set is converted to a ME specific set in the TA before converting it to GSM 7 bit default alphabet set when message is sent to the network. It is recommended that characters which cannot be converted to GSM 7 bit default alphabet set are deleted.

Conversion from IRA to GSM 7 bit default alphabet:

	00	10	20	30	40	50	60	70
00	-	-	20	30	00	50	-	70
01	-	-	21	31	41	51	61	71
02	-	-	22	32	42	52	62	72
03	-	-	23	33	43	53	63	73
04	-	-	02	34	44	54	64	74
05	-	-	25	35	45	55	65	75
06	-	-	26	36	46	56	66	76
07	-	-	27	37	47	57	67	77
08	-	-	28	38	48	58	68	78
09	-	-	29	39	49	59	69	79
0A	LF	-	2A	3A	4A	5A	6A	7A
0B	-	-	2B	3B	4B	-	6B	-
0C	-	-	2C	3C	4C	-	6C	-
0D	CR-	-	2D	3D	4D	-	6D	-
0E	-	-	2E	3E	4E	-	6E	-
0F	-	-	2F	3F	4F	11	6F	-

Conversion from PCCP437 (PC-8 Code Page 437) to GSM 7 bit default alphabet:

	00	10	20	30	40	50	60	70	80	90	A0	B0	C0	D0	E0	F0
00	-	-	20	30	00	50	-	70	09	1F	61[10]	-	-	-	-	-
01	-	-	21	31	41	51	61	71	7E	1D	69[11]	-	-	-	1E	-
02	-	-	22	32	42	52	62	72	05	1C	6F[12]	-	-	-	13	-
03	-	-	23	33	43	53	63	73	61[1]	6F[7]	75[13]	-	-	-	-	-
04	-	-	02	34	44	54	64	74	7B	7C	7D	-	-	-	18	-
05	-	5F	25	35	45	55	65	75	7F	08	5D	-	-	-	-	-
06	-	-	26	36	46	56	66	76	0F	75[8]	-	-	-	-	-	-
07	-	-	27	37	47	57	67	77	09[2]	06	-	-	-	-	-	-
08	-	-	28	38	48	58	68	78	65[3]	79[9]	60	-	-	-	12	-
09	-	-	29	39	49	59	69	79	65[4]	5C	-	-	-	-	19	-
0A	LF	-	2A	3A	4A	5A	6A	7A	04	5E	-	-	-	-	15	-
0B	-	-	2B	3B	4B	-	6B	-	69[5]	-	-	-	-	-	-	-
0C	-	-	2C	3C	4C	-	6C	-	69[6]	01	-	-	-	-	-	-
0D	CR	-	2D	3D	4D	-	6D	-	07	03	40	-	-	-	-	-
0E	-	-	2E	3E	4E	-	6E	-	5B	-	-	-	-	-	-	-
0F	-	-	2F	3F	4F	11	6F	-	0E	-	-	-	-	-	-	-

[1] : â ⇨ a [2] : ç ⇨ Ç [3] : ê ⇨ e [4] : ë ⇨ e [5] : ï ⇨ i

[6] : î ⇨ i [7] : ô ⇨ o [8] : û ⇨ u [9] : ÿ ⇨ y [10] : á ⇨ a

[11] : í ⇨ i [12] : ó ⇨ o [13] : ú ⇨ u

Conversion from PCDN (PC-8 Danish/ Norwegian) to GSM 7 bit default alphabet:

	00	10	20	30	40	50	60	70	80	90	A0	B0	C0	D0	E0	F0
00	-	-	20	30	00	50	-	70	09	1F	61[10]	-	-	-	-	-
01	-	-	21	31	41	51	61	71	7E	1D	69[11]	-	-	-	1E	-
02	-	-	22	32	42	52	62	72	05	1C	6F[12]	-	-	-	13	-
03	-	-	23	33	43	53	63	73	61[1]	6F[7]	75[13]	-	-	-	-	-
04	-	-	02	34	44	54	64	74	7B	7C	7D	-	-	-	18	-
05	-	5F	25	35	45	55	65	75	7F	08	5D	-	-	-	-	-
06	-	-	26	36	46	56	66	76	0F	75[8]	-	-	-	-	-	-
07	-	-	27	37	47	57	67	77	09[2]	06	-	-	-	-	-	-
08	-	-	28	38	48	58	68	78	65[3]	79[9]	60	-	-	-	12	-
09	-	-	29	39	49	59	69	79	65[4]	5C	-	-	-	-	19	-
0A	LF	-	2A	3A	4A	5A	6A	7A	04	5E	-	-	-	-	15	-
0B	-	-	2B	3B	4B	-	6B	-	69[5]	0C	-	-	-	-	-	-
0C	-	-	2C	3C	4C	-	6C	-	69[6]	01	-	-	-	-	-	-
0D	CR	-	2D	3D	4D	-	6D	-	07	0B	40	-	-	-	-	-
0E	-	-	2E	3E	4E	-	6E	-	5B	-	-	-	-	-	-	-
0F	-	-	2F	3F	4F	11	6F	-	0E	-	-	-	-	-	-	-

[1] : â ⇨ a [2] : ç ⇨ Ç [3] : ê ⇨ e [4] : ë ⇨ e [5] : ï ⇨ i

[6] : î ⇨ i [7] : ô ⇨ o [8] : û ⇨ u [9] : ÿ ⇨ y [10] : á ⇨ a

[11] : í ⇨ i [12] : ó ⇨ o [13] : ú ⇨ u

Conversion from 8859-1 (ISO 8859 Latin 1) to GSM 7 bit default alphabet:

	00	10	20	30	40	50	60	70	80	90	A0	B0	C0	D0	E0	F0
00	-	-	20	30	00	50	-	70	-	-	-	-	41[1]	-	7F	-
01	-	-	21	31	41	51	61	71	-	-	40	-	41[2]	5D	61[20]	7D
02	-	-	22	32	42	52	62	72	-	-	-	-	41[3]	4F[12]	61[21]	08
03	-	-	23	33	43	53	63	73	-	-	01	-	41[4]	4F[13]	61[22]	6F[29]
04	-	-	02	34	44	54	64	74	-	-	24	-	5B	4F[14]	7B	6F[30]
05	-	-	25	35	45	55	65	75	-	-	03	-	0E	4F[15]	0F	6F[31]
06	-	-	26	36	46	56	66	76	-	-	-	-	1C	5C	1D	7C
07	-	-	27	37	47	57	67	77	-	-	5F	-	09	-	09[23]	-
08	-	-	28	38	48	58	68	78	-	-	-	-	45[5]	0B	04	0C
09	-	-	29	39	49	59	69	79	-	-	-	-	1F	55[16]	05	06
0A	LF	-	2A	3A	4A	5A	6A	7A	-	-	-	-	45[6]	55[17]	65[24]	75[32]
0B	-	-	2B	3B	4B	-	6B	-	-	-	-	-	45[7]	55[18]	65[25]	75[33]
0C	-	-	2C	3C	4C	-	6C	-	-	-	-	-	49[8]	5E	07	7E
0D	CR	-	2D	3D	4D	-	6D	-	-	-	-	-	49[9]	59[19]	69[26]	79[34]
0E	-	-	2E	3E	4E	-	6E	-	-	-	-	-	49[10]	-	69[27]	-
0F	-	-	2F	3F	4F	11	6F	-	-	-	-	60	49[11]	1E	69[28]	79[35]

[1] : À ⇨ A [2] : Á ⇨ A [3] : Â ⇨ A [4] : Ã ⇨ A [5] : È ⇨ E

[6] : Ê ⇨ E [7] : Ë ⇨ E [8] : Ì ⇨ I [9] : Í ⇨ I [10] : Î ⇨ I

[11] : Ï ⇨ I [12] : Ò ⇨ O [13] : Ó ⇨ O [14] : Ô ⇨ O [15] : Õ ⇨ O

[16] : Ù ⇨ U [17] : Ú ⇨ U [18] : Û ⇨ U [19] : Ý ⇨ Y [20] : á ⇨ a

[21] : â ⇨ a [22] : ã ⇨ a [23] : ç ⇨ Ç [24] : ê ⇨ e [25] : ë ⇨ e

[26] : í ⇨ i [27] : î ⇨ i [28] : ï ⇨ i [29] : ó ⇨ o [30] : ô ⇨ o

[31] : õ ⇨ o [32] : ú ⇨ u [33] : û ⇨ u [34] : ý ⇨ y [35] : ÿ ⇨ y

Conversions from GSM 7 bit default alphabet to above character sets are otherwise straightforward, but no conversions of the characters listed below tables are applied.

Annex B (Informative): Example of processing a data block

B.1 Example state diagrams for the block receiver

The state diagrams on the following two pages show how the receiver component at the block level could work. In this example the received octets are processed in two stages.

Stage 1 is a low level function which detects the unique start and end markers, and removes any stuffing octets. The results of this stage are passed to stage 2. Any unexpected octet value after a DLE will be indicated as 'abort'.

Stage 2 assembles the message content and the BCS octets, using octets passed from stage 1 and the 'start' and 'end' indications. A 'start' will always reset the process to state 1 from any state. An 'abort' will always cause a return to state 0 where a 'start' will be awaited. When an 'end' is received in state 1, the following two octets are checked as the BCS. If the BCS is correct, the message content is passed to another stage of the receiver for processing of the message content.

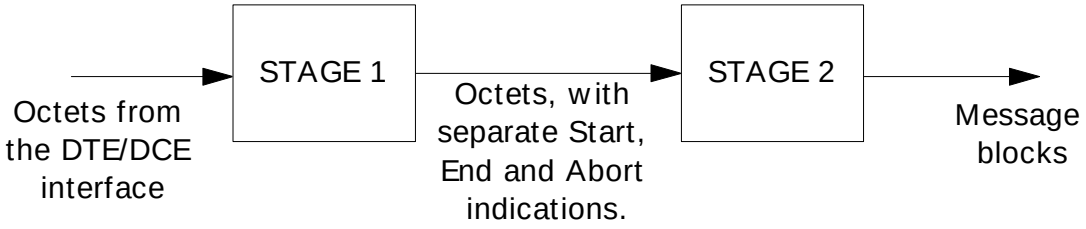
B.2 Example of coding and decoding a data block

The last page of this annex shows the coding of an example message at a transmitter, and the decoding stages at a receiver which has the two stages of processing as described above.

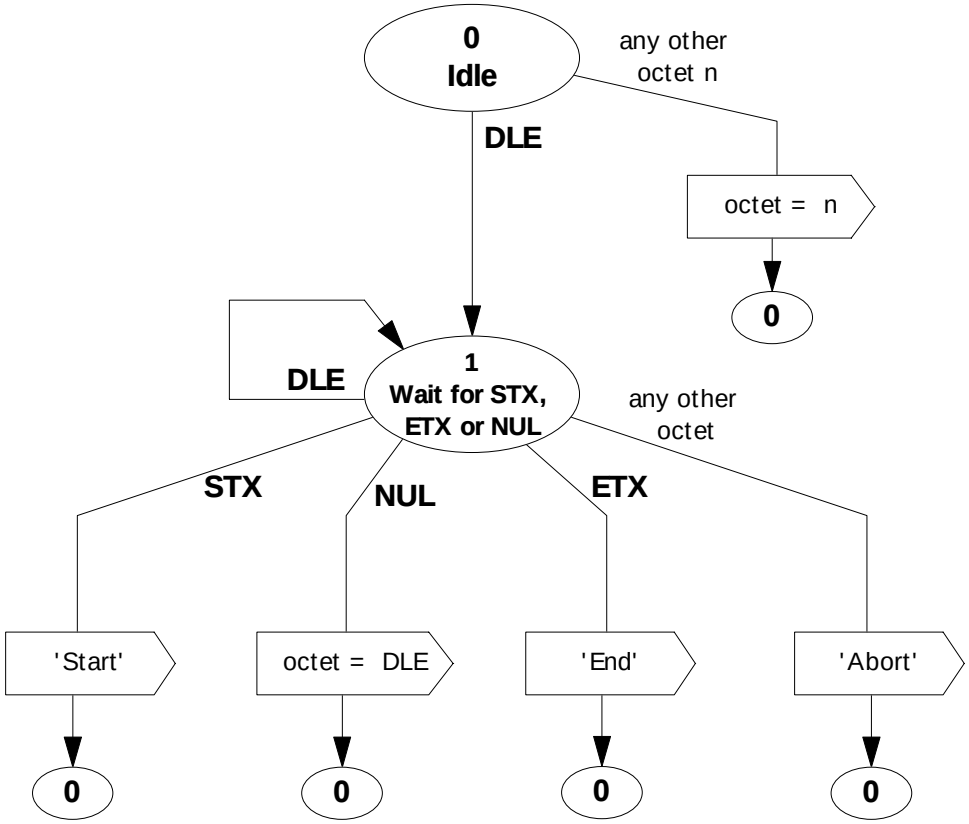
In this example, the message content and the BCS both contain an octet with a value of 10 hex. Therefore the message as transmitted over the interface has additional stuffing octets (00 hex) inserted after these octets. The receiver first detects the start and end markers, and removes the stuffing octets. Finally the BCS is checked.

EXAMPLE STATE DIAGRAMS FOR THE BLOCK RECEIVER

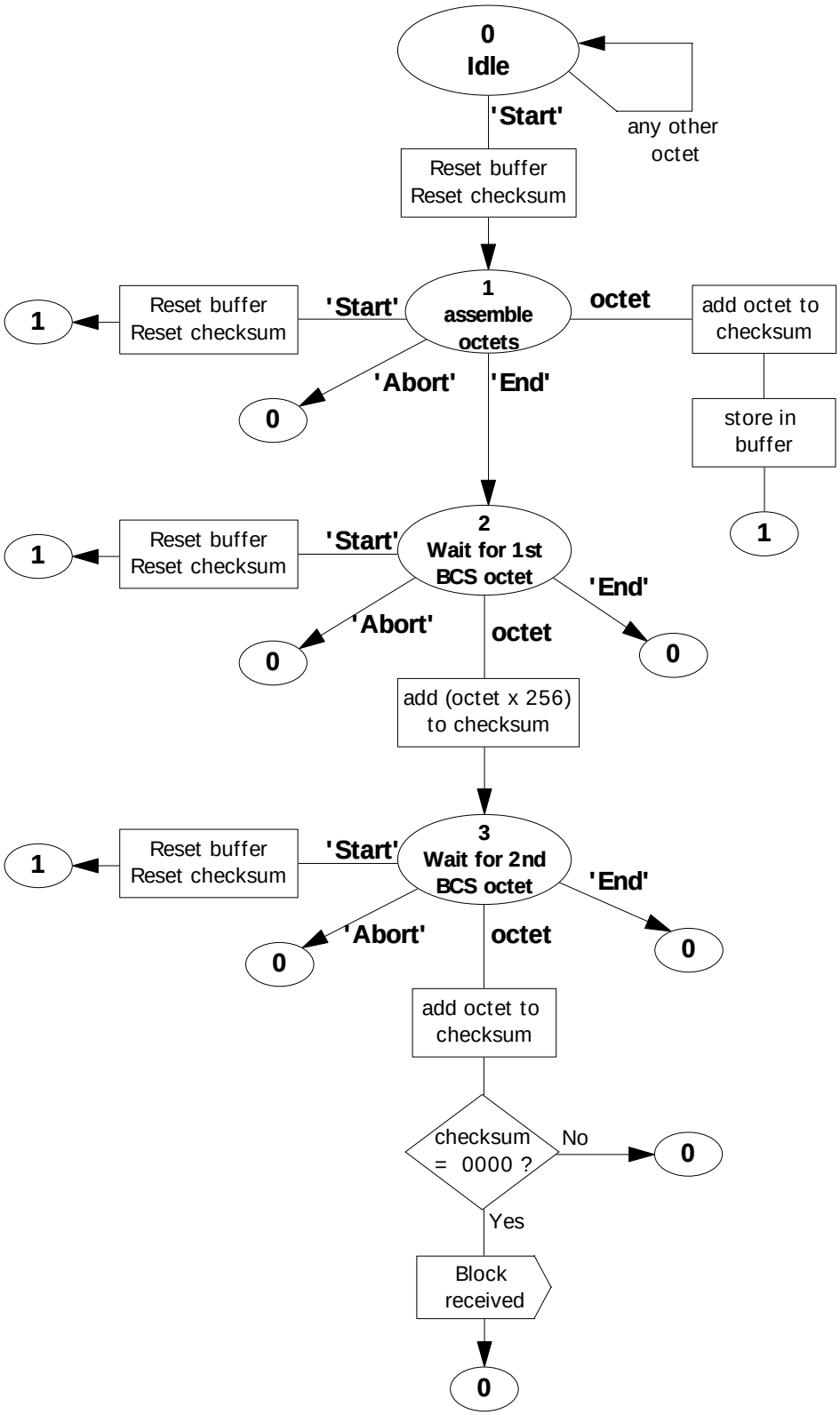
The block receiver can be considered as two stages. Stage 1 detects start and end markers, and removes stuffing characters. Stage 2 assembles the received message and checks the BCS.



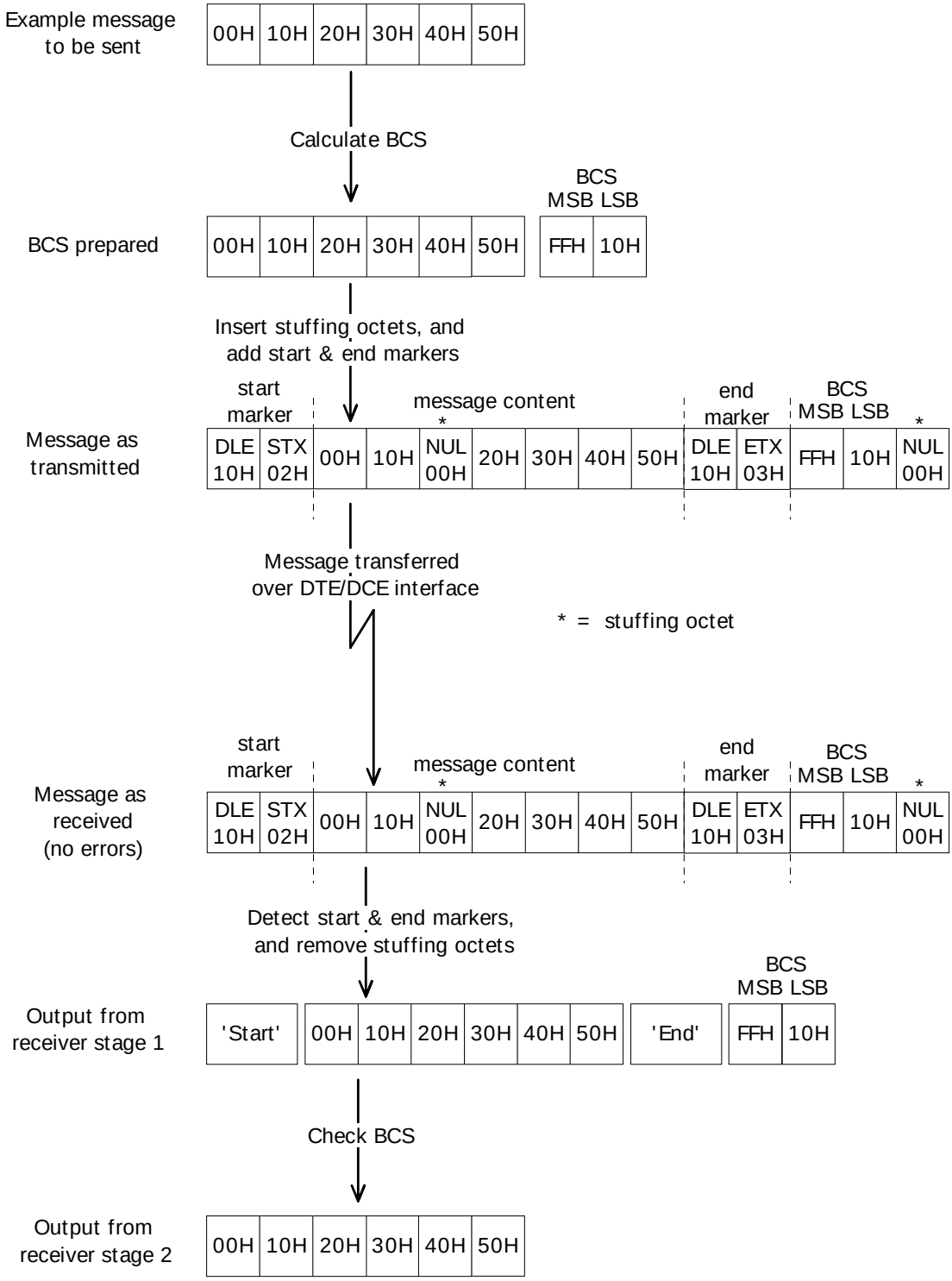
STATE TRANSITIONS IN STAGE 1



STATE TRANSITIONS IN STAGE 2

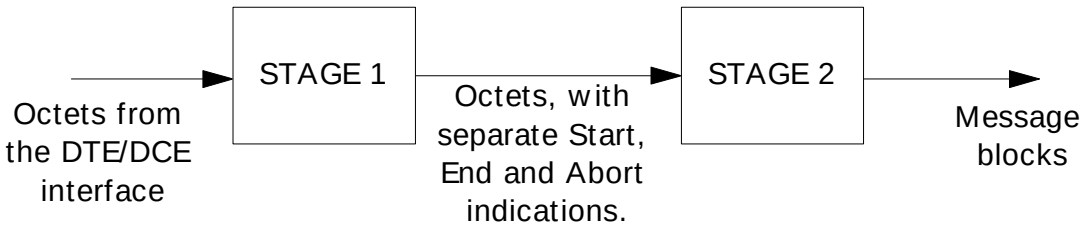


Example of coding / decoding a message at the DTE/DCE interface

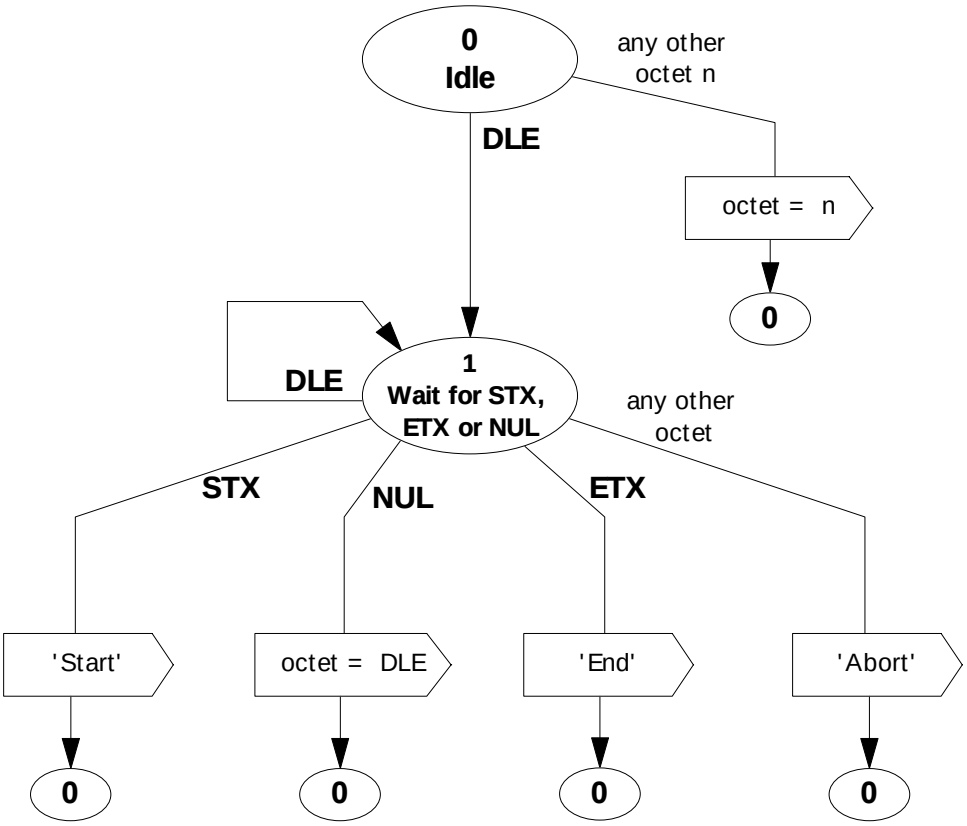


EXAMPLE STATE DIAGRAMS FOR THE BLOCK RECEIVER

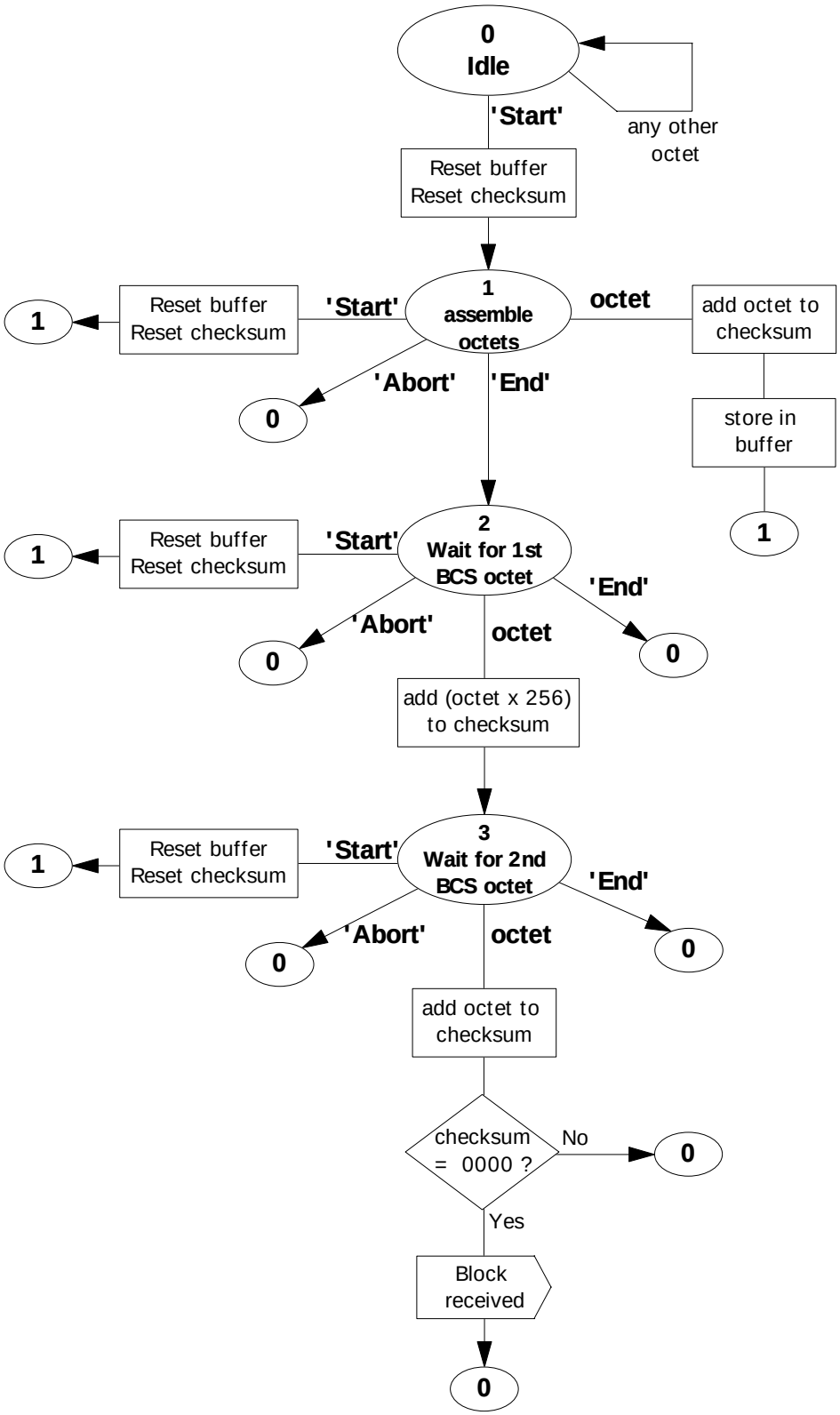
The block receiver can be considered as two stages. Stage 1 detects start and end markers, and removes stuffing characters. Stage 2 assembles the received message and checks the BCS.



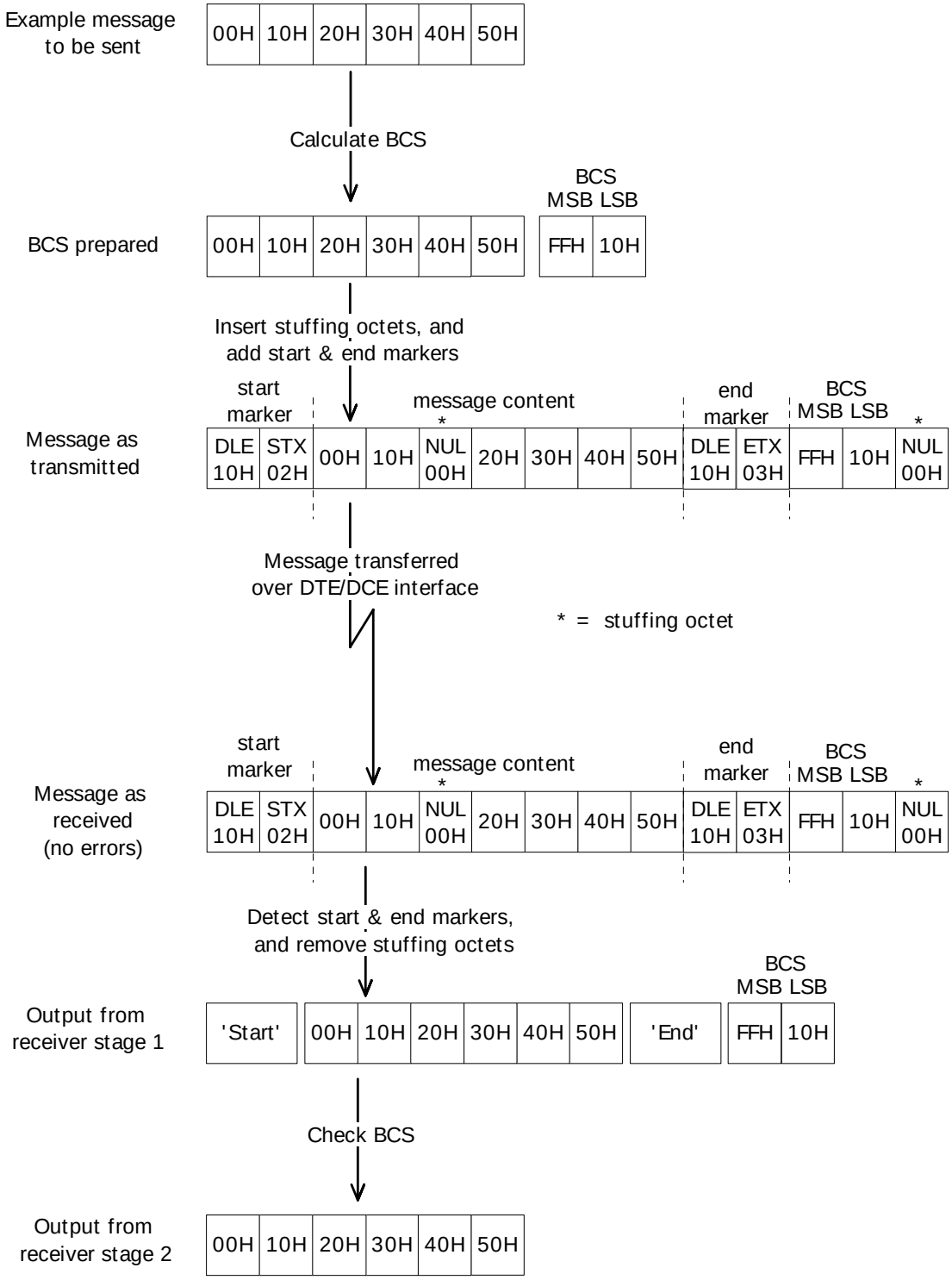
STATE TRANSITIONS IN STAGE 1



STATE TRANSITIONS IN STAGE 2



Example of coding / decoding a message at the DTE/DCE interface



Annex C (Informative): Change History

TSG-T#	TDoc	VER	CR	REV	REL	CAT	WORKITEM	SUBJECT	NEW_VER
T#3			New					Creation of 3GPP 27.005 v1.0.0 out of GSM 07.05 v7.0.0	3.0.0
T#6	TP-99237	3.0.0	001		R99	F	TEI	Adaptations for UMTS	3.1.0
T#11	-	3.1.0	-		Rel-4			Upgrade to Rel-4	4.0.0

3GPP TSG-T2 #14
Edinburgh, Scotland
3-7 September 2001

T2-010707

CR-Form-v4

CHANGE REQUEST

⌘ **27.007** **CR** **069** ⌘ ev **-** ⌘ Current version: **3.9.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE **X** Radio Access Network ☐ Core Network ☐

Title:	⌘	Removal of +CGCLOSP and corrections due to IHOSS and OSP removal
Source:	⌘	T2
Work item code:	⌘	TI-ATC
Date:	⌘	2001-08-15
Category:	⌘	**A**
Release:	⌘	R99

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	It was decided at TSG-SA#8 to remove the IHOSS service from R98 and onwards (SP-000197). This CR aligns the targeted specification accordingly.
Summary of change:	⌘	This CR deletes the AT command +CGCLOSP and parameters values in +CGDCONT, +CGDATA and Request GPRS service 'D', which are related to the removed feature. The reference to this commands was already removed from 27.060 (N3-010114)
Consequences if not approved:	⌘	The specification is not aligned with the R99 22.060, 23.060 and 27.060.

Clauses affected:	⌘	3.2, 10.1.1, 10.1.12, 10.1.13, 10.2.1.1
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

3.2 Abbreviations

For the purposes of the present document, 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 3GPP TS 27.001 [41] and 3GPP 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 Organization
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)
MT	Mobile Termination
~~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
UICC	Universal Integrated Circuit Card
USIM	Universal Subscriber Identity Module
VBS	Voice Broadcast Service
VGCS	Voice Group Call Service

10.1.1 Define PDP Context +CGDCONT

Table 1: +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

IP Internet Protocol (IETF STD 5)
IPV6 Internet Protocol, version 6 (IETF RFC 2460)
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.

10.1.12 Enter data state +CGDATA

Table 2: +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 3GPP TS 27.060[34] and in more detail in 3GPP 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 VOID~~Configure local Octet Stream PAD parameters +CGCLOSP~~

~~Table 110: 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.~~

10.2.1.1 Request Packet Domain service 'D'

Table 4: D command syntax

Command	Possible Response(s)
D*<GPRS_SC>[*[<called_address>] [*[<L2P>][*[<cid>[,<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 3GPP 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 initialization 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 3GPP 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.

3GPP TSG-T2 #14
Edinburgh, Scotland
3-7 September 2001

T2-010708

CR-Form-v4

CHANGE REQUEST

⌘ **27.007** **CR** **070** ⌘ ev **-** ⌘ Current version: **4.2.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☒ Radio Access Network ☐ Core Network ☐

Title:	⌘	Removal of +CGCLOSP and corrections due to IHOSS and OSP removal
Source:	⌘	T2
Work item code:	⌘	TI-ATC
Date:	⌘	2001-08-15
Category:	⌘	**A**
Release:	⌘	REL-4

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	It was decided at TSG-SA#8 to remove the IHOSS service from R98 and onwards (SP-000197). This CR aligns the targeted specification accordingly.
Summary of change:	⌘	This CR deletes the AT command +CGCLOSP and parameters values in +CGDCONT, +CGDATA and Request GPRS service 'D', which are related to the removed feature.
Consequences if not approved:	⌘	The specification is not aligned with the Rel-4 22.060, 23.060 and 27.060.

Clauses affected:	⌘	3.2, 10.1.1, 10.1.12, 10.1.13, 10.2.1.1
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

3.2 Abbreviations

For the purposes of the present document, 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 3GPP TS 27.001 [41] and 3GPP 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 Organization
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)
MT	Mobile Termination
~~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
UICC	Universal Integrated Circuit Card
USIM	Universal Subscriber Identity Module
VBS	Voice Broadcast Service
VGCS	Voice Group Call Service

10.1.1 Define PDP Context +CGDCONT

Table 1: +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

IP Internet Protocol (IETF STD 5)
IPV6 Internet Protocol, version 6 (IETF RFC 2460)
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.

10.1.12 Enter data state +CGDATA

Table 2: +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 3GPP TS 27.060[34] and in more detail in 3GPP 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 VOID~~Configure local Octet Stream PAD parameters +CGCLOSP~~

~~Table 115: 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.~~

10.2.1.1 Request Packet Domain service 'D'

Table 4: D command syntax

Command	Possible Response(s)
D*<GPRS_SC>[*[<called_address>] [*[<L2P>][*[<cid>[,<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 3GPP 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 initialization 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' (TS 24.008). (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 3GPP 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.

3GPP TSG-T2 #14
Edinburgh, Scotland
3-7 September 2001

T2-010709

CR-Form-v4

CHANGE REQUEST

⌘ **27.007** **CR** **071** ⌘ ev **-** ⌘ Current version: **3.9.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE **X** Radio Access Network ☐ Core Network ☐

Title:	⌘	Removal of +CGCLPAD and correstions due to X.25 removal
Source:	⌘	T2
Work item code:	⌘	TI-ATC
Date:	⌘	2001-08-15
Category:	⌘	**F**
Release:	⌘	R99

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	Support of X.25 is no longer required for R'99 packet Domain. This CR aligns the targeted specification accordingly.
Summary of change:	⌘	This CR deletes the AT command + CGCLPAD and parameters values in +CGDATA and Request GPRS service 'D', which are related to the removed feature. The reference to this commands was already removed from 27.060 (N3-000099)
Consequences if not approved:	⌘	The specification is not aligned with the R99 GPRS specifications

Clauses affected:	⌘	10.1.12, 10.1.12 (same number but different chapter!), 10.2.1.1
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

10.1.12 Enter data state +CGDATA

Table 1: +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 3GPP TS 27.060[34] and in more detail in 3GPP 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.

10.1.12 VOID~~Configure local triple-X PAD parameters +CGCLPAD (GPRS only)~~

~~Table 115: 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 3GPP 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.~~

10.2.1.1 Request Packet Domain service 'D'

Table 3: D command syntax

Command	Possible Response(s)
D*<GPRS_SC>[*[<called_address>] [*[<L2P>][*[<cid>[,<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 clause~~s 8 (for X.25) and~~ 9 (for IP) of 3GPP 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 initialization 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 3GPP 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.

3GPP TSG-T2 #14
Edinburgh, Scotland
3-7 September 2001

T2-010710

CR-Form-v4

CHANGE REQUEST

⌘ **27.007** **CR** **072** ⌘ ev **-** ⌘ Current version: **4.2.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☒ Radio Access Network ☐ Core Network ☐

Title:	⌘	Removal of +CGCLPAD and correstions due to X.25 removal
Source:	⌘	T2
Work item code:	⌘	TI-ATC
Date:	⌘	2001-08-15
Category:	⌘	**A**
Release:	⌘	REL-4

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	Support of X.25 was removed from R'99 packet Domain. This CR aligns the targeted specification accordingly.
Summary of change:	⌘	This CR deletes the AT command + CGCLPAD and parameters values in +CGDATA and Request GPRS service 'D', which are related to the removed feature.
Consequences if not approved:	⌘	The specification is not aligned with the R4 GPRS specifications

Clauses affected:	⌘	10.1.12, 10.1.12 (same number but different chapter!), 10.2.1.1
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

10.1.12 Enter data state +CGDATA

Table 1: +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 3GPP TS 27.060[34] and in more detail in 3GPP 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.

10.1.12 VOIDConfigure local triple-X PAD parameters +CGCLPAD (GPRS only)

Table 120: 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 3GPP 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.

10.2.1.1 Request Packet Domain service 'D'

Table 3: D command syntax

Command	Possible Response(s)
D*<GPRS_SC>[*[<called_address>][*[<L2P>][*[<cid>[,<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 clause~~s 8 (for X.25) and~~ 9 (for IP) of 3GPP 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 initialization 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' (TS 24.008). (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 3GPP 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.

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Foreword

This Technical Specification (TS) has been produced by the 3rd Generation Partnership Project (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 the present document, 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 or greater 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 document.

Introduction

The multiplexer protocol described in the present document operates between an 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 UE and TE.

The design of the multiplexer is flexible and independent of 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 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 UE and TE is of a very good quality and where the HDLC transparency mechanism (byte stuffing) can not be implemented in the UE. If an 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 AT+CMUX command described in 3GPP TS 27.007 [4].

1 Scope

The scope of the present document is to define a multiplexing protocol between a UE and a TE. 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. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

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

[2] ISO/IEC 13239:1997: "Information technology -- Telecommunications and information exchange between systems -- High-level data link control (HDLC) procedures".

[3] 3GPP 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] 3GPP TS 27.007: "AT command set for 3G User Equipment (UE)".

[5] 3GPP TR 21.905: "3G Vocabulary".

[6] 3GPP TS~~GSM 04~~6.021: "~~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 abbreviations can be found in ~~GSM 01.04 [1] and~~ 3GPP TR 21.905 [5].

4 Overview of Multiplexing System

The multiplexer provides mechanisms for conveying streams of data between TE and UE 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.

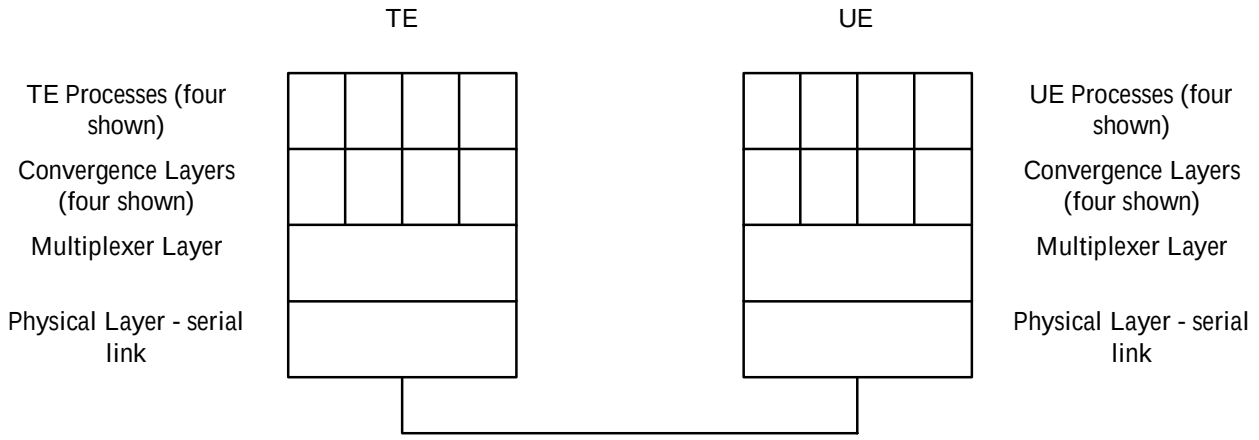


Figure 1: Protocol Stacks

The multiplexer provides a virtual connection between a process in the TE and a similar process in the UE. For example, a PC application supporting SMS functions could be connected to the SMS handler in the UE via a multiplexer channel.

The present document 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 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 and TE;
- a mechanism that permits either UE 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

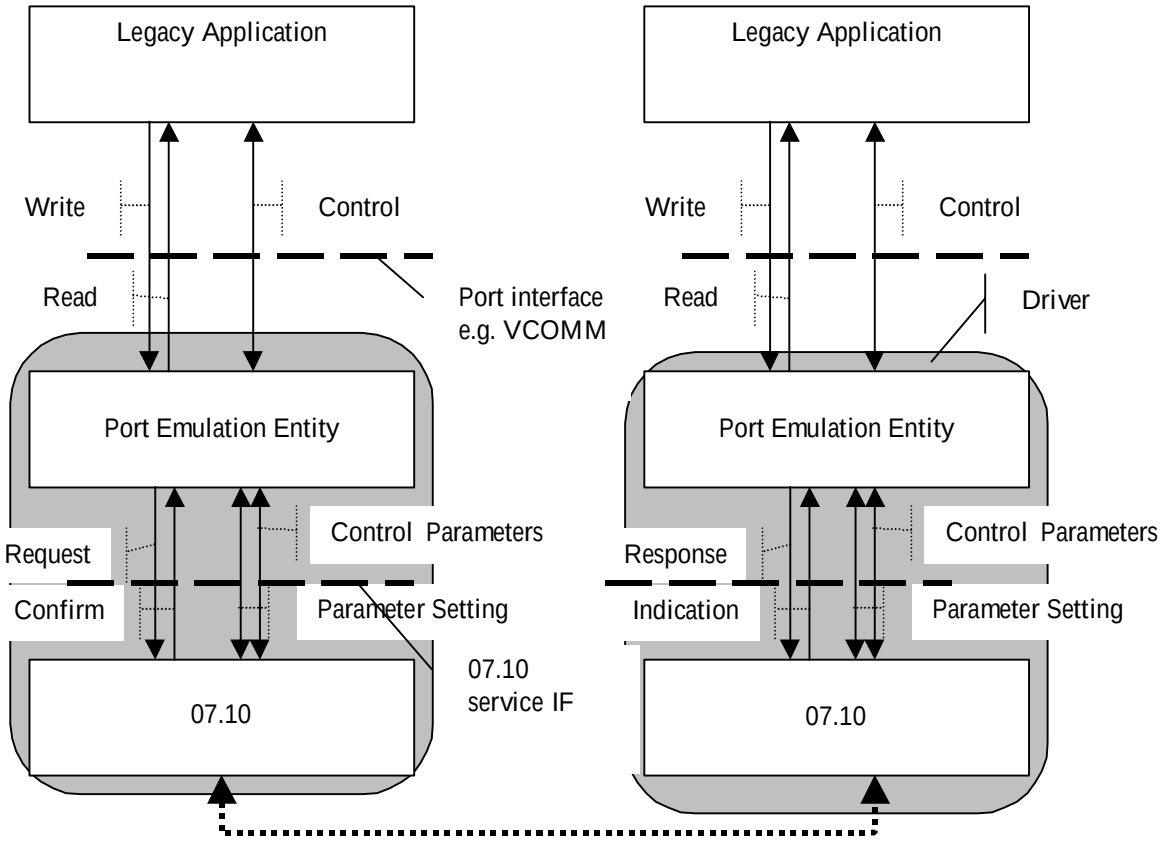
This subclause describes the services provided by the 3GPP TS 27.010 data link layer to the upper layer. The interface is specified in terms of primitives and parameters.

NOTE: This subclause is only for information, detailed description of the parameters is found in the following subclauses.

5.1.1 Service Definition Model

The 27.010 specification is intended to define a protocol that can be used to emulate a serial port. In most systems the 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 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 27.010.

The figure below shows a model of how 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 27.010 services. The 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 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 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 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 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 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 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 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 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 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 27.010. The TS 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 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 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 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 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~~3GPP TS 46.021 | 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 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 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 27.010 entity. The request primitive with *State* = *enable* enables the issuing of TS_0710_DATA.*indications* by the 27.010 entity. These requests may or may not result in the remote 27.010 entity issuing a TS_0710_FLOW.*indication* to the remote service user, depending on the states of the buffers in the 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 27.010 entity of a TS_0710_FLOW.*request* from the remote service user. They may have been issued by the local 27.010 entity as a result of its buffer state.

The initial state of the 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 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 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 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 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.

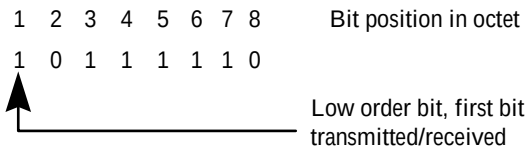
5.2.7 Advanced Option

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-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:



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 UE. The action taken by the higher layers of the TE upon the initiation of the establishment of a DLC from the UE is outside the scope of the present document.

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 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 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 (3GPP 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 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 UE with the fields set to the values that the TE intends to use for the particular DLCI. The UE replies with a parameter negotiation response with its proposed set of values. The following rules must be observed by the UE in constructing its response:

- The DLCI value may not be changed.
- The use of I frames or UI frames is optional so an UE may respond with a UIH choice if it does not implement UI frames or I frames.
- The UE may not change the convergence layer proposed by the TE.
- The 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 UE will insert its own T1 value. It is advisable that different T1s are used in each direction.
- The 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 UE will insert its own N2 value.
- The 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 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 UE from the network for which no DLC has been set up, the 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 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 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 the present document.

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	D		L	C	I	

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 – 3GPP TS 46.021~~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 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 UE wish to enter a low-power state. This is achieved by the use of the multiplexer control channel.

If either TE or 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 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 27.010 via the control channel commands Fcon and Fcoff (basic option) or XON/XOFF in the advance option.
FCS3	27.010 internal buffer management (implementation specific)

The flow control signals FCS1-3 are combined with the RTR signal from the opposite 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).

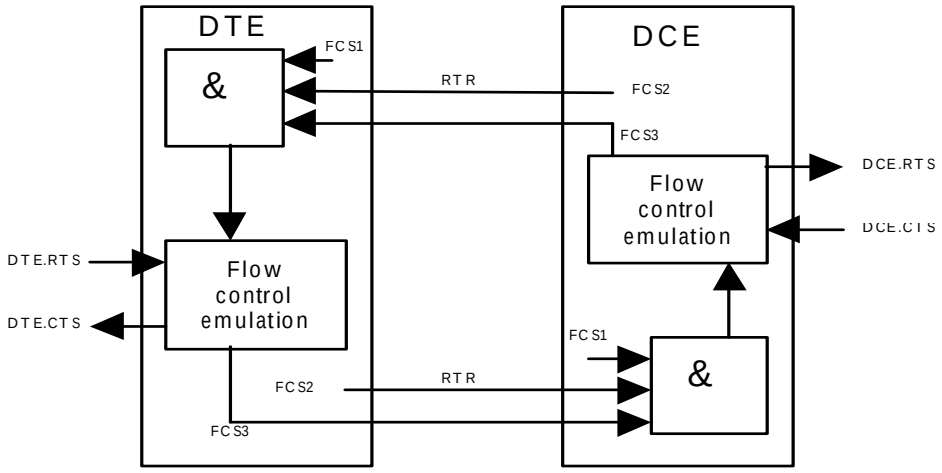


Figure 12: RTR Flow Control

5.4.8.2 XON/XOFF Flow Control

Some 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 27.010 instance i.e. the XON/XOFF characters are filtered out and the flow control signal is transferred as a 27.010 flow signal, see figure 13.

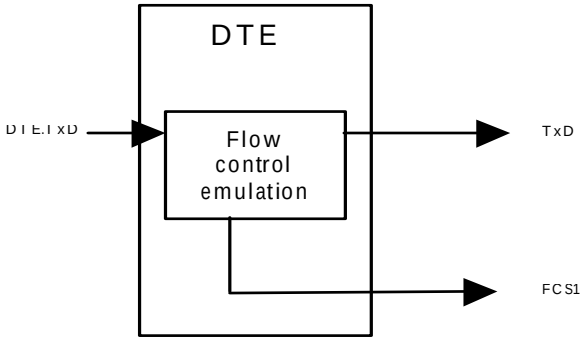


Figure 13: XON/XOFF Flow Control on input

if XON/XOFF flow control is enabled on output then the 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 27.010 flow control signals, see figure 14.

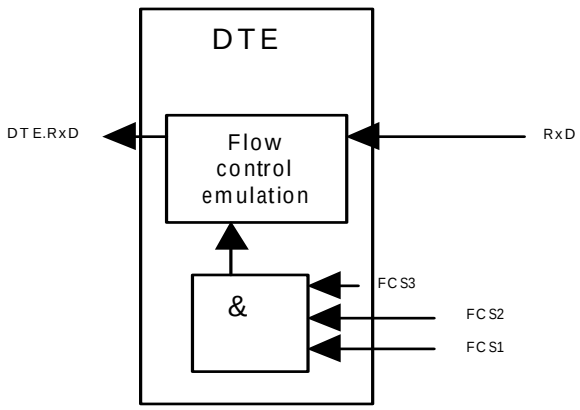


Figure 14: XON/XOFF Flow Control on input

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 the present document.

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 3GPP TS 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 UE and is outside the scope of the present document. 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 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-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 3GPP TS 27.007 [4], and will allow the normal AT command procedures for both 3GPP TS 27.007 [4] and 3GPP TS 27.005 [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 3GPP TS 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 UE, the TE shall always try to configure the multiplexer with this transparency mechanism. If it is not supported by the 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): Change History

TSG	TDoc	VERS	NEW_ VERS	CR	REV	REL	CAT	WORKITEM	SUBJECT
T#4	TP-99119	2.0.0	3.0.0	New		R99			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		R99	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		R99	A	MUX MS-TE	Editorial corrections
T#5	TP-99177	3.1.0	3.2.0	003		R99	A	TEI	Clarification of CR bit
T#5	TP-99177	3.1.0	3.2.0	004		R99	A	TEI	Correction of the bits in the start and close flags of the frame in the example on Annex B
T#7	TP-000024	3.2.0	3.3.0	005		R99	F	TEI	Adaptations for UMTS
T#11	-	3.3.0	4.0.0			Rel-4			Upgrade to Rel-4