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Technical Specification

Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station (MS) supporting GPRS (GSM 07.60 version 6.2.1 Release 1997)

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Contents

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Foreword

This Technical Specification (TS) has been produced by the Special Mobile Group (SMG) of the European Telecommunications Standards Institute (ETSI).

This specification provides the necessary information to develop a MS for support of GPRS within the digital cellular telecommunications system.

The contents of this TS are subject to continuing work within SMG and may change following formal SMG approval. Should SMG modify the contents of this TS it will then be republished by ETSI with an identifying change of release date and an increase in version number as follows:

Version 6.x.y

where:

6   indicates GSM Release 1997 of Phase 2+

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

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

Introduction

This document contains the necessary information to develop a MS for support of GPRS. It is up to the manufacturer how to implement the various functions but this specification and existing GSM 07.01, 07.02, and 07.03 shall be followed where applicable.

It is the intention that this document shall remain as the specification to develop a MS for support of GPRS and its text includes references to GSM standards.

1 Scope

The GSM PLMN supports a wide range of voice and non-voice services in the same network. In order to enable non-voice traffic in the GSM PLMN there is a need to connect various kinds of terminal equipments to the Mobile Station (MS). This Specification describes the functionality of a MS supporting GPRS, including the protocols and signalling needed to support the first phase of GPRS, as defined in GSM 02.60 and 03.60 (packet based services).

2 Normative references

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies.

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

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

[2]   GSM 02.02: "Digital cellular telecommunication system (Phase 2+); Bearer Services (BS) supported by a GSM Public Land Mobile Network (PLMN)".

[3]   GSM 02.60: "Digital cellular telecommunication system (Phase 2+); General Packet Radio Service (GPRS); Service Description Stage 1".

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

[5]   GSM 03.03: "Digital cellular telecommunications system (Phase 2+); Numbering, addressing and identification".

[6]   GSM 03.10: "Digital cellular telecommunication system (Phase 2+); GSM Public Land Mobile Network (PLMN) connection types".

[7]   GSM 03.22: "Digital cellular telecommunications system (Phase 2+); Functions related to Mobile Station (MS) in idle mode and group receive mode".

[8]   GSM 03.40: "Digital cellular telecommunications system (Phase 2+); Technical realization of the Short Message Service (SMS); Point-to-Point (PP)".

[9]   GSM 03.60: "Digital cellular telecommunication system (Phase 2+); General Packet Radio Service (GPRS) Service Description Stage 2".

[10]   GSM 04.02: "Digital cellular telecommunication system (Phase 2+); GSM Public Land Mobile Network (PLMN) access reference configuration".

[11]   GSM 04.07: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface signalling layer 3; General aspects".

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

[13]   GSM 04.60: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station (MS) - Base Station System (BSS) interface; Radio Link Control / Medium Access Control (RLC/MAC) protocol".

[14]   GSM 04.64: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Logical Link Control (LLC)".

[15]   GSM 04.65: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Subnetwork Dependent Convergence Protocol (SNDCP)".

[16]   GSM 07.07: "Digital cellular telecommunication system (Phase 2+); AT command set for GSM Mobile Equipment (ME)".

[17]   GSM 09.61: "Digital cellular telecommunication system (Phase 2+); General Packet Radio Service (GPRS); Interworking between the Public Land Mobile Network (PLMN) supporting GPRS and Packet Data Networks (PDN)".

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

[19]   CCITT Recommendation V.42 bis: "Data communication over the telephone network – Data compression procedures for data circuit-terminating equipment (DCE) using error correction procedures".

[20]   CCITT Recommendation X.3: "Packet assembly disassembly facility (PAD) in a public data network".

[21]   CCITT Recommendation X.25: "Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit".

[22]   CCITT Recommendation X.28: "DTE / DCE interface for a start-stop mode data terminal equipment accessing the packet assembly / disassembly facility (PAD) in a public data network situated in the same country".

[23]   CCITT Recommendation X.29: "Procedures for the exchange of control information and user data between a packet assembly / disassembly (PAD) facility and a packet mode DTE or another PAD".

[24]   CCITT Recommendation X.75: "Packet-switched signalling system between public networks providing data transmission services".

[25]   CCITT Recommendation X.121: "International Numbering Plan for Public Data Networks".

[26]   IETF RFC 768 (1980): "User Datagram Protocol" (STD 6).

[27]   IETF RFC 791 (1981): "Internet Protocol" (STD 5).

[28]   IETF RFC 792 (1981): "Internet Control Message Protocol" (STD 5).

[29]   IETF RFC 793 (1981): "Transmission Control Protocol" (STD 7).

[30]   ITU-T Recommendation V.250 (ex V.25ter): "Serial asynchronous automatic dialling and control".

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

[32]   ITU-T Recommendation V.28: "Electrical Chracteristics for unbalanced double-current interchange circuits"

[33]   ITU-T Recommendation V.80: "In-band DCE control and synchronous data modes for asynchronous DTE"

3 Definitions abbreviations and symbols

3.1 Definitions

Refer to: GSM 02.60 [2].

In GSM 02.02 the bearer services are described. The general network configuration is described in GSM 03.02 and the GSM PLMN access reference configuration is defined in GSM 04.02. The various connection types used in the GSM PLMN are presented in GSM 03.10. Terminology used in this Specification is presented in GSM 01.04. For support of data services between GSM PLMN and other networks see GSM 09-series of Specifications.

3.2 Abbreviations

For the purposes of this specification the following abbreviations apply:

APN	Access Point Name
GGSN	Gateway GPRS Support Node
GPRS	General Packet Radio Service
GSN	GPRS Support Node
GTP	GPRS Tunnelling Protocol
HDLC	High Level Data Link Control
ICMP	Internet Control Message Protocol
IETF	Internet Engineering Task Force
IP	Internet Protocol
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
LA	Location Area
LAPB	Link Access Protocol Balanced
LCP	Link Control Protocol
LLC	Logical Link Control
MAC	Medium Access Control
ME	Mobile Equipment
MS	Mobile Station
MT	Mobile Termination
NCP	Network Control Protocol
PAD	Packet Assembler/Disassembler
PDN	Packet Data Network
PDP	Packet Data Protocol , e.g., IP or X.25
PDU	Protocol Data Unit
PSPDN	Packet Switched Public Data Network
PTM	Point To Multipoint
PTP	Point To Point
PVC	Permanent Virtual Circuit
RA	Routing Area
SGSN	Serving GPRS Support Node
SNDCP	SubNetwork Dependent Convergence Protocol
TE	Terminal Equipment
TCP	Transmission Control Protocol
UDP	User Datagram Protocol

3.3 Symbols

For the purposes of this specification the following Symbols apply:

Gb	Interface between an SGSN and a BSC.
Gi	Reference point between GPRS and an external packet data network.
Gn	Interface between two GSNs within the same PLMN.
Gp	Interface between two GSNs in different PLMNs. The Gp interface allows support of GPRS network services across areas served by the co-operating GPRS PLMNs.
Gs	Interface between an SGSN and MSC.
R	The reference point between a non-ISDN compatible TE and MT. Typically this reference point supports a standard serial interface.
Um	The interface between the MS and the GPRS fixed network part. The Um interface is the GPRS network interface for providing packet data services over the radio to the MS. The MT part of the MS is used to access the GPRS services through this interface.

4 Access reference configuration

Figure 1 shows the relationship between the MS, its terminal equipment and the GSM network in the overall GPRS environment.
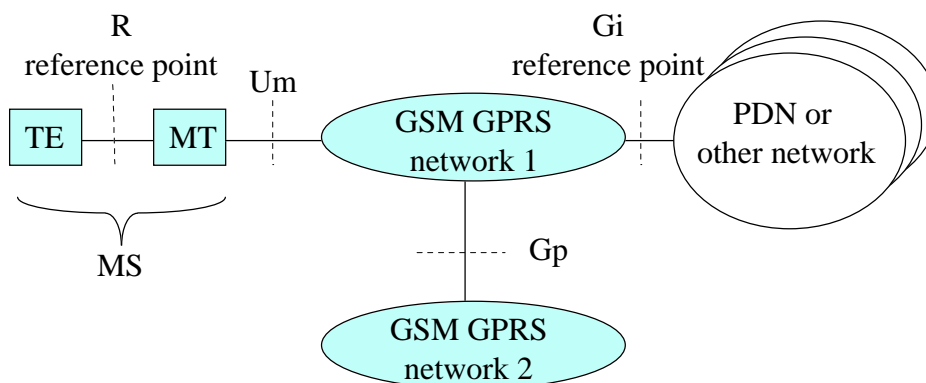
Figure 1:GPRS Access Interfaces and Reference Points

5 Functions to support data services

The main functions of the MT to support data services are:

- physical connection at the reference point R;

- flow control between TE and MT;

- mapping of user signalling to/from the GPRS bearer;

- support of data integrity between the terminal equipment and the GPRS bearer;

- functions to support character based data;

- functions to support packet based data;

6 Interface to GPRS Bearer Services

The following figure 2: Transmission Plane shows the relationship of the GPRS Bearer terminating at the SNDCP layer to the rest of the GPRS environment. It is shown for reference purposes only and detailed information can be found in GSM 03.60.
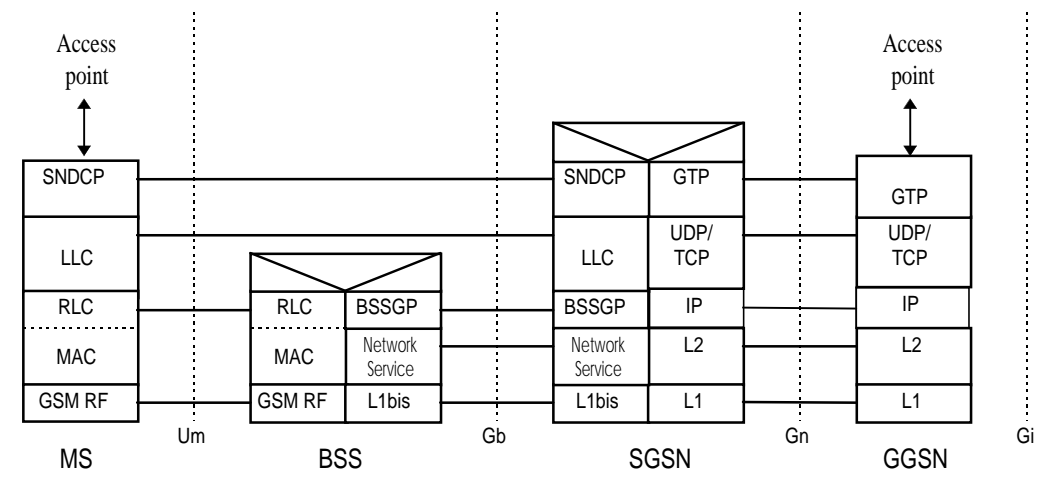
NOTE: In the SGSN and GGSN UDP is mandatory. TCP is optional but recommended for X.25 services.
Figure 2:GPRS Transmission Plane

7 Functions common to all configurations of the GPRS MS

7.1 Mobile Classes

Three GPRS MS classes are identified: Class A, B, and C. These classes are described in GSM 02.60.

7.2 Physical Interface

The physical interface between the TE and the MT may conform to CCITT/ITU-T V.24/V.28, or to IrDA IrPHY physical standard specification, or to PCMCIA PC-Card electrical specification. All signal levels and their operation shall be as specified in GSM 07.01, 07.02, and 07.03. This shall not preclude any new developments such as USB (Universal Serial Bus).

7.3 Terminal context procedures

This subclause describes the relationships for GPRS Attach and Detach, and PDP Context Activation and Deactivation. The procedures for these functions are described in GSM 03.60.

7.3.1 GPRS Attach

The GPRS Attach shall be performed prior to activating a PDP context. The GPRS Attach may be performed automatically or manually depending on the manufacturer's implementation and configuration.

7.3.2 GPRS Detach

The GPRS Detach may be performed automatically or manually depending on the manufacturer's implementation and configuration. The following cases are valid:

- if the connection between the TE and MT is broken then the MT may perform the GPRS Detach procedure;

- if the network originates a GPRS Detach the MT may inform the TE;

- if the radio connection is broken then the MT may inform the TE;

- if the TE deactivates the last PDP context then the MT may perform the GPRS Detach procedure.

7.3.3 Mobile Originated PDP Context Activation

The PDP Context Activation may be performed automatically or manually depending on the manufacturer's implementation and configuration. Depending on the manufacturer's implementation and configuration, 0, 1, or more PDP contexts can be active simultaneously.

7.3.4 Network Requested PDP Context Activation.

The network can request a GPRS attached MS to activate a specific PDP context.

7.3.5 PDP Context Deactivation

The PDP Deactivation may be performed automatically or manually depending on the manufacturer's implementation and configuration. The following cases are valid:

- if the connection between the MT and the TE is broken then the MT may perform the PDP Context Deactivation procedure.

- if the radio connection is broken then the MT may inform the TE.

- if the TE deactivates the last PDP context then the MT may perform the GPRS Detach procedure.

7.3.6 PDP context related parameters

It shall be possible to enquire and/or set the following parameters:

- Requested Quality of Service.
  (this includes the peak bit rate, the mean bit rate, the delay requirements, the service precedence, and the reliability level)

- Data Compression on or off.

- TCP/IP Header Compression on or off.

- PDP address

- PDP type

- Access Point Name (APN)

8 X.25 Based Services

This clause describes the use of X.25 based services over the GPRS bearer. Two services are specified at the R reference point -

1) Character mode (specified in ITU-T X.3, X.28, X.29) with the triple X PAD in the MT.

2) Packet mode (specified in ITU-T X.25).

NOTE: In order to maintain consistency within GSM specifications, the term TE is used when referring to what CCITT/ITU-T X.25 calls a DTE. Exceptionally, in text quoted from an ITU-T Recommendation, the term DTE is retained.

8.1 X.25 Character mode (triple X PAD) service

This mode is an asynchronous character based service allowing the application to set up a single connection using the CCITT/ITU-T X.28 / X.29 procedures. This supports both mobile originate and mobile terminate calls. The MT terminates the X.25 packet layer and provides a triple X PAD function.
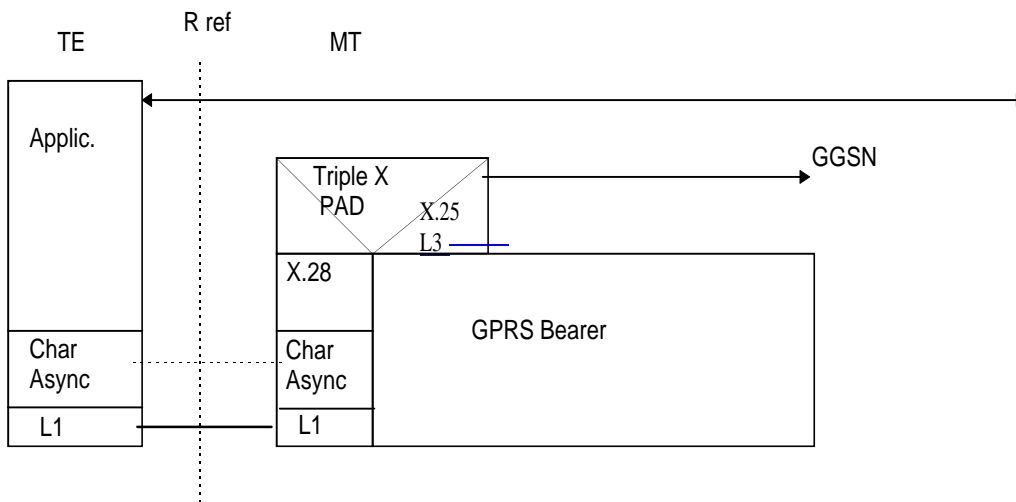
Figure 3: Character (Triple X PAD) mode

8.1.1   PAD Parameters

The following table lists the minimum set of X.3 parameters that shall be implemented. A full range is specified in the CCITT/ITU-T X series documents and those parameters not implemented shall be fixed to their defined defaults.

Table 4: Table of Minimum X.3 Parameters

Parameter Number	Description	Default Value	Valid Values	Value/Function
1	PAD Recall Character	1	0 1 32-36	(None) DLE Binary representation of decimal value
2	Echo	0	0 1	Off On
3	Data Forwarding Character	2	0 1 2 4 8 16 32 64	(on 128th data byte) A-Z, a-z, 0-9 CR ESC, BEL, ENQ, ACK DEL, CAN, DC2 ETX, EOT HT, LF, VT, FF All characters between NUL & US not listed above
4	Delay Timer	0	0 1-255	Disabled Period of TXD cct inactivity before data forwarded (1/20 of a second). The minimum time-out is 0.5s. Any value of parameter 4 between 1 & 10 will default to 0.5s.
5	Flow Control from Pad (to DTE)	0	0 1	None XON/XOFF
6	Service Signals	5	0 1 5	Disabled Enabled, excluding prompt Enabled, including prompt
7	Action on Break	8	8	PAD escapes from data transfer state
11	Data Rate	13	2 3 4 6 12 13 14	300 bps 1200 bps 600 bps 150 bps 2400 bps 4800 bps 9600 bps Other values may be implemented as long as they conform to the CCITT/ITU-T specifications.
12	Flow Control to Pad (from DTE)	0	0 1	None XON/OFF
13	Line Feed insertion	0	0 1	None LF inserted after CR to DTE
15	Character Deletion	0	0 1	Disabled Enabled

Although not CCITT/ITU-T defined, to be able to specify either X.28 or X.29 modes a Parameter 0 can be used as follows.

For X.28 mode parameter 0 shall be set to 0.

For the four X.29 variants available, each with a corresponding protocol identifier, the parameter value is set as listed below. The identifier octet is supplied with the call request packet when setting up a call.

Value	Description	Protocol Identifier Octet
2	CCITT use	00000001
3	National use	01xxxxxx
4	International User Bodies	10xxxxxx
5	DTE - DTE use	11xxxxxx

x - this digit may be represented by either a 1 or 0 (to be specified in ITU-T Recommendation X.244).

8.1.2 Example mapping of functions between the R reference point and the GPRS bearer

The following example illustrates the case when the PAD functionality is used in the MT. In PAD mode only one PDP context can be activated per R reference point.
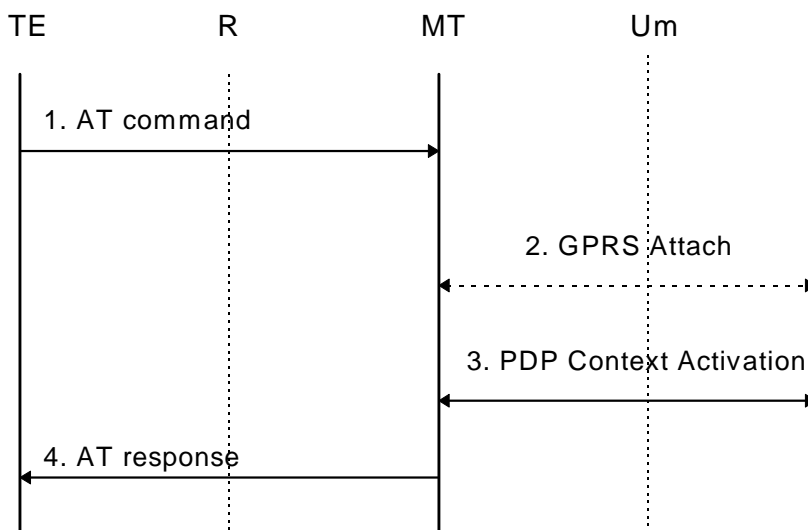
NOTE: The 2 ended arrows indicate an exchange of 0 or more messages.

Figure 4: PAD Service

1) The TE issues an AT command to activate PAD mode.

2) If the MS is not yet GPRS attached, the MT performs the GPRS Attach procedure as described in GSM 03.60.

3) The MT performs the PDP Context Activation as described in GSM 03.60.

4) The MT sends an AT response to the TE. Following a positive AT response the PAD prompt is issued.

8.2 X.25 Packet mode service

This mode offers a packet based service allowing the application to set up one or more virtual calls using the CCITT/ITU-T X.25 procedures. The maximum permitted number of concurrent virtual calls is implementation dependent. Both mobile originate and mobile terminate calls are supported. The MT performs a relay function for X.25 layer 3 which is terminated in the TE. The layer 2 protocol at the R reference point is terminated in the TE and the MT.

Depending on the application, the TE may or may not incorporate a triple X PAD function.
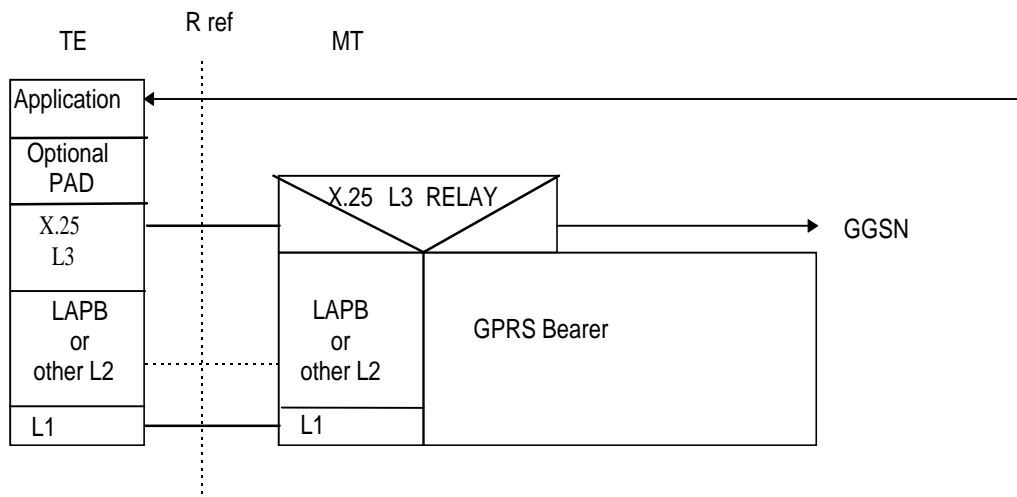
NOTE: The "other L2" could be GSM 07.10 or a manufacturer's defined layer 2

Figure 5: Packet mode

8.2.1 Layer 1 and Layer 2 options

This subclause describes standardized layers 1 and 2 which may be used for the TE-MT interface. As an alternative, the multiplexing protocol specified in GSM 07.10 or a manufacturer's defined layers 1 and 2 may be used providing they meet the requirements for carrying X.25 layer 3 frames over the R reference point.

8.2.1.1 Synchronous serial interface

For TEs with a synchronous serial port -

Layer 1 is synchronous X.21 or X.21bis (V.24/V.28).

Layer 2 is LAP B (X.25 L2) based on bit-oriented HDLC.

NOTE. Configuration of the MT in this case is outside the scope of this specification.

8.2.1.2 Asynchronous serial interface

For TEs with an asynchronous serial port -

Layer 1 is asynchronous V.24/V.28.

Layer 2 is LAP B (X.25 L2) based on character-oriented HDLC.

NOTE. The methods described in ITU-T Rec. V.80 may be applicable here.

8.2.1.3 Synchronous and asynchronous (dual mode) interface

For TEs with a serial port that can operate in both synchronous and asynchronous modes the following mechanism may be used where the interface supports AT commands. The interface starts in asynchronous mode and AT commands may be used to configure the MT. When configuration is complete, the interface switches to synchronous mode and X.25 starts up in the usual way. Setting Data Terminal Ready (circuit 108/2) to off is a protocol independent way of returning to asynchronous mode. Alternatively, the closing down of LAP B could be used as the signal.

8.2.2 Example mappings of functions between the R reference point and the GPRS bearer

The minimum requirement is that the MT shall be GPRS-attached and the X.25 context activated whilst an X.25 virtual call is in progress. Any extension to this requirement depends on whether the MT implements any other GPRS-

supported services (e.g. SMS) which might require that the MT remains GPRS-attached even when there is no X.25 virtual call in progress.

The following subclauses describe only the X.25 requirements. These actions may be filtered by the requirements of any other GPRS-supported service. For example, if a GPRS-only MT also supports SMS, a request for 'disconnection' of the X.25 service would result in a deactivation of the X.25 context but not a GPRS-detach.

8.2.2.1 Standardized X.25 TE

This case applies to TEs which implement only the X.25 procedures, i.e. they have no support for AT commands. The layer 1 and 2 options described in subclause 8.2.1.1 and 8.2.1.2 apply.

Because of the different implementations of X.25 procedures in existing DTEs, attach/detach and activate/deactivate may need to be controlled at layer 1, 2 or 3 of the X.25 interface. Whilst it is always possible to use layer 3 control, this requires the most complete implementation of the X.25 protocol stack in the MT. Control at a lower layer may result in a simpler implementation. The procedures for connection and disconnection at all three layers are described in CCITT/ITU-T X.25.

In all cases it may be desirable to incorporate a timer to delay the deactivate/detach procedures in order to avoid excessive changes of the activation and attachment states in the course of a number of consecutive calls.

> NOTE: The activation and deactivation of an X.25 context to carry packets over GPRS is analogous to setting up and clearing a switched ISDN B channel connection to carry them over an ISDN. The call control mapping procedures used in the ISDN case are described in detail in ITU-T X.31 clause 7.3 (layer 1) and appendix I (layers 2 and 3).

8.2.2.1.1 Layer 1 control

This applies to X.25 DTEs which disconnect at the physical layer when no virtual calls are in progress. The TE and MT signal to one another by using V.24 or X.21 control signals.

From TE -

> Physical layer connect received by MT -> attach, activate

> Physical layer disconnect received by MT -> deactivate, detach

From network -

> If the X.25 context is not currently active, an attempt by the network to offer a mobile terminated X.25 virtual call will be signalled by the receipt at the MT of a Request PDP Context Activation message. The MT signals this to the TE by using V.24 or X.21 control signalling and, if successful, -> attach, activate.

> A network request that the X.25 context should be deactivated or a failure of the radio link will result in the MT performing a physical layer disconnect.

8.2.2.1.2 Layer 2 control

This applies to X.25 DTEs which keep layer 1 active but disconnect at the data link layer when no virtual calls are in progress. The TE and MT signal to one another by starting and stopping the data link layer protocol.

From TE -

> Data link layer set-up received by MT -> attach, activate

> Data link layer disconnect received by MT -> deactivate, detach

From network -

> If the X.25 context is not currently active, an attempt by the network to offer a mobile terminated X.25 virtual call will be signalled by the receipt at the MT of a Request PDP Context Activation message. The MT signals this to the TE by attempting to start the data link layer and, if successful, -> attach, activate.

A network request that the X.25 context should be deactivated or a failure of the radio link will result in the MT performing a data link layer disconnect.

8.2.2.1.3 Layer 3 control

This applies to X.25 DTEs which keep layers 1 and 2 active when no virtual calls are in progress.

From TE -

Call Request packet received by the MT -> attach, activate
(Action is taken only if there are no X.25 virtual calls already in progress)

Clear Confirmation packet received by the MT from the TE -> deactivate, detach
(Action is taken only if there are no more X.25 virtual calls in progress.)

From network -

If the X.25 context is not currently active, an attempt by the network to offer a mobile terminated X.25 virtual call will be signalled by the receipt at the MT of a Request PDP Context Activation message. Following activation by the MT, an X.25 Call Request packet will be received from the network.

Clear Confirmation packet received by the MT from the network -> deactivate, detach
(Action is taken only if there are no more X.25 virtual calls in progress.)

A network request that the X.25 context should be deactivated or a failure of the radio link will result in the MT clearing any outstanding X.25 virtual calls.

The above refer only to normal clearing situations. An actual implementation shall take into account exceptional conditions such as the receipt of a Clear Request packet from the TE but no acknowledging Clear Confirmation from the network.

8.2.2.2 X.25 TE with support for AT commands

This case applies to TEs which implement AT commands in addition to supporting X.25 procedures. The layer 1 and 2 options described in subclauses 8.2.1.2 and 8.2.1.3 apply.

The TE sends GPRS AT commands to configure the MT, followed by a command to switch the interface into packet mode and start X.25. A mode of operation may be supported which provides compatibility with existing modem dial procedures.

9 IP Based Services

All protocols that are supported by the underlying IP protocol are applicable in the GPRS environment. However there may be some limitations due to the RF environment.

The IP protocol can be run over various underlying protocols as shown in the following figure.
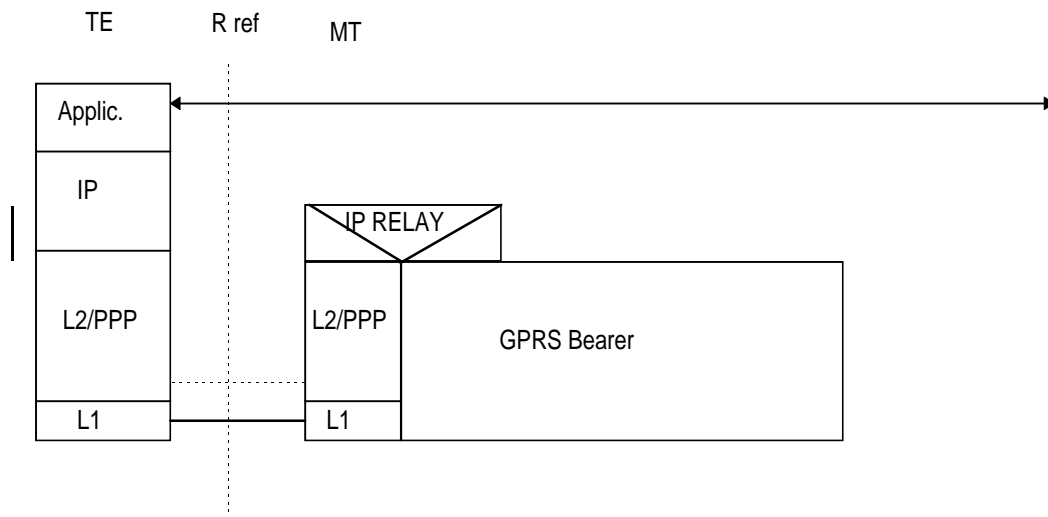
Figure 6: IP Based Services

PPP is a widely supported protocol in numerous operating systems and this alleviates the need for any GPRS specific protocol at the TE. PPP at the MT shall comply with the following specifications IETF STD 51 (RFC 1661, RFC 1662), RFC 1570, RFC 1989, and RFC 1332. The Domain Name Server information shall be delivered as defined in RFC 1877. The delivery of vendor-specific packets and options shall conform to RFC 2153.

As an alternative to PPP, an L2 protocol can be used which is defined as a manufacturer's operating system dependent protocol capable of carrying IP frames over the R reference point.

9.1 Example mapping of functions between the R reference point and the GPRS bearer for IP over PPP

The following example illustrates the case when the IP over PPP functionality is used in the MT. The example does not include all the details of PPP, but only describes the logical operation of PPP connection establishment, host authentication and IP configuration.

Each interface at the R reference point can support only one PPP connection and each PPP connection can support only one IP session. Therefore, in PPP mode only one IP PDP context can be activated per interface at the R reference point. However, it is possible for a PCMCIA card (or other multiplexed interface) to support multiple virtual interfaces (communications ports) at the R reference point. Multiple PPP connections and IP contexts are possible in this case.
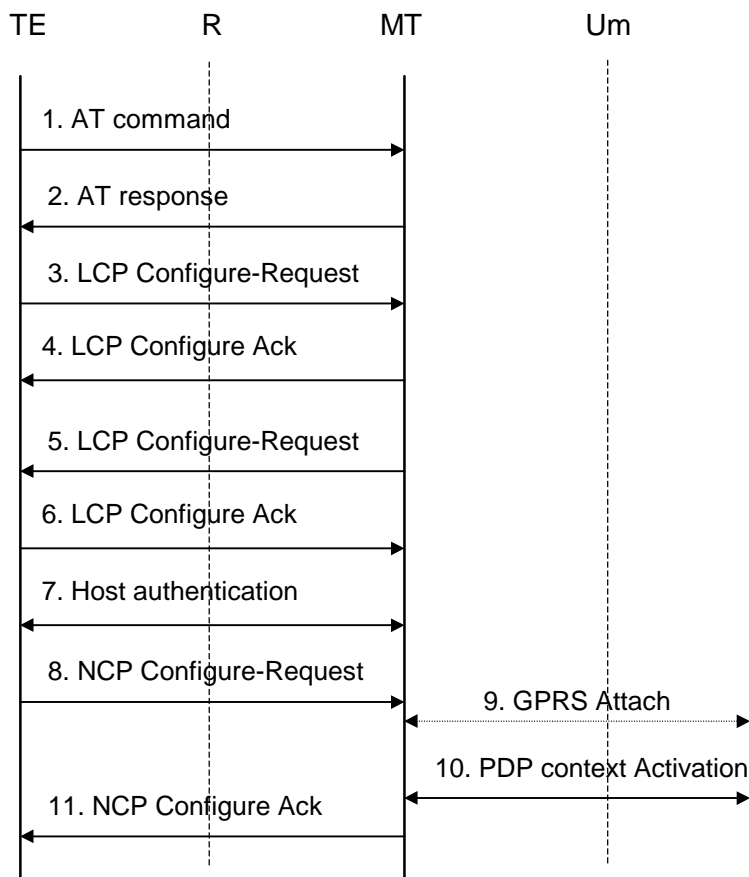
Figure 7: IP Over PPP Based Service

1) The TE issues AT commands to set up parameters and enter PPP mode (refer to subclause on AT commands for further details).

2) The MT sends AT responses to the TE.

3) The PPP protocol in the TE sends a LCP Configure-Request. This command is to establish a PPP link between the TE and the MT.

4) The MT returns LCP Configure-Ack to the TE to confirm that the PPP link has been established. The MT might previously have sent a LCP Configure-Nak in order to reject some options proposed by the TE. This in turn might have triggered a retransmission of the LCP Configure-Request with different options.

5) The PPP protocol in the MT sends a LCP Configure-Request in order to negotiate for the authentication protocol used for authentication of the host TE towards the MT. The MT shall initially negotiate for CHAP, and if this is unsuccessful, for PAP.

6) The TE returns a LCP Configure-Ack to the MT to confirm the use of the specified authentication protocol. The MT might previously have sent a LCP Configure-Nak in order to reject the protocol proposed by the TE. This in turn might have triggered a retransmission of the LCP Configure-Request with different options.

7) If the negotiated authentication protocol is either of CHAP or PAP, the TE authenticates itself towards the MT by means of that protocol. The MT stores the necessary authentication data and sends a locally generated positive acknowledgement of the authentication to the TE. If none of the protocols is supported by the host TE no authentication shall be performed. Refer to GSM 09.61 for further details on the authentication.

8) The PPP protocol in the TE sends to the MT a NCP Configure-Request. This command activates the IP protocol.

9) If the MS is not yet GPRS attached, the MT performs the GPRS Attach procedure as described in GSM 03.60.

10) The MT performs a PDP Context Activation as described in GSM 03.60. IP configuration parameters may be carried between the MT and the network in PDP Context Activation messages.

11) The MT acknowledges to the PPP protocol in the TE that the IP protocol is now activated by sending a NCP Configure-Ack command. Before sending a NCP Configure-Ack, the MT might previously have sent a NCP Configure-Nak in order to reject some IP parameters proposed by the TE. This in turn might have triggered a retransmission of the NCP Configure-Request with different parameter values. NCP Configure-Ack may also carry IP protocol related parameters such as dynamic IP address to the TE. The MT shall also pass name server information to the TE if the TE has requested for it and if this information is provided by the GGSN. Other packet types and options may optionally be delivered.

10 AT commands

This clause defines commands that a TE may use to control a GPRS MT via a non-multiplexed character-stream interface. This places certain limitations on the functionality of the interface. For example, it is not possible for the MT to send control information to the TE or for the TE to send commands to the MT whilst the interface is in the V.250 online data state unless the layer 2 protocol itself supports this feature. However, a manufacturer-specific escape mechanism may be provided to enable the TE to switch the MT into the V.250 online command state. The use of a multiplexed interface, for example that specified in GSM 07.10, is not considered here.

It is anticipated that GPRS MTs will vary widely in functionality. At one extreme, a class A MT might support multiple PDP types as well as circuit switched data, and use multiple external networks and QoS profiles. At the other extreme a class C MT might support only a single PDP type using a single external network, and rely on the HLR to contain the context definition.

A comprehensive set of AT commands is defined to provide the flexibility needed by the more complex MT. It is designed to be expandable to accommodate new PDP types and interface protocols, merely by defining new values for many of the parameters. Multiple contexts may be activated if the interface link-layer protocol is able to support them. The commands use the extended information and error message capabilities described in GSM 07.07. The GPRS-specific commands, and extensions to existing GSM AT commands and error codes are described in subclauses 10.2 and 10.3 respectively.

For MTs of intermediate complexity, most commands have simplified forms where certain parameters may be omitted.

For the simplest MTs, and for backwards compatibility with existing communications software, it is possible to control access to the GPRS using existing modem-compatible commands. A special dial-string syntax is defined for use with the D command. This "modem compatible" mode of operation is described in subclause 10.4.

Subclause 10.5 contains examples of command sequences for a number of applications.

10.1 General on AT commands

10.1.1 Interaction of AT commands, GPRS management and PDPs

State machines may be used to describe the behaviour of -

    AT commands (ITU-T V.250).

    GPRS PDP context management (GSM 03.60).

    PDP startup, data transfer and termination (Packet Data Protocol specifications).

    The layer 2 protocol (if any) used across the TE-MT interface (layer 2 protocol specifications).

This subclause does not attempt to describe in detail how these state machines interact but rather to give some general guidance on their relationships.

10.1.1.1 AT commands and responses

AT commands may be issued and responses received by the TE only when the TE and MT are in V.250 command state.

The possibility of suspending the PDP and/or layer 2 protocol and entering V.250 online command state is not considered here; neither is the use of a multiplexed interface where the PDP and the AT commands use separate logical channels.

10.1.1.2 PDP and layer 2 protocol operation

The PDP (across the TE-MT interface) may startup, transfer data and terminate only when the TE and MT are in V.250 online data state. It may be necessary to startup a layer 2 protocol across the interface before starting the PDP. The PDP startup procedure may provide information needed for the PDP context activation procedure (see 10.1.1.3.2).

10.1.1.3 GPRS management

A particular PDP may be used to transfer data only when a context is active for that PDP. Before a context can be activated, the MT must be attached to the GPRS network.

In order to provide flexibility and support a variety of types of GPRS MT and PDP, AT commands are provided which give the TE explicit control over attachment and detachment (+CGATT), and context activation and deactivation (+CGACT) procedures. These commands allow the TE to retain control of the MT, and receive status information from the MT, after these actions have been performed.

10.1.1.3.1 GPRS attachment

The MT may be attached and detached using the +CGATT command. However, it may not be necessary to use the command since attachment may occur -

on power up or reset;

when an attempt is made to activate a context either explicitly (+CGACT) or as a result of a PDP startup procedure;

when the mobile class is changed (+CGCLASS).

Similarly, detachment may occur -

as a result of a PDP termination procedure (if no other GPRS services are active);

when the mobile class is changed (+CGCLASS).

10.1.1.3.2 PDP context activation

Certain information must be provided to the network in order for a context activation attempt to be successful. The TE may provide some of this information to the MT during the PDP startup procedure rather than through AT command procedures. In this case the context activation cannot be initiated by the +CGACT command but rather on receipt of the appropriate information during the PDP startup.

10.1.2 Use of default context parameter values

The activate context request message sent by the MT to the network contains a number of parameters whose values can usefully be set by the TE. Under certain circumstances the values for some or all of the parameters need not be provided by the TE, either via AT commands or the PDP startup procedure. The storage of context information in the SIM is not considered in this specification. Rules concerning what values shall be sent by the MT to the network under various circumstances are given in 03.60.

One particular rule that is designed to simplify operation in modem compatibility mode is that if there is only one PDP context subscription in the HLR then all of PDP type, PDP address and APN may be omitted.

10.1.2.1 PDP type

This may be omitted:

when the MT supports only one PDP type (it will be provided by the MT);

or according to the rules given in 03.60.

10.1.2.2   PDP address (of the MS)

This shall be omitted when:

a dynamic address is required;

or according to the rules given in 03.60.

10.1.2.3   Access Point Name

This may be omitted:

according to the rules given in 03.60.

10.1.2.4   QoS Requested

This may be omitted when:

the default subscribed QoS is acceptable.

10.1.2.5   PDP Configuration Options

These shall be omitted:

when none are required for the PDP concerned;

or according to the rules given for the PDP.

10.2   Commands specific to MTs supporting the GPRS

10.2.1   Define PDP Context +CGDCONT

Table 2: +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)

`<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>`

    At present none is defined.

Implementation

Mandatory unless only a single subscribed context is supported.

10.2.2 Quality of Service Profile (Requested) +CGQREQ

Table 3: +CGQREQ parameter command syntax

Command	Possible Response(s)
+CGQREQ=[<cid> [,<precedence > [,<delay> [,<reliability.> [,<peak> [,<mean>]]]]]]	OK ERROR
+CGQREQ?	+CGQREQ: <cid>, <precedence >, <delay>, <reliability>, <peak>, <mean> [<CR><LF>+CGQREQ: <cid>, <precedence >, <delay>, <reliability.>, <peak>, <mean> […]]
+CGQREQ=?	+CGQREQ: <PDP_type>, (list of supported <precedence>s), (list of supported <delay>s), (list of supported <reliability>s) , (list of supported <peak>s), (list of supported <mean>s) [<CR><LF>+CGQREQ: <PDP_type>, (list of supported <precedence>s), (list of supported <delay>s), (list of supported <reliability>s) , (list of supported <peak>s), (list of supported <mean>s) […]]

Description

This command allows the TE to specify a Quality of Service Profile that is used when the MT sends an Activate PDP Context Request message to the network.

The set command specifies a profile for the context identified by the (local) context identification parameter, <cid>. Since this is the same parameter that is used in the +CGDCONT command, the +CGQREQ command is effectively an extension to the +CGDCONT command. The QoS profile consists of a number of parameters, each of which may be set to a separate value.

A special form of the set command, +CGQREQ= <cid> causes the requested profile for context number <cid> to become undefined.

The read command returns the current settings for each defined context.

The test command returns values supported as a compound value. If the MT supports several PDP types, the parameter value ranges for each PDP type are returned on a separate line.

Defined values

    <cid>: a numeric parameter which specifies a particular PDP context definition (see +CGDCONT command).

The following parameters are defined in GSM 03.60 -

    <precedence>: a numeric parameter which specifies the precedence class

    <delay>: a numeric parameter which specifies the delay class

    <reliability>: a numeric parameter which specifies the reliability class

    <peak>: a numeric parameter which specifies the peak throughput class

    <mean>: a numeric parameter which specifies the mean throughput class

If a value is omitted for a particular class then the value is considered to be unspecified.

Implementation

Optional. If the command is not implemented then all the values are considered to be unspecified.

10.2.3 Quality of Service Profile (Minimum acceptable) +CGQMIN

Table 4: +CGQMIN parameter command syntax

Command	Possible Response(s)
+CGQMIN=[<cid> [,<precedence > [,<delay> [,<reliability.> [,<peak> [,<mean>]]]]]]	OK ERROR
+CGQMIN?	+CGQMIN: <cid>, <precedence >, <delay>, <reliability>, <peak>, <mean> [<CR><LF>+CGQMIN: <cid>, <precedence >, <delay>, <reliability.>, <peak>, <mean> [...]]
+CGQMIN=?	+CGQMIN: <PDP_type>, (list of supported <precedence>s), (list of supported <delay>s), (list of supported <reliability>s) , (list of supported <peak>s), (list of supported <mean>s) [<CR><LF>+CGQMIN: <PDP_type>, (list of supported <precedence>s), (list of supported <delay>s), (list of supported <reliability>s) , (list of supported <peak>s), (list of supported <mean>s) [...]]

Description

This command allows the TE to specify a minimum acceptable profile which is checked by the MT against the negotiated profile returned in the Activate PDP Context Accept message.

The set command specifies a profile for the context identified by the (local) context identification parameter, <cid>. Since this is the same parameter that is used in the +CGDCONT command, the +CGQMIN command is effectively an extension to the +CGDCONT command. The QoS profile consists of a number of parameters, each of which may be set to a separate value.

A special form of the set command, +CGQMIN= <cid> causes the minimum acceptable profile for context number <cid> to become undefined. In this case no check is made against the negotiated profile.

The read command returns the current settings for each defined context.

The test command returns values supported as a compound value. If the MT supports several PDP types, the parameter value ranges for each PDP type are returned on a separate line.

Defined values

    <cid>: a numeric parameter which specifies a particular PDP context definition (see +CGDCONT command).

The following parameters are defined in GSM 03.60 -

    <precedence>: a numeric parameter which specifies the precedence class

    <delay>: a numeric parameter which specifies the delay class

    <reliability>: a numeric parameter which specifies the reliability class

    <peak>: a numeric parameter which specifies the peak throughput class

    <mean>: a numeric parameter which specifies the mean throughput class

If a value is omitted for a particular class then this class is not checked.

Implementation

Optional. If the command is not implemented then no check is made against the negotiated profile.

10.2.4 GPRS attach or detach +CGATT

Table 5: CGATT action command syntax

Command	Possible Response(s)
+CGATT=[<state>]	OK ERROR
+CGATT?	+CGATT: <state>
+CGATT=?	+CGATT: (list of supported <state>s)

Description

The execution command is used to attach the MT to, or detach the MT from, the GPRS service. After the command has completed, the MT remains in V.250 command state. If the MT is already in the requested state, the command is ignored and the OK response is returned. If the requested state cannot be achieved, an ERROR or +CME ERROR response is returned. Extended error responses (enabled by the +CMEE command) are listed in subclause 10.3.1.

Any active PDP contexts will be automatically deactivated when the attachment state changes to detached.

The read command returns the current GPRS service state.

The test command is used for requesting information on the supported GPRS service states.

   NOTE: This command has the characteristics of both the V.250 action and parameter commands. Hence it has the read form in addition to the execution/set and test forms.

Defined Values

   <state>: indicates the state of GPRS attachment
      0 - detached
      1 - attached
      Other values are reserved and will result in an ERROR response to the execution command.

Implementation

Optional.

10.2.5 PDP context activate or deactivate +CGACT

Table 6: CGACT action command syntax

Command	Possible Response(s)
+CGACT=[<state> [,<cid>[,<cid>[,…]]]]	OK ERROR
+CGACT?	+CGACT: <cid>, <state> [<CR><LF>+CGACT: <cid>, <state> [...]]
+CGACT=?	+CGACT: (list of supported <state>s)

Description

The execution command is used to activate or deactivate the specified PDP context (s). After the command has completed, the MT remains in V.250 command state. If any PDP context is already in the requested state, the state for that context remains unchanged. If the requested state for any specified context cannot be achieved, an ERROR or +CME ERROR response is returned. Extended error responses (enabled by the +CMEE command) are listed in subclause 10.3.1.If the MT is not GPRS attached when the activation form of the command is executed, the MT first performs a GPRS attach and them attempts to activate the specified contexts. If the attach fails then the MT responds with ERROR or, if extended error responses are enabled, with the appropriate failure-to-attach error message.

If no <cid>s are specified the activation form of the command activates all defined contexts.

If no <cid>s are specified the deactivation form of the command deactivates all active contexts.

The read command returns the current activation states for all the defined PDP contexts.

The test command is used for requesting information on the supported PDP context activation states.

> NOTE. This command has the characteristics of both the V.250 action and parameter commands. Hence it has the read form in addition to the execution/set and test forms.

Defined Values

> `<state>`: indicates the state of PDP context activation
> 0 - deactivated
> 1 - activated
> Other values are reserved and will result in an ERROR response to the execution command.

> `<cid>`: a numeric parameter which specifies a particular PDP context definition (see +CGDCONT command).+CGDCONT

Implementation

Optional.

10.2.6   Enter data state +CGDATA

Table 7: +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.250 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 clauses 8 (for X.25) and 9 (for IP) 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.250 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.250 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
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.

10.2.7   Show PDP address +CGPADDR

Table 8:+CGPADDR action command syntax

Command	Possible response(s)
+CGPADDR=[<cid> [,<cid> [,…]]]	+CGPADDR: <cid>,<PDP_addr> [<CR><LF>+CGPADDR: <cid>,<PDP_addr> [...]]
+CGPADDR=?	+CGPADDR: (list of defined <cid>s)

Description

The execution command returns a list of PDP addresses for the specified context identifiers.

The test command returns a list of defined <cid>s.

Defined values

<cid>: a numeric parameter which specifies a particular PDP context definition (see +CGDCONT command). If no <cid> is specified, the addresses for all defined contexts are returned.

<PDP_address>: a string that identifies the MT in the address space applicable to the PDP. The address may be static or dynamic. For a static address, it will be the one set by the +CGDCONT command when the context was defined. For a dynamic address it will be the one assigned during the last PDP context activation that used the context definition referred to by <cid>. <PDP_address> is omitted if none is available.

Implementation

Optional.

10.2.8   Automatic response to a network request for PDP context activation +CGAUTO

Table 9: CGAUTO parameter command syntax

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

Description

The set command disables or enables an automatic positive response (auto-answer) to the receipt of a Request PDP Context Activation message from the network. It also provides control over the use of the V.250 basic commands 'S0', 'A and 'H' for handling network requests for PDP context activation. The setting does not affect the issuing of the unsolicited result code RING or +CRING.

The test command returns the values of <n> supported by the MT as a compound value.

When the +CGAUTO=1 command is received, the MT shall attempt to perform a GPRS attach if it is not already attached. Failure will result in ERROR or, if enabled, +CME ERROR being returned to the TE. Subsequently, the MT will announce a network request for PDP context activation by issuing the unsolicited result code RING or +CRING to the TE, followed by the intermediate result code CONNECT. The MT then enters V.250 online data state and follows the same procedure as it would after having received a +CGANS=1 with no <L2P> or <cid> values specified.

   NOTE.   The +CGAUTO=0 command does not perform an automatic GPRS detach.

Defined values

   <n>:

      0   turn off automatic response (circuit switched as in GSM 07.07)
      1   turn on automatic response (circuit switched as in GSM 07.07)
      2 modem compatibility mode, GPRS only
      3 modem compatibility mode, GPRS and circuit switched calls (default)

For <n> = 0 or 1 GPRS network requests are manually accepted or rejected by the +CGANS command. The 'S0', 'A' and 'H' commands control only circuit switched calls according to GSM 07.07.

For <n> = 2, automatic acceptance of GPRS network requests is controlled by the 'S0' command. Manual control uses the 'A' and 'H' commands, respectively, to accept and reject GPRS requests. (+CGANS may also be used.) Incoming circuit switched calls can be neither manually nor automatically answered.

For <n> = 3, automatic acceptance of both GPRS network requests and incoming circuit switched calls is controlled by the 'S0' command. Manual control uses the 'A' and 'H' commands, respectively, to accept and reject GPRS requests. (+CGANS may also be used.) Circuit switched calls are handled according to GSM 07.07.

Implementation

Optional. If not implemented, the MT shall behave according to the case of <n> = 3.

10.2.9 Manual response to a network request for PDP context activation +CGANS

Table 10: CGANS action command syntax

Command	Possible response(s)
+CGANS=[<response>, [<L2P>,[<cid>]]]	OK ERROR
+CGANS=?	+CGANS: (list of supported <response>s), (list of supported <L2P>s)

Description

The execution command requests the MT to respond to a network request for GPRS PDP context activation which has been signalled to the TE by the RING or +CRING: unsolicited result code. The <response> parameter allows the TE to accept or reject the request.

If <response> is 0, the request is rejected and the MT returns OK to the TE.

If <response> is 1, the following procedure is followed by the MT.

Commands following the +CGANS command in the AT command line shall not be processed by the MT.

If the <L2P> parameter value is unacceptable to the MT, the MT shall return an ERROR or +CME ERROR response. Otherwise, the MT issues the intermediate result code CONNECT and enters V.250 online data state.

The detailed behaviour after the online data state has been entered is dependent on the PDP type. It is described briefly in clauses 8 (for X.25) and 9 (for IP) and in more detail in GSM 09.61 and the specifications for the relevant PDPs. PDP context activation procedures shall take place prior to or during the PDP startup.

One or more <cid>s may be specified in order to provide the values needed for the context activation request.

During the PDP startup procedure the MT has the PDP type and the PDP address provided by the network in the Request PDP Context Activation message. The MT may also have some or all of the following information -

The MT may have a priori knowledge, for example, it may implement only one PDP type.

The command may have provided an <L2P> parameter value.

The TE may provide one or both of PDP type and PDP address to the MT in the PDP startup.

If any of this information is in conflict, the command will fail.

If one or more <cid> is given then an attempt shall be made to identify an appropriate context definition by matching the PDP type and PDP address in the network request with the PDP type and PDP address in each of the specified context definitions (in the order in which their <cid>s appear in the command) as follows -

The PDP type must match exactly.

The PDP addresses are considered to match if they are identical or if the address in the context definition is unspecified.

The context shall be activated using the values for PDP type and PDP address provided by the network, together with the other information found in the PDP context definition. An APN may or may not re required, depending on the application.

If no <cid> is given or if there is no matching context definition, the MT will attempt to activate the context using the values for PDP type and PDP address provided by the network, together with any other relevant information known to the MT. The other context parameters will be set to their default values.

If the activation is successful, data transfer may proceed.

After data transfer is complete, and the layer 2 protocol termination procedure has completed successfully, the V.250 command state is re-entered and the MT returns the final result code OK

In the event of an erroneous termination or a failure to startup, the V.250 command state is re-entered and the MT returns the final result code NO CARRIER or, if enabled, +CME ERROR. Attach, activate and other errors may be reported. It is also an error to issue the +CGANS command when there is no outstanding network request.

NOTE: This is not the same as if the MT issues a +CGDATA (or +CGACT) command after receiving a +CRING unsolicited result code. A +CGDATA (or +CGACT) does not command the MT to acknowledge the network request but rather to make a new request for context activation. The network request would be ignored.

The test command returns the values of <response> and <L2P> supported by the MT as compound values.

This command may be used in both normal and modem compatibility modes.

Defined values

<response>: is a numeric parameter which specifies how the request should be responded to.

  0   reject the request
  1   accept and request that the PDP context be activated

If <response> is omitted it is assumed to be 0. Other values are reserved and will result in the ERROR response.

<L2P>: a string parameter which indicates the layer 2 protocol to be used (see +CGDATA command).

<cid>: a numeric parameter which specifies a particular PDP context definition (see +CGDCONT command).

Implementation

Optional.

10.2.10 GPRS mobile station class +CGCLASS

Table 11: CGCLASS parameter command syntax

Command	Possible Response(s)
+CGCLASS= [<class>]	OK ERROR
+CGCLASS?	+CGCLASS: <class>
+CGCLASS=?	+CGCLASS: (list of supported <class>s)

Description

The set command is used to set the MT to operate according to the specified GPRS mobile class. If the requested class is not supported, an ERROR or +CME ERROR response is returned. Extended error responses (enabled by the +CMEE command) are listed in subclause 10.3.1.

The read command returns the current GPRS mobile class.

The test command is used for requesting information on the supported GPRS mobile classes.

Defined Values

<class>: a string parameter which indicates the GPRS mobile class (in descending order of functionality)
    A   class A (highest)
    B   class B
    C   class C in GPRS and circuit switched alternate mode
    CG   class C in GPRS only mode
    CC   class C in circuit switched only mode (lowest)

Other values are reserved and will result in an ERROR response to the set command.

If the MT is GPRS attached when the set command is issued with a <class> = CC specified, a detach request shall be sent to the network.

Implementation

Optional.

10.2.11 Configure local triple-X PAD parameters +CGCLPAD

Table 12: 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 table 4 (subclause 8.1.1).

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.

10.2.12 GPRS event reporting +CGEREP

Table 13: CGEREP parameter command syntax

Command	Possible response(s)
+CGEREP=[<mode>[,<bfr>]]	OK ERROR
+CGEREP?	+CGEREP: <mode>,<bfr>
+CGEREP=?	+CGEREP: (list of supported <mode>s),(list of supported <bfr>s)

Description

Set command enables or disables sending of unsolicited result codes, +CGEV: XXX from MT to TE in the case of certain events occurring in the GPRS MT or the network. <mode> controls the processing of unsolicited result codes specified within this command. <bfr> controls the effect on buffered codes when <mode> 1 or 2 is entered. If a setting is not supported by the MT, ERROR or +CME ERROR: is returned.

Read command returns the current mode and buffer settings

Test command returns the modes and buffer settings supported by the MT as compound values.

Defined values

> <mode>:

0   buffer unsolicited result codes in the MT; if MT result code buffer is full, the oldest ones can be discarded. No codes are forwarded to the TE.

1   discard unsolicited result codes when MT-TE link is reserved (e.g. in on-line data mode); otherwise forward them directly to the TE

2   buffer unsolicited result codes in the MT when MT-TE link is reserved (e.g. in on-line data mode) and flush them to the TE when MT-TE link becomes available; otherwise forward them directly to the TE

> <bfr>:

0   MT buffer of unsolicited result codes defined within this command is cleared when <mode> 1 or 2 is entered

1   MT buffer of unsolicited result codes defined within this command is flushed to the TE when <mode> 1 or 2 is entered (OK response shall be given before flushing the codes)

Defined events

The following unsolicited result codes and the corresponding events are defined -

+CGEV: REJECT <PDP_type>, <PDP_addr>

> A network request for PDP context activation occurred when the MT was unable to report it to the TE with a +CRING unsolicited result code and was automatically rejected.

+CGEV: NW REACT <PDP_type>, <PDP_addr>, [<cid>]

> The network has requested a context reactivation. The <cid> that was used to reactivate the context is provided if known to the MT.

+CGEV: NW DEACT <PDP_type>, <PDP_addr>, [<cid>]

> The network has forced a context deactivation. The <cid> that was used to activate the context is provided if known to the MT.

```
+CGEV: ME DEACT  <PDP_type>, <PDP_addr>, [<cid>]
```

The mobile equipment has forced a context deactivation. The <cid> that was used to activate the context is provided if known to the MT.

```
+CGEV: NW DETACH
```

The network has forced a GPRS detach. This implies that all active contexts have been deactivated. These are not reported separately.

```
+CGEV: ME DETACH
```

The mobile equipment has forced a GPRS detach. This implies that all active contexts have been deactivated. These are not reported separately.

```
+CGEV: NW CLASS <class>
```

The network has forced a change of MS class. The highest available class is reported (see +CGCLASS).

```
+CGEV: ME CLASS <class>
```

The mobile equipment has forced a change of MS class. The highest available class is reported (see +CGCLASS).

Implementation

Optional.

10.2.13 GPRS network registration status +CGREG

Table 14: CGREG parameter command syntax

Command	Possible response(s)
+CGREG=[<n>]	
+CGREG?	+CGREG: <n>,<stat>[,<lac>,<ci>] *+CME ERROR: <err>*
+CGREG=?	+CGREG: (list of supported <n>s)

Description

The set command controls the presentation of an unsolicited result code +CGREG: <stat> when <n>=1 and there is a change in the MT's GPRS network registration status, or code +CGREG: <stat>[,<lac>,<ci>] when <n>=2 and there is a change of the network cell.

NOTE.   If the GPRS MT also supports circuit mode services, the +CREG command and +CREG: result code apply to the registration status and location information for those services.

The read command returns the status of result code presentation and an integer <stat> which shows whether the network has currently indicated the registration of the MT. Location information elements <lac> and <ci> are returned only when <n>=2 and MT is registered in the network. Refer to subclause 10.3.1 for possible <err> values.

Defined values

`<n>:`

0 disable network registration unsolicited result code

1 enable network registration unsolicited result code `+CGREG: <stat>`

2 enable network registration and location information unsolicited result code `+CGREG:`
   `<stat>[,<lac>,<ci>]`

`<stat>:`

0 not registered, ME is not currently searching a new operator to register to

1 registered, home network

2 not registered, but ME is currently searching a new operator to register to

3 registration denied

4 unknown

5 registered, roaming

`<lac>`: string type; two byte location area code in hexadecimal format (e.g. "00C3" equals 195 in decimal)

`<ci>`: string type; two byte cell ID in hexadecimal format

Implementation

Optional.

10.2.14 Select service for MO SMS messages +CGSMS

Table 15: CGSMS parameter command syntax

Command	Possible Response(s)
+CGSMS=[`<service>`]	OK ERROR
+CGSMS?	+CGSMS: `<service>`
+CGSMS=?	+CGSMS: (list of currently available `<service>`s)

Description

The set command is used to specify the service or service preference that the MT will use to send MO SMS messages.

The read command returns the currently selected service or service preference.

The test command is used for requesting information on the currently available services and service preferences.

Defined Values

`<service>`: a numeric parameter which indicates the service or service preference to be used
    0   GPRS
    1   circuit switched
    2   GPRS preferred (use circuit switched if GPRS not available)
    3   circuit switched preferred (use GPRS if circuit switched not available)

Other values are reserved and will result in an ERROR response to the set command.

Implementation

Optional.

10.3 Extensions to existing GSM AT commands and result codes

These commands are described fully in GSM 07.07 (See table A.2 of this specification for a list of section numbers in 07.07.). This subclause extends their use to MTs supporting the GPRS.

10.3.1 Report Mobile Equipment error +CMEE (+CME ERROR: result code)

This command disables or enables the use of the result code +CME ERROR: <err> as an indication of an error relating to the functionality of the MT. When enabled, MT related errors cause +CME ERROR: <err> final result code instead of the normal ERROR final result code. ERROR is returned normally when the error is related to invalid syntax or parameters. The format of <err> can be either numeric or verbose.

Additional <err> values defined for GPRS-related errors are given below.

NOTE. Numeric values 101 - 150 are reserved by GSM 07.07 for use by GPRS.

Implementation

Mandatory for numeric format codes applicable to the implemented GPRS command set.

10.3.1.1 Errors related to a failure to perform an Attach

Numeric	Text
103	Illegal MS (#3)
106	Illegal ME (#6)
107	GPRS services not allowed (#7)
111	PLMN not allowed (#11)
112	Location area not allowed (#12)
113	Roaming not allowed in this location area (#13)

(Values in parentheses are GSM 04.08 cause codes.)

10.3.1.2 Errors related to a failure to Activate a Context

Numeric Text

132	service option not supported (#32)
133	requested service option not subscribed (#33)
134	service option temporarily out of order (#34)
149	PDP authentication failure

(Values in parentheses are GSM 04.08 cause codes.)

10.3.1.3 Other errors

Numeric Text

150	invalid mobile class
148	unspecified GPRS error

10.3.2 Extended error report +CEER

This command causes the MT to return one or more lines of information text, determined by the MT manufacturer, which should offer the user of the MT an extended report of the reason for the most recent of a number of specified events. The following GPRS-specific events shall be added to the list in 07.07 -

- the last unsuccessful GPRS attach or unsuccessful PDP context activation,

- the last GPRS detach or PDP context deactivation.

Implementation

Optional.

10.3.3 Cellular result codes +CRC (+CRING: result code)

This command controls whether or not the MT should use the extended format for indicating network requested PDP context activation. When enabled, the receipt of a Request PDP Context Activation message by the MT from the network is indicated to the TE with the unsolicited result code +CRING: <type> instead of the normal RING. If the MT is unable to announce to the TE the network's request (for example it is in V.250 online data state) the MT shall reject the request. No corresponding unsolicited result code shall be issued when the MT returns to a command state.

An additional value for <type> is defined for GPRS -

GPRS <PDP_type>, <PDP_addr>[, <L2P>]

<PDP_type> and <PDP_addr> are as defined in the Define PDP Context (+CGDCONT) command.

The optional <L2P> proposes a layer 2 protocol to use between the MT and the TE. It is defined in the Enter GPRS Data Mode (+CGDATA) command.

Implementation

Optional.

10.3.4 Service Reporting Control +CR (+CR: result code)

This command controls whether or not the intermediate result code +CR: <serv> is returned from the MT to the TE. If service reporting is enabled, and the service is GPRS, the intermediate result code +CR: is transmitted immediately before the intermediate result code CONNECT.

An additional value for <serv> is defined for GPRS -

GPRS [<L2P>]

The optional <L2P> proposes a layer 2 protocol to use between the MT and the TE. It is defined in the Enter GPRS Data Mode (+CGDATA) command.

Implementation

Optional.

10.4 Modem compatibility

This subclause describes how existing AT commands, designed for use with a modem, may be used to control a GPRS MT. This is to provide backwards compatibility with existing communications software. For new applications it is recommended that the GPRS-specific commands, described in previous subclauses, be used.

10.4.1 MT originated PDP context activation

In this mode of operation, the MT behaves like an originating modem and accepts the normal V.250 commands associated with placing and clearing a call. If GPRS-specific configuration commands are required, they may be sent to the MT as part of the modem initialisation commands.

10.4.1.1 Request GPRS service 'D'

Table 16: D command syntax

Command	Possible Response(s)
`D*<GPRS_SC>[*[<called_address>]` `[*[<L2P>][*[<cid>]]]]#`	CONNECT ERROR

Description

The V.250 'D' (Dial) command causes the MT to enter the V.250 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.250 online data state. No further commands may follow on the AT command line.

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.250 command state and return the NO CARRIER final result code.

If <L2P> and <cid> are supported, their usage shall be the same as in the +CGDCONT command. The +CGDCONT command may be used in the modem initialisation AT command string to set values for APN, QoS etc..

This command may be used in both normal and modem compatibility modes.

Defined Values

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

    <called_address>: a digit string (see note) that specifies the address of a called party in the address space applicable to the PDP.

    <L2P>: a digit string (see note) which indicates the layer 2 protocol to be used (see +CGDATA command). Numeric equivalents to the alphanumeric values used by +CGDATA are:
    1   PPP
    2   PAD
    3   X25
    9yyyy M-xxxx
    Other values are reserved and will result in an ERROR response to the set command.

    <cid>: a digit string which specifies a particular PDP context definition (see +CGDCONT command).

NOTE.   The dial string conforms to the syntax specified in GSM 02.30.

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.

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.

10.4.2   Network requested PDP context activation

In this mode of operation, the MT behaves like an answering modem and accepts the normal V.250 commands
associated with answering a call. If GPRS-specific configuration commands are required, they may be sent to the MT as
part of the modem initialisation commands.

The +CGAUTO command is used to select modem compatibility mode.

10.4.2.1   Automatic response to a network request for PDP context activation 'S0'

The V.250 'S0=n' (Automatic answer) command may be used to turn off (n=0) and on (n>0) the automatic response to a
network request for a PDP context activation.

When the 'S0=n' (n>0) command is received, the MT shall attempt to perform a GPRS attach if it is not already
attached. Failure will result in ERROR being returned to the TE. Subsequently, the MT will announce a network
request for PDP context activation by issuing the unsolicited result code RING to the TE, followed by the intermediate
result code CONNECT. The MT then enters V.250 online data state and follows the same procedure as it would after
having received a +CGANS=1 with no <L2P> or <cid> values specified.

NOTE.   The 'S0=n' (n=0) command does not perform an automatic GPRS detach.

Implementation

Optional.

10.4.2.2   Manual acceptance of a network request for PDP context activation 'A'

The V.250 'A' (Answer) command may be used to accept a network request for a PDP context activation announced by
the unsolicited result code RING. The MT responds with CONNECT, enters V.250 online data state and follows the
same procedure as it would after having received a +CGANS=1 with no <L2P> or <cid> values specified. It is an error
to issue the 'A' command when there is no outstanding network request.

Implementation

Optional.

10.4.2.3   Manual rejection of a network request for PDP context activation 'H'

The V.250 'H' or 'H0' (On-hook) command may be used to reject a network request for PDP context activation
announced by the unsolicited result code RING. The MT responds with OK. It is an error to issue the 'H' command
when there is no outstanding network request.

NOTE: This is an extension to the usage of the 'H' command that is described in ITU-T V.250.

Implementation

Optional.

10.5   Example command sequences

10.5.1   PPP in dial compatibility mode

10.5.1.1   Mobile initiated IP context activation

In this mode of operation, the MT behaves like an originating modem and accepts the normal V.250 commands associated with placing and clearing a call to a dial-up PPP server. Although the procedures for setting up the IP context are initiated from the mobile end, IP-based sessions, for example the File Transfer Protocol (FTP), may be initiated from either end once the context is active.

For this example it is assumed that

- the user has subscribed to only one PDP context (of type IP) and therefore no context parameter values are needed,

- the MT supports only PPP at the MT-TE interface and therefore no layer 2 protocol need be specified.

A possible sequence of events is -

The MT begins in V.250 command state.

TE -> MT: AT<GPRS-specific configuration commands, if required>

MT -> TE: OK

The TE sends a dial command requesting the GPRS.

TE -> MT: ATD*99#

MT -> TE   CONNECT

The MT enters V.250 online data state.

> *TE starts up PPP (LCP exchange) -*
> TE -> MT: LCP Configure-request
> MT -> TE: LCP Configure-ack
> > *PPP Authentication may take place (optional)*
> > *TE starts up IP (NCP for IP exchange) -*
> > TE -> MT: NCP(IP) Configure-request
> > MT <-> network: MT performs the GPRS-attach procedure if the MT is not currently attached.
> > MT <-> network: MT performs the IP context activation procedure.
> > MT -> TE: NCP(IP) Configure-ack
> > > TE <-> MT< - > network: IP packets may now be transferred
> > *TE stops IP (optional) -*
> > TE-> MT: NCP(IP) Terminate-Request   ) this
> > MT<-> network: MT performs the IP context deactivation procedure   ) is
> > MT -> TE: NCP(IP) Terminate-Ack   ) optional
> *TE stops PPP -*
> TE-> MT: LCP Terminate-Request
> MT <-> network: MT performs the IP context deactivation procedure if it has not already done so.
> MT <-> network: MT may perform the GPRS-detach procedure if no other GPRS services are active.
> MT -> TE: LCP Terminate-Ack

The MT returns to V.250 command state and issues the final result code -

MT -> TE   NO CARRIER

The TE may recognise this as a return to V.250 command state. However, if it is using procedures intended for controlling modems, it may attempt to force a disconnect since in the modem case it cannot rely on the remote modem dropping the carrier. It will use some combination of -

TE -> MT: TE drops circuit 108/2 (Data Terminal Ready)

TE -> MT: escape sequence (e.g. +++)

TE -> MT: ATH

The MT should respond according to V.250 even if it is already in command state.

If the connection is lost at any time, the MT shuts down PPP, returns to V.250 command state and issues the final result code -

MT -> TE NO CARRIER

10.5.1.2 Network requested IP context activation

In this mode of operation, the MT behaves like an answering modem and accepts the normal V.250 commands associated with answering a call to a PPP server. Although the procedures for setting up the IP context are initiated from the network end, IP-based sessions, for example the File Transfer Protocol (FTP), may be initiated from either end once the context is active.

Two example sequences of events are given, for the cases of automatic and manual answering -

Case 1: automatic answering

The MT begins in V.250 command state.

TE -> MT: AT<GPRS-specific configuration commands, if required >

The TE sets automatic answering mode -

TE -> MT: ATS0=1

MT <- > network: MT performs the GPRS-attach procedure if the MT is not currently attached. *Subsequently -*

network -> MT: Request PDP Context Activation message
MT -> TE: RING

The MT returns the intermediate result code -

MT -> TE CONNECT

- and enters V.250 online data state.

The TE and MT perform the PPP and IP startup procedures which include the MT requesting the network to activate the IP context.

Case 2: manual answering

The MT begins in V.250 command state.

TE -> MT: AT<GPRS-specific configuration commands, if required >

The TE sets manual answering mode and requests a GPRS-attach (if necessary) -

TE -> MT: ATS0=0

TE -> MT: AT+CGATT=1

MT <- > network: MT performs the GPRS-attach procedure if the MT is not currently attached.

network -> MT: Request PDP Context Activation message

MT -> TE: RING

The TE answers manually, -

TE -> MT: ATA

MT -> TE CONNECT

- and enters V.250 online data state.

The TE and MT perform the PPP and IP startup procedures which include the MT requesting the network to activate the IP context.

or the TE rejects the connection -

TE -> MT: ATH

- and remains in V.250 command state

10.5.2   MO X.25 virtual call using a triple-X PAD in dial compatibility mode

This example shows how the `<called_address>` string may be used in the D command to make an X.25 call to a specified X.121 address.

The MT begins in V.250 command state.

TE -> MT: AT<GPRS-specific configuration commands, if required>

MT -> TE: OK

The TE sends a dial command requesting the GPRS to X.121 address 1234567890.

TE -> MT: ATD*99*1234567890#

MT -> TE   CONNECT

The MT enters V.250 online data state, performs a GPRS attach if necessary and activates the X.25 context. It then automatically makes an X.25 call to the specified address, bypassing the PAD prompt. If the call is successful the MT responds with the PAD connect message -

1234567890 COM

Annex A (informative):
Summary of AT commands for GPRS

This informative annex lists the AT commands for GPRS that are described in this specification.

Table A.1: Summary of AT commands for GPRS

Command	Subclause reference	Description
+CGACT	10.2.5	PDP context activate or deactivate
+CGANS	10.2.9	Manual response to a network request for PDP context activation
+CGATT	10.2.4	GPRS attach or detach
+CGAUTO	10.2.8	Automatic response to a network request for PDP context activation
+CGCLASS	10.2.10	GPRS mobile station class
+CGCLPAD	10.2.11	Configure local triple-X PAD parameters
+CGDATA	10.2.6	Enter data state
+CGDCONT	10.2.1	Define PDP context
+CGEREP	10.2.12	Control unsolicited GPRS event reporting
+CGPADDR	10.2.7	Show PDP address
+CGREG	10.2.13	GPRS network registration status
+CGQMIN	10.2.3	Quality of service profile (minimum acceptable)
+CGQREQ	10.2.2	Quality of service profile (requested)
+CGSMS	10.2.14	Select service for MO SMS messages

Table A.2: Summary of GPRS Extensions to existing GSM AT commands

Command	Subclause reference	Description
+CEER	10.3.2	Extended error report (07.07 subclause 6.10)
+CMEE	10.3.1	Report mobile equipment error (07.07 subclause 9.1)
+CR	10.3.4	Service reporting control (07.07 subclause 6.9)
+CRC	10.3.3	Cellular result codes (07.07 subclause 6.11)

Table A.3: Summary of AT commands for GPRS modem compatibility mode

Command	Subclause reference	Description
A	10.4.2.2	Answer - manual acceptance of a network request for PDP context activation
D	10.4.1.1	Dial - request GPRS service
H	10.4.2.3	On-hook - manual rejection of a network request for PDP context activation
S0	10.4.2.1	Automatic answering control - automatic acceptance of a network request for PDP context activation

Annex B (informative):
Document change history

SPEC	SMG#	CR	PHASE	VERS	NEW_VERS	SUBJECT
07.60	s23	NEW	R97	2.0.0	5.0.0	Draft GSM 07.60 v. 2.0.0
07.60	s24	A002	R97	5.0.0	5.1.0	IP configuration parameters and PPP clarifications
07.60	s25	A004	R97	5.1.0	6.0.0	X.25 Based Services
07.60	s26	A005	R97	6.0.0	6.1.0	AT commands for GPRS
07.60	s26	A006	R97	6.0.0	6.1.0	Editorial review of 07.60
07.60	s26	A007	R97	6.0.0	6.1.0	Authentication for IP over PPP
				6.1.0	6.1.1	Correction to CR implementation
07.60	s27	A008	R97	6.1.1	6.2.0	Addition of a new AT command, +CGREG, to display current GPRS registration status
07.60	s27	A009	R97	6.1.1	6.2.0	Addition of a new AT command, +CGSMS, to select the service for the transport of MO SMS messages
07.60	s27	A011	R97	6.1.1	6.2.0	Corrections and clarifications, mainly to the AT commands specifications
07.60	s27	A012	R97	6.1.1	6.2.0	Addition of a GPRS extension to the existing 07.07 AT command, Service Reporting Control +CR
07.60	s27		R97	6.2.0	6.2.1	Editorial update to section 8.1

History

Document history		
V6.1.1	July 1998	Publication
V6.2.1	November 1998	Publication