Developer's Guide

Motorola g20
AT Commands

98-08901C68-C

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REVISION HISTORY

Revision	Date	Purpose
O	30 Jun 03	Initial Release
A	15 Feb 04	Updated manual version
B		Major manual update - additional commands and features
C	July 04	Manual update - additional commands and features
		Updated sections: 1.1, 1.3, 2.1.4.1, 2.8, 4.3.3.2, 4.3.3.4, 4.3.3.8, 4.3.3.12, 4.3.3.17, 4.3.3.18, 4.4.1.2, 4.4.1.3, 4.4.1.4, 4.4.1.5, 4.4.1.6, 4.4.1.11, 4.5.1.11, 4.5.1.13, 4.5.1.14, 4.5.1.16, 4.5.1.17, 4.5.1.19, 4.6.1.1, 4.6.1.6, 4.7.1.1, 4.7.1.2, 4.7.1.3, 4.7.1.11, 4.7.10, 4.8.3.3, 4.8.3.8, 4.9.1.3, 4.9.1.4, 4.9.1.5, 4.10.1.1, 4.10.1.2, 4.10.1.3, 4.10.1.4, 4.10.1.5, 4.10.1.5.1, 4.10.1.5.2, 4.10.3.1, 4.11.3, 4.11.5, 4.11.10, 4.12.2.2, 4.12.2.7, 4.12.2.8, 4.13.1, 4.15.1.5, 4.15.2.2, 4.16.1.2, 4.165.2, 4.16.6.4, 4.16.6.5, 5.2.4, A.1
		New sections: 2.1.4, 2.1.5, 4.2.1.10, 4.3.3.17, 4.3.3.18, 4.4.1.9, 4.4.1.10, 4.4.1.11, 4.4.1.12, 4.5.1.19, 4.5.1.20, 4.7.1.13, 4.7.1.14, 4.7.1.15, 4.7.1.16, 4.8.2.8, 4.11.6.3, 4.11.6.4, 4.11.7, 4.11.8, 4.11.9, 4.11.10, 4.11.11, 4.12.2.8

g20 AT Commands

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PREFACE

1.1 SCOPE OF THIS MANUAL

This manual introduces the g20 AT commands, and describes how software developers can use these commands to communicate with the g20 device, and to create software applications that communicate with the g20 using these commands.

We at Motorola want to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

You can reach us by email: n2cshd@motorola.com.

1.2 WHO SHOULD USE THIS MANUAL

This manual is intended for software developers who communicate with the g20 device using the AT commands, and create applications to communicate with the g20 device using the AT commands.

1.3 APPLICABLE DOCUMENTS

• g20 Cellular Engine Module Description – 9808901C66-D
• g20 Developer's Kit – 9808901C67-C

1.4   TERMS AND ABBREVIATIONS

This section provides definitions for terms and acronyms used in this document.

Table 1. Terms and Abbreviations

Acronym/Term	Definition/Description
ACCH	AT Command Channel - Used for AT-commands, TCP/IP, Internal-GPRS session, STK, Voice-Call, and SMS applications
AOC	Advice of Charge
APN	Access Point Name
ASCII	A standard seven-bit code character set
ATA	AT command for call answer
ATD	AT command for call originating
ATH	AT command for Hanging-up a call
ATO	AT command to return to Data mode after temporarily exiting by ESC
BM	Broadcast Message
CB	Cell Broadcast
CBM	Cell Broadcast Message
CDS	Call Data Services (External-GPRS session, CSD session, FAX session)
CSD	Circuit-switched Data
CSNS	Single Numbering Call Scheme
CTS	Clear to Send
CTS	RS232 pin used for HW flow control. The MGOM uses this pin to stop data transmission from the DTE (on the TXD pin).
DA	Destination Address
DCD	Data Carrier Detect
DCE	Data Communication Equipment (g20)
DCSs	Data Coding Schemas
DLC	Data Link Connection
DLC0	The multiplexer control channel.
DLCI	Data Link Connection Identifier
DSP	Digital Signal Processor
DSR	Data Set Ready
DSR	MGOM is ON and ready to communicate with the DTE device.
DT	Discharge Time
DTE	Data Terminal Equipment (such as terminals, PCs and so on). Also called Application Processor (AP).
DTMF	Dual-Tone Multi-Frequency
DTR	Data Terminal Ready
EF	Elementary Files
EONS	Enhanced Operator Name String
ERM	Error Recovery Mode
ESC	Exit to Command Mode from Data Mode (usually the +++ sequence)
ETSI	European Telecommunication Standards Institute
FCC	Federal Communications Commission (U.S.)
FO	First Octet

Table 1. Terms and Abbreviations *(Continued)*

Acronym/Term	Definition/Description
FTA	Full Type Approval
GCF	GSM Certification Forum
GGSN	Gate GPRS Support Node
GPIO	General Purpose Input/Output
GPRS	General Packet Radio Service
GR232CFG	The real RS232 HW lines configuration (in PREMUX).
GRLC	General RS232 Logical Channel - This channel can handle the 07.07/07.05 AT command set (CSD, FAX, GPRS, Voice, Network AT, and so on.)
GSM	Global System for Mobile Communications
HCO	Hearing Carry Over allows Speech Disabled callers who can hear well on the telephone to listen directly to the person they are talking with. The Speech Disabled Relay user types his or her part of the conversation on a TTY. A Communication Assistant (CA) then speaks the typed conversation, word for word, to the standard telephone user.
IC	Integrated Circuit
ID	Identification
IDLC	Information DLC - refers to all the data channels except the control channel.
IMEI	International Mobile Equipment Identification.
ISR	Interrupt Service Routine
ITU	International Telecommunication Union
LCA	Low Cost Architecture
MCC/MNC	Mobile Country Code / Mobile Network Code
ME	Mobile Equipment
MGOM	Motorola g20/g21 GSM OEM Modem, also called Base Band processor.
MIDs	Message IDs (Channels)
MO	Mobile Originated - sets up a call session.
MR	Message Reference
MT	Mobile Terminated - accepts a call session.
MUX	Multiplexer entity
OA	Origination Address
OEM	Original Equipment Manufacturer
P2K	Platform 2000
PCB	Printed Circuit Board
PCM	Pulse Code Modulation
PDN	Packet Data Network
PDU	Packet Data Unit
PID	Protocol Identifier
PPP	Point-to-Point Protocol
QoS	Quality of Service
RA	Recipient Address
RI	Ring Indicator
RTS	Request To Send
RTS	RS232 pin used for HW flow control. The DTE uses this pin to stop data transmission from the MGOM (on the RXD pin).

Table 1. Terms and Abbreviations *(Continued)*

Acronym/Term	Definition/Description
RXD	DTE received data from MGOM.
S-register	Software Resister
SC	Service Center
SCA	Service Center Address
SCTS	Service Center Time Stamp
SIM	Subscriber Identity Module
SM	Short Message
SMS	Short Message Service
SN	Serial Number
ST	Status
SW flow control	ISO/IEC 646 SW flow control (the DC1/XON and DC3/XOFF control characters).
TA	Terminal Adaptor
TBD	To Be Defined
TDMA	Time Division Multiple Access
TE	Terminal Equipment
TODA	Type of Destination Address
TOOA	Type of Origination Address
TORA	Type of Recipient Address
TOSCA	Type of SCA
TTY	Tele Typewriter
TXD	DTE transmit data to MGOM
UA	Unnumbered Acknowledgement
UIH	Unnumbered Information, with Only Header Checksum
USB	Universal Serial Bus
VCO	Voice Carry Over. This is available for people who cannot hear but are able to speak clearly. During a VCO relay call, the Deaf or Hard of Hearing caller speaks directly to the person they are conversing with. When that person responds, a Communication Assistant (CA) types back exactly what is said to the screen of the TTY or VCO phone.

1.5   HOW THIS MANUAL IS ORGANIZED

This manual contains the following chapters:

- **Chapter 1** contains this Preface.
- **Chapter 2** introduces the new product features and provides a list of the AT commands.
- **Chapter 3** provides an introduction to the AT commands, and includes a general explanation of the command's format and usage. It also describes supported character sets and error handling.
- **Chapter 4** provides a reference to all available AT commands, including examples, where relevant.
- **Chapter 5** provides scenarios and examples for implementing various g20 functionality, including g20 setup and connectivity, SMS, call control, data calls, GPRS, Sleep mode, audio, STK, TCP/IP and MUX user integration.
- **Chapter 6** describes the PC Driver and PC Loader tools provided by the application.
- **Appendix A** provides conversions between different character sets. It also provides an alphabetical list of all the AT commands.
- **Appendix B** describes the MUX's PREMUX and MUX states.

2.1 IMPROVED OEM FEATURES

g20 contains the following new and improved features:

- SIM Application Toolkit (STK)
- TCP/IP support
- Audio (digital and analog) - path, gain and algorithm
- User-defined profiles
- USB session output indication line

For a full list of g20 features, refer to the g20 Cellular Engine Module Description manual.

2.1.1 STK

2.1.1.1 Overview

The SIM Tool Kit (STK, also known as the SIM Application Toolkit or SAT) is a set of applications operated by the network provider (usually the module's SIM provider). If the STK is supported and enabled on the mobile side, specific data can be obtained via menu browsing.

2.1.1.2 Features and Benefits

The g20 STK enables the terminal to obtain information via menus created by the provider, for example, "local news" or "weather info". These menus are provider dependent. Enabling the STK allows the provider to perform other actions regarding call control, SMS and so on.

2.1.1.3 Technical Description

The STK supports the specific mechanism(s) that SIM applications require to interact and operate with the g20. Using this mechanism, the SIM can notify the terminal, via the g20, that a specific action is requested. A full list of supported actions is listed in the Proactive SIM section. For more information regarding the STK mechanism, refer to the GSM 11.11 [20], GSM 11.14 ETSI standards.

2.1.1.3.1 Profile Download

Profile downloading provides a mechanism for the g20 to transmit information describing its capabilities to the SIM. During the early, profile download phase of the protocol, the g20 negotiates and confirms its ability to support the capabilities requested by the STK.

2.1.1.3.2   Data Transfer into the SIM

STK data transfer uses the short message service (SMS) as a transfer layer.

2.1.1.3.3   Set up Idle Mode Text

The proactive SIM mechanism enables the SIM to initiate actions to be handled by the g20. Using this service, the SIM can inform the g20 that it has information pending for action. The SIM can issue a variety of protocol commands through this mechanism, for example:

- Displaying text
- Sending a short message
- Setting up a voice call to a number held by the SIM
- Setting up a data call to a number whose bearer capabilities are held by the SIM
- Sending an SS control or USSD string
- Playing a tone
- Initiating a dialogue with the user (get inkey, get input)
- Providing local information from the g20 to the SIM
- Profile download
- Send DTMF
- Set up idle text mode
- Launch browser
- Set up event list

2.1.1.3.4   Menu Selection

The SIM supplies a set of possible menu entries via a proactive SIM command. The menu selection mechanism is used to transfer the SIM application menu item selected by the user to the SIM and then via SMS to the provider.

2.1.1.3.5   Call Control by SIM

When this service is activated by the SIM, all dialed digit strings, supplementary service control strings and USSD strings are first passed to the SIM before the g20 sets up the call, the supplementary service operation or the USSD operation. The SIM has the ability to allow, disable or modify the call. The STK has the ability to replace a call request, a supplementary service operation or a USSD operation with another call, for example, a call request by the g20 can be diverted to a different destination.

2.1.2   TCP/UDP IP Connection

2.1.2.1   Overview

The network capabilities are achieved by using different layers of connections. Every layer of connections provides basic connections to the layer above it. The higher the layer is, the more capabilities it can provide.
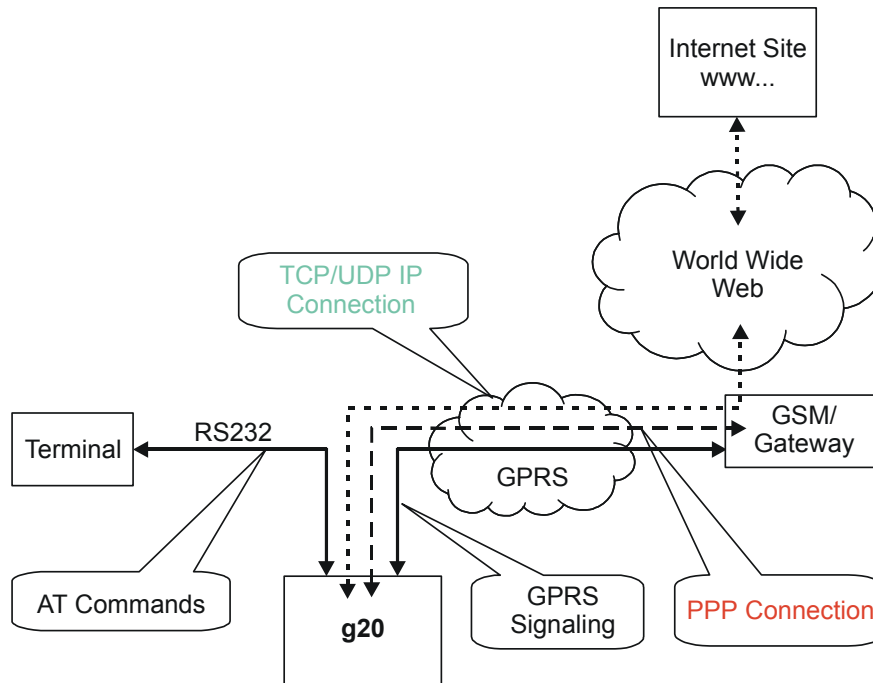
Figure 1. System Overview

The three layers of connections are:

• Physical links
• Point-to-point links
• TCP/UDP links

2.1.2.2   TCP/IP

When establishing the TCP/IP connection the g20 can only be the "initiator". The TCP/IP feature enables the g20 to be a wireless end point for a TCP/IP socket.

Note The TCP protocol use the value TTL (Time to live) = 64.

2.1.2.2.1 Creating TCP/IP Connections

Connection from the g20 to the Web

The following occurs when creating a TCP/IP connection from the g20 to the Web:

1. The g20 connects to the GPRS network and receives an IP address (using the +MIPCALL command).

2. The g20 opens a TCP/IP stack as one of its "sockets" (it must know the target's IP address and port number).

3. Once the connection is established, data is transferred freely in both directions (upload and download).

Connection with another g20 using the "GPRS Manager"

The following occurs when creating a TCP/IP connection with another g20 using the "GPRS Manager":

1. The OEM on the target side (server) uses the "GPRS Manager" application. When using this application the TCP/IP is external to the OEM. (External TCP stack is used).

2. The target side activates the "server application" (The term "server application" means an application that has the ability to listen on a given IP address and port number).

3. After connecting to the GPRS network, the "server" sends its IP address to the g20 using an alternative connection (for example, CSD, SMS and so on).

4. The server application listens on a known port, waiting for g20 to connect.

5. The g20 connects to the same GPRS network as the server, and receives an IP address (using the +MIPCALL command).

6. The g20 initiates a TCP/IP connection with the listening "server". (It knows the IP address and port number of the server).

7. Once the server is connected, the TCP/IP connection is created and data can be transferred freely in both directions (upload and download).

Note The server side can use the g18 OEM module too.

2.1.2.3 UDP/IP

The set of AT commands created for the TCP/IP connection is used for the UDP/IP connection as well. Therefore, UDP/IP must open a UDP stack using the MIPOPEN AT command. The connection created does not change any concept regarding the UDP/IP known protocol (which is connectionless), this is just an easy way for the terminal to specify to the g20 which of the four possible stacks should be used.

When establishing the UDP/IP connection, the g20 is both the "initiator" and the "listener".

2.1.2.3.1 Creating UDP/IP Connections

Connection with another g20

The following occurs during a UDP/IP connection with another g20:

1. Side A:
   - The g20 connects to the GPRS network and receives an IP address (using the +MIPCALL command).
   - The g20 opens a UDP/IP stack as one of its "sockets" (using the +MIPOPEN and selecting the protocol UDP).

2. Side B:
   - The g20 connects to the GPRS network and receives an IP address (using the +MIPCALL command).
   - The g20 opens a UDP/IP stack as one of its "sockets" (using the +MIPOPEN and selecting the protocol UDP).

3. Side A and B previously agree on a port number, and exchange their given IP addresses via other means of connection (SMS, CSD, Voice, DB and so on).

4. The g20 sends and receives data to and from the targeted site as it knows the IP address and port number of the target.

5. Sending (accumulating) data is done using the +MIPSEND command.

6. Actual send is done using the +MIPPUSH command, by specifying the IP address and port number of the destination.

> **Note**
> Every +MIPPUSH sets the destination IP address and destination port number for the current and future transactions. These values are used for the next push if not explicitly overwritten.

Connection from the g20 (client/server) to WEB (client/server)

The following occurs when creating a UDP/IP connection from the g20 (client/server) to WEB (client/server):

1. Client side:

   • The g20 client connects to the GPRS network and receives an IP address (using the +MIPCALL command).
   • The g20 opens a UDP/IP stack as one of its "sockets" (using the +MIPOPEN and selecting the protocol UDP).

2. The g20 sends data to the Website, as the Web site's IP address is known and is public, and the port number is previously agreed upon.

3. Sending (accumulating) data is done by the +MIPSEND command.

4. Actual send is done by the +MIPPUSH command by specifying the Website IP address and Website port number.

5. Server side:

   • After receiving the first packet from the client, the server knows the IP address and port number of the g20.
   • The IP address and port number for the specific mobile g20 should be saved in the DB.

> **Note**
> Every +MIPPUSH sets the destination IP address and destination port number for the current and future transactions. These values are used for the next push if not explicitly overwritten.

2.1.2.4   Features and Benefits

The TCP/UDP IP feature provides the terminal with the following benefits:

• Up to four simultaneous protocol connections.
• Ability to pass data via the protocol stack using AT commands (command mode). This relieves the terminal from switching the RS232 to "binary mode" and back to "command mode".
• Ability to use UDP and TCP simultaneously.
• No need for protocol support from the terminal - only data sending and receiving.
• Reduced memory utilization. The g20 manages the protocol stack and therefore saves terminal memory.

2.1.2.5   Technical Description

Figure 1, "System Overview," on page 7 displays the system overview which comprises the following links and layers:

Physical layer links:

• The terminal is connected to the g20 using a physical RS-232 connection.
• The g20 is connected to the GGSN using a GPRS link.
• The GGSN is connected to the Internet via some sort of physical connection (usually telephone or cable).

Point-to-point layer links:

- AT command protocol is used to transfer data between the terminal and the g20.
- After authentication, the g20 is linked to the GGSN using PPP protocol.
- The GGSN is connected to its Internet service provider using some protocol.

TCP / UDP layer:

- The g20 can transfer data with the WEB using either TCP/IP or UDP/IP protocols.
- The protocol stacks in the terminal or in the OEM must be managed when using TCP/IP or UDP/IP protocols. The g20 software can manage these stacks internally. This enables the g20 to relieve the terminal from the job of managing these protocols.

> **Note**
>
> Currently, the embedded TCP/IP feature may be used only for mobile-initiated connections. The embedded TCP/IP feature cannot listen on a port for incoming connections.

2.1.3   Audio

2.1.3.1   Overview

The audio (digital and analog) feature in the g20 module involves three main issues: path (routes the current input and output devices), gain (volume management) and algorithm. For more information, refer to "Audio" on page 216.

2.1.3.2   Features and Benefits

The following algorithm related features are provided:

2.1.3.2.1   Sidetone

Sidetone reduces the microphone audio input that is routed to the selected speaker so that the person speaking can hear himself or herself talking. This creates a slight echo because the speaker sound then gets picked up again by the microphone and is again routed to the speaker, and so on. Echo suppress is designed to take care of this echo.
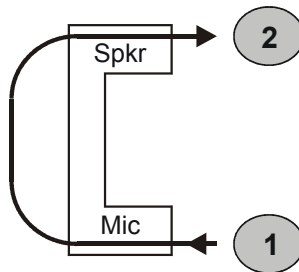
Figure 2. Sidetone

2.1.3.2.2   Echo Cancel

Echo Cancel suppresses a large amount of the output sound picked up by the input device (cancels all echoes).
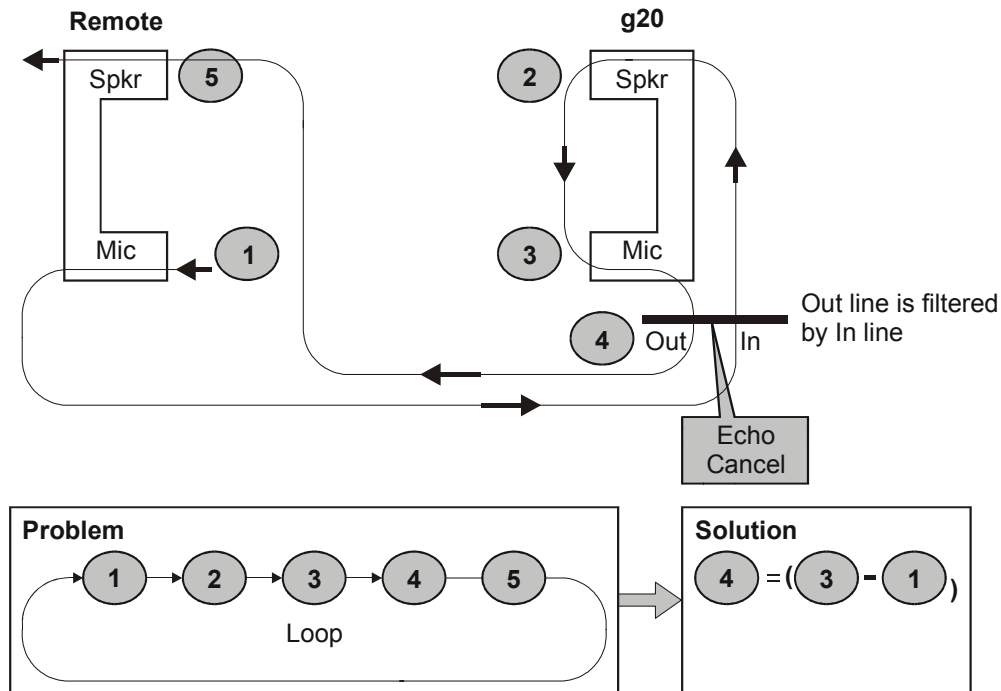
Figure 3. Echo Cancel

2.1.3.2.3   Noise Suppress

Noise suppression improves audio quality in all modes by suppressing environment noise from being picked up by the input device.

2.1.3.3   Technical Description

The path features provide full control over the navigation of the audio in the product.

The gain features provide full control over the volume levels of the different output accessories and tones.

The algorithm provides full control over activation/deactivation of audio quality features such as echo canceling and noise suppression.

The user can access these features by means of AT commands. These are described later in this document.

2.1.4   User-defined Profiles

2.1.4.1   Overview

The g20 enables the user to define two profiles. You can switch between profiles and display the currently used profile.

2.1.4.2   Benefits

When the g20 is used, the application/user can switch between the two predefined profiles. Setup time is reduced by the use of these profiles.

2.1.5   USB Session Output Indication Line

2.1.5.1   Overview

A USB session output indication line indicates whether the g20 is in a GPRS or CSD data session while communicating with the terminal using USB (instead of RS232). The g20 is in a data session if it has an active GPRS context created in any appropriate way (such as, +CGACT, ATD*99#, or +MIPCALL), or when in an MO or MT CSD data session.

2.1.5.2   Benefits

This feature enables you to receive information indicating that a data session was terminated while using the USB as a communication channel.

2.1.5.3   Technical Description

This feature is active by default. However, it can be eliminated by changing the FLEX. The USB session output indication line is active on PIN 32 of the 70-pins connector.

When this feature is active, the use of the Evaluation Board keypad is blocked.

Note

The USB session line indicates the following:

• In Circuit Switch Data mode, an active line (low) indicates that a valid carrier (data signal) was detected by g20 (CONNECT message is received). An inactive line (high) indicates idle.
• In GPRS mode, the line indicates the PDP context status. When PDP context is active, it sets the line active (low). PDP context inactive sets the line inactive (high).

2.2 GPRS OPERATION

2.2.1 Overview

The GPRS allows the service subscriber to send and receive data in an end-to-end packet-transfer mode, without utilizing network resources in circuit-switched mode.

2.2.2 Features and Benefits

GPRS enables the cost-effective and efficient use of network resources for packet mode data applications:

• Always connected.

• No setup time before data transmission.

• Cost change based on current data communication (not time based).

2.2.3 Technical Description (GPRS – Class B Operation)

The g20 is attached to both GPRS and other GSM services, but can only operate one set of services at a time (GPRS or CSD).

The g20 can activate a GPRS context and at the same time be alerted for an incoming CSD call.

This functionality is available on the g20 single serial line by either of two procedure options:

Option 1:

1. While in GPRS, listen to the RI signal (RS232) for an incoming CST call ring.

2. Upon being interrupted by the RI signal, drop the DTR line to switch to command mode (depending on the previous DTR configuration: AT&D).

3. Answer the call (suspending the GPRS session).

4. At the end of the call, pull the DTR to resume the GPRS session.

Option 2:

1. Use the MUX protocol for virtual channels support, with a unique channel for the GPRS session (Data) and a unique channel for answering the voice call (command)

2.3 CSD OPERATION

2.3.1 Overview

GSM CSD bearer service, the most widely used data service, provides both a transparent and non-transparent (error correction and flow control) data rate of 9.6 kbit/s.

Data transfer over Circuit Switched Data (CSD) is possible. Once the connection is established, data can be transferred to and from the remote side.

The user should take the CSD call setup time into account.

Network operators charge the user for the call time regardless of data usage.

2.3.2   Features and Benefits

CSD operation enables the terminal to perform a data transfer over a circuit switched link.

It enables the user to:

• Connect to a remote modem without any Internet network involvement.
• Own a real IP address and enable its access by connecting to an external ISP.

The following are examples of standard CSD call uses:

• Connecting an Internet Service Provider (ISP).
• Remotely accessing corporate Intranet via Remote Access Server (RAS).
• User specific protocol, where the user defines both the remote and local sides.

2.3.3   Technical Description

GSM network operators typically support the non-transparent CSD bearer service through a modem interworking function. This means that a g20 initiates a data call and the network routes the call to the modem interworking function, which is located at the Mobile Switching Centre (MSC) of the GSM network. The modem interworking function then dials the number supplied by the mobile station.

This is different from voice calls, where the GSM network itself routes the call, often to another mobile station on the same network. The GSM network does not route data calls - it dials the requested number on behalf of the mobile station and leaves the routing to the external wireline telephone network. The main reason for this is that the GSM network has information about what the user wants to do with the data call. For example, the user may be contacting his or her Internet Service Provider (ISP) to send email or dialing the corporate Intranet to set up a virtual private network (VPN) connection to retrieve confidential customer information from a company database.

2.4   MUX INTEGRATION

2.4.1   Overview

The g20 is supplied with an internal GSM 7.10 protocol stack, also referred to as a multiplexer or MUX.

The g20 with multiplexer support utility provides the following capabilities:

• Provides the terminal with up to five virtual channels on one physical RS-232 connection.
• Provides simultaneous data (CSD/GPRS) and command (AT command set) services. In this way, many applications can use a single RS232 line via virtual channels. This enables a user to make network and phone service inquiries and maintain data communication at the same time.

These capabilities are illustrated in the following figure:
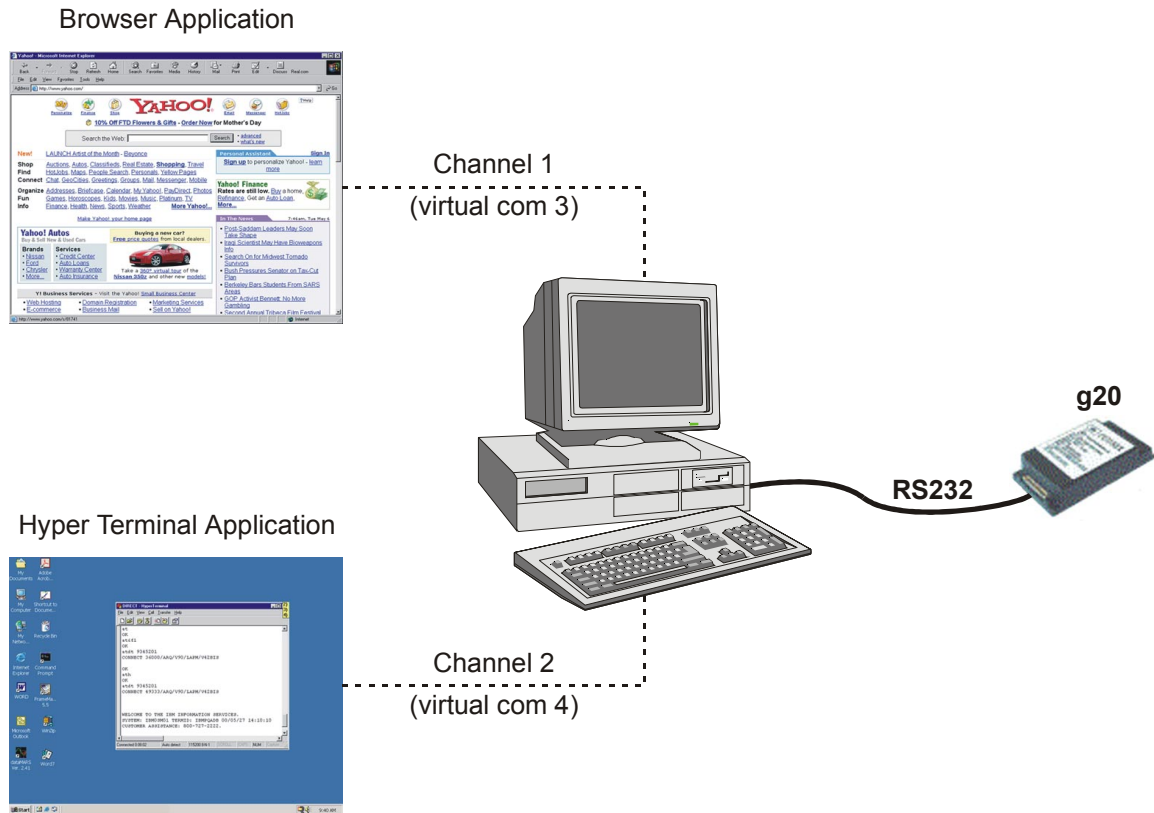
Figure 4. g20 with Multiplexer Support Capabilities

2.4.2   Features and Benefits

The g20 with the MUX feature ENABLES multiple channel operation and simultaneous data and control operation. For example, it allows a user to be connected to an Internet website (GPRS session connected), receive a file via CSD Call, and query the g20 phone book all at the same time.

The following actions are enabled during a data session:

- Incoming call alert string RING (while g20 is in GPRS session)
- Answering to incoming call via the ATA command (while g20 is in GPRS session)
- Receive Incoming SMS indication
- Inquiry GSM coverage indication
- Setup a voice call (while g20 is in GPRS session)
- Send & Receive SMS
- Read/write to/from Phone Book
- Local modem operation
- Network interrogation and settings

2.4.3   Technical Description

The MUX feature adds five virtual channels on a single physical RS232 line:

• Channel #0 - DLC0 for MUX Control

• Channels #1 through #4 are used for Data/Fax, GPRS, Voice call and control, and Logger/External modem applications

2.5   SHORT MESSAGE SERVICE (SMS)

2.5.1   Overview

The SMS feature provides means for SMS messages handling and the reporting of SMS reception events.

g20 SMS implementation is based on the GSM 07.05 specification.

2.5.2   Features and Benefits

The SMS, as defined within the GSM 900/1800/1900 digital mobile phone standard, has several unique features:

• A single short message can be up to 160 characters of ASCII text in length (7-bit coded). Message text can comprise words, numbers or an alphanumeric combination.

• Short messages can be written and displayed in various coding schemes, including ASCII and UCS2.

• Reception of an incoming message can invoke an indication to the terminal. This feature is configurable using the command AT+CNMI. Short messages received during data calls are not indicated.

• Short messages can be sent and received simultaneously with GSM voice, data and fax calls.

• Cell broadcast messages can also be selected and received on the g20. The g20 enables registration to specific broadcast channels.

2.5.3   Technical Description

The g20 memory for incoming short messages is SIM-dependent. A new incoming message is saved in the first free memory location, from index 1, according to the SIM card.

The g20 memory can contain up to 73 outgoing and CB messages. A new outgoing message is saved in the next free memory location, from index 101 up to index 352.

Table 2. SMS Type Characteristics

SMS Type	SMS Index	Max Number of SMS
Incoming messages	1	SIM-dependent
	2	
	...	
	30	
Future use	31	N/A
	...	
	100	

Table 2. SMS Type Characteristics *(Continued)*

SMS Type	SMS Index	Max Number of SMS
Outgoing and CB messages	101	73
	102	
	...	
	352	

2.6   FAX

2.6.1   Overview

A Service Class 1 facsimile g20 provides a basic level of services necessary to support Group 3 facsimile operation. This requires support from the facsimile terminal to implement the recommended T.30 procedures for document facsimile transmission and recommended T.4 for representing facsimile images.

2.6.2   Features and Benefits

Sending and receiving Fax services.

2.6.3   Technical Description

Service Class 1 includes the following services, as required or optional in Group 3 facsimile:

• Connection
• Waiting and silence detection
• Data transmission and reception
• HDLC data framing, transparency and error detection
• Message generation

2.7   CHARACTER SETS

The following includes the references to various tables that provide conversions between the different character sets.

• CS1 - GSM to UCS2.
• CS2 - ASCII to/from UTF8.
• CS3 - UCS2 to/from UTF8.

For the full content of a specific conversion table, refer to Appendix A, Character Set Tables.

2.7.1   ASCII Character Set Management

The ASCII character set is a standard seven-bit code that was proposed by ANSI in 1963, and finalized in 1968. ASCII was established to achieve compatibility between various types of data processing equipment.

2.7.2   GSM Character Set Management

In g20, the GSM character set is defined as octant stream. This means that text is displayed not as GSM characters but in the hex values of these characters.

2.7.3   UCS2 Character Set Management

UCS2 is the first officially standardized coded character set, eventually to include the characters of all the written languages in the world, as well as all mathematical and other symbols.

Unicode can be characterized as the (restricted) 2-octet form of UCS2 on (the most general) implementation level 3, with the addition of a more precise specification of the bi-directional behavior of characters, as used in the Arabic and Hebrew scripts.

The 65,536 positions in the 2-octet form of UCS2 are divided into 256 rows with 256 cells in each. The first octet of a character representation denotes the row number, the second the cell number. The first row (row 0) contains exactly the same characters as ISO/IEC 8859-1. The first 128 characters are thus the ASCII characters. The octet representing an ISO/IEC 8859-1 character is easily transformed to the representation in UCS2 by placing a 0 octet in front of it. UCS2 includes the same control characters as ISO/IEC 8859 (also in row 0).

2.7.4   UTF-8 Character Set Management

UTF-8 provides compact, efficient Unicode encoding. The encoding distributes a Unicode code value's bit pattern across one, two, three, or even four bytes. This encoding is a multi-byte encoding.

UTF-8 encodes ASCII in a single byte, meaning that languages using Latin-based scripts can be represented with only 1.1 bytes per character on average.

UTF-8 is useful for legacy systems that want Unicode support because developers do not have to drastically modify text processing code. Code that assumes single-byte code units typically does not fail completely when provided UTF-8 text instead of ASCII or even Latin-1.

Unlike some legacy encoding, UTF-8 is easy to parse. So-called lead and trail bytes are easily distinguished. Moving forwards or backwards in a text string is easier in UTF-8 than in many other multi-byte encoding.

The codes in the first half of the first row in Character Set Table CS2 (UTF-8 <-> ASCII) are replaced in this transformation format by their ASCII codes, which are octets in the range between 00h and 7F. The other UCS2 codes are transformed to between two and six octets in the range between 80h and FF. Text containing only characters in Character Set Table CS3 (UTF-8 <-> UCS-2) is transformed to the same octet sequence, irrespective of whether it was coded with UCS-2.

2.7.5   8859-1 Character Set Management

ISO-8859-1 is an 8 bit character set - a major improvement over the plain 7 bit US-ASCII.

Characters 0 to 127 are always identical with US-ASCII and the positions 128 to 159 hold some less used control characters. Positions 160 to 255 hold language-specific characters.

ISO-8859-1 covers most West European languages, such as French (fr), Spanish (es), Catalan (ca), Basque (eu), Portuguese (pt), Italian (it), Albanian (sq), Rhaeto-Romanic (rm), Dutch (nl), German (de), Danish (da), Swedish (sv), Norwegian (no), Finnish (fi), Faroese (fo), Icelandic (is), Irish (ga), Scottish (gd) and English (en). Afrikaans (af) and Swahili (sw) are also included, extending coverage to much of Africa.

2.8   AT COMMANDS SUMMARY

The following list contains a summary of all the g20 AT commands sorted by functionality.

Table 3. AT Commands

AT Command	Description	Page
Modem ID		
Subscriber Unit Identity		
+CGMI	This command displays manufacturer identification.	45
+GMI	This command displays manufacturer identification.	45
+FMI	This command displays manufacturer identification.	45
+CGMM	This command displays the model identification.	46
+GMM	This command displays the model identification.	46
+FMM	This command displays the model identification.	46
+CGMR	This command displays the revision identification.	47
+GMR	This command displays the revision identification.	47
+FMR	This command displays the revision identification.	47
+CGSN	This command displays the product serial number identification.	47
+GSN	This command requests the product serial number identification.	47
+CSCS	This command selects the g20 character set.	48
+CIMI	This command displays the International Mobile Subscriber Identity number.	50
I	This command displays various g20 information items.	51
+CNUM	This command displays up to five strings of text information that identify the g20.	51
$	This command displays a list of all the AT commands supported by the g20.	53
CLAC	This command displays a list of all the AT commands supported by the g20.	53
Capability Reporting		
+MAID	This command displays the AT Feature Review that is supported in the g20.	55
+MAPV	This command displays the version of the user protocol that is supported by the g20.	57

Table 3. AT Commands *(Continued)*

AT Command	Description	Page
Call Control		
Call Control Commands		
D	This command places a voice call on the current network, when issued from an accessory device.	60
D>	This command places a voice/fax/data call on the current network by dialing directly from the g20 phone book.	61
DL	This command places a voice call to the last number dialed.	63
H	This command hangs up, or terminates a particular call.	65
A	This command answers an incoming call, placing the g20 into the appropriate mode, as indicated by the RING message.	66
+CRC	This command controls whether to present the extended format of the incoming call indication.	67
RING	This unsolicited event is received when an incoming call (voice, data or fax) is indicated by the cellular network.	67
+CRING	This unsolicited event indicates the type of incoming call.	67
+CLIP	This command controls the Calling Line Identity (CLI) presentation to the terminal when there is an incoming call.	70
+CCWA	This command controls the Call Waiting supplementary service, including settings and querying of the network by the g20.	72
+CHLD	This command controls the Call Hold and Multiparty Conversation supplementary services.	77
+CCFC	This command controls the call-forwarding supplementary service.	81
+CLIR	This command enables/disables the sending of caller ID information to the called party, for an outgoing call.	83
+CBST	This command handles the selection of the bearer service and the connection element to be used when data calls are originated.	86
O	This command returns a phone to the Online Data mode and issues a CONNECT or CONNECT <text> result code.	88
&Q	This command handles the selection of the asynchronous mode	89
+CHUP	This command causes the TA to hang up the current GSM call of the g20.	89

Table 3. AT Commands *(Continued)*

AT Command	Description	Page
+CSNS	This command handles the selection of the bearer or teleservice to be used when a mobile terminated single numbering scheme call is established.	89
+MDC	This command enables you to select the desired messages to be displayed upon connection of a voice call with a remote party.	92
+CTFR1	This command terminates an incoming call and diverts the caller to the number previously defined in CCFC, or to a voice mail if one exists for the subscriber.	93
Call Status Messages		
+CPAS	This command displays the current activity status of the g20, for example, call in progress, or ringing.	96
+CLCC	This command displays a list of all current g20 calls and their statuses, and also enables/disables the unsolicited indication of the call list.	97
Call Advice of Charge Messages		
+CAOC	This command displays information about the cost of calls.	101
+CACM	This command resets the Advice of Charge accumulated call meter value in the SIM file, EFACM.	104
+CAMM	This command sets the Advice of Charge accumulated call meter maximum value in the SIM file, EFACMmax.	105
+CPUC	This command sets the parameters of the Advice of Charge-related price per unit and currency table found in the SIM file, EFPUCT.	108
+CR	This command controls whether or not the extended format of an outgoing call is displayed or not.	110
Supplementary Services		
+CSSN	This command handles the enabling and disabling of supplementary service-related, network-initiated, notifications.	111
+CUSD	This command allows control of Unstructured Supplementary Service Data (USSD), according to GSM 02.90.	114
+COLP	This command refers to the GSM supplementary service COLP, Connected Line Identification Presentation, which enables a calling subscriber to get the connected line identity (COL) of the called party after setting up a mobile-originated call.	119

Table 3. AT Commands *(Continued)*

AT Command	Description	Page
Phone and Date Books		
Directory Access Commands		
+CPBS	This command handles the selection of the memory to be used for reading and writing entries in g20s that contain more than one phone book memory.	121
+CPBR	This command recalls phone book entries from a specific entry number, or from a range of entries.	123
+MPBR	This command recalls phone book entries from a specific entry number, or from a range of entries.	125
+MCSN	This command sets EFmsisdn in the SIM.	145
+MDSI	This command enables unsolicited reporting of indications of SIM deactivation and invalidation.	142
+MFS	This command is used to determine how long the g20 waits before attempting to re-register after a registration attempt has failed and the g20 is not registered.	139
+CPBF	This command searches the currently active phone book for a particular entry, by name.	128
+MPBF	This command searches the currently active phone book for a particular entry, by name, and returns fields that are unique to Motorola phones.	129
+CPBW	This command stores a new entry in the phone book, or deletes an existing entry from the phone book.	132
+MPBW	This command stores a new entry in the phone book, or deletes an existing entry from the phone book.	134
+CSVM	This command handles the selection of the number to the voice mail server.	137
+MPDPM	This command returns the collective percentage of memory used by the phonebook and datebook in their shared dynamic memory storage.	150
Date Book Access Commands		
+MDBL	This command locks/unlocks the date book database.	151
+MDBR	This command reads entries stored in the date book.	153
+MDBAD	This command sets/reads the auto-delete user preference setting in the date book database.	154
System Date and Time Access Commands		
+CCLK	This command reads/sets the g20's current date and time settings.	156

Table 3. AT Commands *(Continued)*

AT Command	Description	Page
SMS		
SMS Commands		
+CSMS	This command handles the selection of the SMS message service type.	158
+CPMS	This command handles the selection of the preferred storage area for messages.	160
+CMGF	This command handles the selection of message formats.	161
+CSCA	This command handles the selection of the SCA and the TOSCA.	162
+CNMI	This command sends an unsolicited indication when a new SMS message is received by the g20.	164
+CNMA	This command acknowledges the receipt of a +CMT response.	166
+CMTI	This unsolicited message, including the SMS message index, is sent upon the arrival of an SMS message.	167
+CMGL	This command displays a list of SMS messages stored in the g20 memory.	169
+MMGL	This command displays a list of SMS messages stored in the g20 memory.	169
+CMGR	This command reads selected SMS messages from the g20 memory.	171
+MMGR	This command reads selected SMS messages from the g20 memory.	171
+MMAR	This command changes the status of an SMS message in the g20 memory from "REC UNREAD" to "REC READ".	172
+CMSS	This command selects and sends pre-stored messages from the message storage.	173
+CMGW	This command writes and saves messages in the g20 memory.	174
+CMGD	This command deletes messages from the g20 memory.	176
+CGSMS	This command handles the selection of the service or service preference used by the g20 to send mobile-originated SMS messages.	177
+CMGS	This command sends an SM from the g20 to the network.	178
+CSCB	This command handles the selection of cell broadcast message types and data coding schemes received by the g20.	179
+CMT	This unsolicited message forwards the SMS upon its arrival.	166
+CBM	This unsolicited message forwards the SMS upon its arrival.	166

Table 3. AT Commands *(Continued)*

AT Command	Description	Page
+MCSAT	This command enables/disables/exercises SMS alert tone for an arriving SMS.	181
+MEGA	This command updates the Email Gateway Address.	183
Network		
Network Commands		
+CSQ	This command displays the signal strength received by the g20.	184
+CRLP	This command displays the Radio Link Protocol parameters.	185
+CREG	This command enables/disables the network status registration unsolicited result code.	187
+CGREG	This command enables/disables the GPRS network status registration unsolicited result code.	189
+COPS	This command enables accessing the network registration information, as well as select and register the GSM network operator.	191
+CPOL	This command is used to edit the list of preferred operators located in the SIM card.	194
Hardware Information		
Hardware Information Commands		
+CBC	This command queries the battery charger connection.	196
+CBAUD	This command sets the baud rate.	197
+IPR	This command is responsible for setting and saving the request baud rate.	199
+GCAP	This command displays the overall capabilities of the g20.	200
+CBAND	This command is supported for backward compatibility only, and has no effect.	266
+MTDTR	This command checks and displays the physical current status of the DTR pin of the RS232.	201
+MTCTS	This command sets the CTS pin of the RS232 to not active (high), waits one second and then sets the CTS to active (low).	202
&K	This command configures the RTS/CTS flow control.	202
&C	This command determines how the state of the DCD line relates to the detection of the received line signal from the distant end.	203

Table 3. AT Commands *(Continued)*

AT Command	Description	Page
&D	This command determines how the g20 responds when the DTR (Data Terminal Ready) status is changed from ON to OFF during the online data state.	205
+MCWAKE	This command displays reports on the status of the GPRS coverage.	206
+CFUN	This command shuts down the phone functionality of smart phones and PDAs with phone capabilities.	208
+ICF	This command determines the local serial port start/stop (asynchronous) character framing used by the DCE when accepting DTE commands and transmitting information text and result codes.	210
+MPCMC	This command defines whether the PCM clock runs continuously or not.	211
ATS97	This command indicates whether the antenna is connected and whether the hardware supports this feature.	213
+MRST	This command enables customer software to perform a hard reset to the g20 unit.	215
Audio		
Basic Audio Setup Commands		
+CRTT	This command plays one cycle of a ring tone, stops the cycle in the middle, and sets the ring tone to be used.	219
S94	This S-parameter represents the Boolean status, On/Off, of the sidetone feature.	159
S96	This S-parameter represents the Boolean status, On/Off, of the echo cancelling feature in the handsfree.	160
+CRSL	This command handles the selection of the incoming call ringer and alert tone (SMS) sound level on the alert speaker of the g20.	223
+CVIB	This command handles the enabling and disabling of the vibrator alert feature of the g20 during a mobile-terminated incoming call.	225
+VTD	This command handles the selection of tone duration.	227
+VTS	This command transmits a string of DTMF tones when a voice call is active.	228
+CMUT	This command mutes/unmutes the currently active microphone path by overriding the current mute state.	230
Advanced Audio Setup Commands		
+MAPATH	This command sets/requests the active input accessory, and the output accessory for each feature.	231
+MADIGITAL	This command switches between analog and digital audio modes.	234

Table 3. AT Commands *(Continued)*

AT Command	Description	Page
+MAVOL	This command determines a volume setting for a particular feature in a particular accessory.	235
+MAFEAT	This command controls the various algorithm features, such as sidetone, echo cancel and noise suppress.	238
+MAMUT	This command controls the muting/unmuting of all input paths (MIC, HDST_MIC, DIGITAL_RX).	239
+CALM	This command handles the selection of the g20's alert sound mode.	241
+CLVL	This command sets the volume of the internal loudspeaker (which also affects the key feedback tone) of the g20.	243
+MMICG	This command handles the selection of microphone gain values.	244
Access		
Access Control Commands		
A/	This command repeats the last command entered on the terminal.	246
AT	This command checks the AT communication and only returns OK.	246
+CPIN	This command is only relevant for phones that use SIM cards. It unlocks the SIM card when the proper SIM PIN is provided, and unblocks the SIM card when the proper SIM PUK is provided.	247
+CPWD	This command sets a new password for the facility lock.	250
+CLCK	This command locks, unlocks or interrogates a g20 or a network facility <fac>.	253
Modem Configuration and Profile		
Modem Register Commands		
V	This command determines the response format of the data adapter and the contents of the header and trailer transmitted with the result codes and information responses.	257
Q	This command determines whether to output/suppress the result codes.	259
E	This command defines whether the g20 echoes the characters received from the user, (whether input characters are echoed to output).	260
X	This command defines the data adaptor response set, and the CONNECT result code format.	260
Sn	This command reads/writes values of the S-registers, and includes registers 1-49, 94, 96 (Audio) and 102 (Sleep mode).	262

Table 3. AT Commands *(Continued)*

AT Command	Description	Page
\S	This command displays the status of selected commands and S-registers.	265
\G	This command sets the use of the software flow control.	265
\J	This command adjusts the terminal auto rate.	265
\N	This command displays the type of link.	266
?	This command displays the most recently updated value stored in the S-register.	266
&F	This command restores the factory default configuration profile.	266
Z	This command resets the default configuration.	267
Sleep Mode Commands		
S24	This S-parameter activates/disables the Sleep mode. If the parameter value is greater than 0, it represent the number of seconds till the g20 enters sleep mode.	271
S102	This S-register sets the value of the delay before sending the data to the terminal.	272
+MSCTS	This command defines the behavior of the CTS line when the g20 is in Sleep mode.	273
Error Handling Commands		
+CMEE	This command enables/disables the use of result code +CME ERROR: <err> as an indication of an error relating to the functionality of the g20.	274
+CEER	This command returns an extended error report containing one or more lines of information text, determined by the manufacturer, providing the reasons for the call-clearing errors.	279
User Interface		
+MH Handset Status Control Commands		
+MHIG	This command enables an intelligent car kit to indicate the ignition state of the vehicle to the g20, which enables the g20 to turn on and off with the ignition, or to enter a power saving state when the ignition is turned off.	283
+CRSM	This command enables you to read UNSU, GID1, GID2 and ICC ID data from the SIM card	295
&V	This command displays the current active configuration and stored user profiles.	291
&W	This command stores the user profile.	293
&Y	This command displays the default user profile.	294

Table 3. AT Commands *(Continued)*

AT Command	Description	Page
+CKPD	This command emulates key presses, or virtual keycodes, as if entered from the g20 keypad or from a remote handset.	283
+MKPD	This command enables accessories to control the press and release of key presses.	286
+CMER	This command enables an external accessory to receive key press information from the g20's internal keypad.	287
Unsolicited UI Status Messages		
+CKEV	This command causes the g20 to send an unsolicited message when a key is pressed on the g20 keypad, and local key press echo is enabled.	288
+MUPB	This command causes the g20 to send an event when a phone book entry is accessed or modified by the user.	291
+CDEV	An unsolicited indication regarding display changes that is sent to the DTE when the <disp> parameter of the +CMER command is set to 1.	289
+CIEV	An unsolicited indication regarding various phone indications that is sent to the DTE when the <ind> parameter of the +CMER command is set to 1.	290
GPRS		
GPRS Commands		
+CGCLASS	This command sets the GPRS mobile station class.	297
+CGDCONT	This command specifies the PDP (Packet Data Protocol) context.	299
+CGQMIN	This command sets the minimum acceptable quality of service profile.	302
+CGQREQ	This command displays the requested quality of service profile.	304
+CGACT	This command activates/deactivates the PDP Context.	306
+CGATT	This command attaches the g20 to the GPRS network.	306
D*99	This command enables the MT to perform the actions necessary for establishing communication between the terminal and the external PDN.	307
+CGPRS	This command indicates whether there is GPRS coverage.	309
NOP Compatible		
Ignored (Compatible Only) Commands		
%C	This command is supported for backward compatibility only, and has no effect.	312

Table 3. AT Commands *(Continued)*

AT Command	Description	Page
&G	This command is supported for backward compatibility only, and has no effect.	312
&J	This command is supported for backward compatibility only, and has no effect.	312
&L	This command is supported for backward compatibility only, and has no effect.	312
&M	This command is supported for backward compatibility only, and has no effect.	312
&P	This command is supported for backward compatibility only, and has no effect.	312
&Q	This command is supported for backward compatibility only, and has no effect.	312
&R	This command is supported for backward compatibility only, and has no effect.	312
&S	This command is supported for backward compatibility only, and has no effect.	312
&T	This command is supported for backward compatibility only, and has no effect.	312
\B	This command is supported for backward compatibility only, and has no effect.	312
B	This command is supported for backward compatibility only, and has no effect.	312
\A	This command is supported for backward compatibility only, and has no effect.	312
\K	This command is supported for backward compatibility only, and has no effect.	312
F	This command is supported for backward compatibility only, and has no effect.	312
L	This command is supported for backward compatibility only, and has no effect.	312
M	This command is supported for backward compatibility only, and has no effect.	312
N	This command is supported for backward compatibility only, and has no effect.	312
P	This command is supported for backward compatibility only, and has no effect.	312
T	This command is supported for backward compatibility only, and has no effect.	312
Y	This command is supported for backward compatibility only, and has no effect.	312
+FAR	This command is supported for backward compatibility only, and has no effect.	314
+FCL	This command is supported for backward compatibility only, and has no effect.	314
+FDD	This command is supported for backward compatibility only, and has no effect.	314
+FIT	This command is supported for backward compatibility only, and has no effect.	314

Table 3. AT Commands *(Continued)*

AT Command	Description	Page
Fax Class 1		
Fax Commands		
+FCLASS	This command places the terminal in particular mode of operation (data, fax, voice).	315
+FTS	This command causes the g20 to stop any transmission.	316
+FRS	This command causes the g20 to listen and to report back an OK result code when the line has been silent for the specified amount of time.	317
+FTM	This command causes the g20 to transmit data.	318
+FRM	This command causes the g20 to enter the receive mode.	320
+FTH	This command causes the g20 to transmit data framed in the HDLC protocol.	321
+FRH	This command causes the g20 to receive HDLC framed data and deliver the next received frame to the terminal.	322
+IFC	This command controls the operation of the local flow control between the terminal and the g20.	323
Features		
STK Commands		
+MTKR	This command displays the profile that is downloaded from the g20 to the SIM during the SIM initialization process	326
+MTKE	This command enables/disables the SIM ToolKit functionalities.	337
+MTKP	This is both a command and an unsolicited event. The command responds to an unsolicited event.	338
+MTKM	This is both a command and an unsolicited event. The command selects items from the menu.	353
+MTKC	This unsolicited event notifies the terminal when supplementary services, SMS Control or Call Control are modified.	356
TCP/IP Commands		
+MIPCALL	This command creates a wireless PPP connection with the GGSN, and returns a valid dynamic IP for the g20.	356
+MIPOPEN	This command causes the g20 module to initialize a new socket and open a connection with a remote side.	358

Table 3. AT Commands *(Continued)*

AT Command	Description	Page
+MIPCLOSE	This command causes the g20 module to free the socket accumulating buffer and disconnect the g20 from a remote side.	360
+MIPSETS	This command causes the g20 to set a watermark in the accumulating buffer. When the watermark is reached, data is pushed from the accumulating buffer into the protocol stack.	361
+MIPSEND	This command causes the g20 to transmit the data that the terminal provides, using an existing protocol stack.	363
+MIPPUSH	This command causes the g20 module to push the data accumulated in its accumulating buffers into the protocol stack.	364
+MIPFLUSH	This command causes the g20 module to flush (delete) data accumulated in its accumulating buffers.	366
+MIPRUDP	This unsolicited event is sent to the terminal when data is received from the UDP protocol stack.	367
+MIPRTCP	This unsolicited event is sent to the terminal when data is received from the TCP protocol stack.	367
+MIPSTAT	This unsolicited event is sent to the terminal indicating a change in link status.	368
+MIPXOFF	This unsolicited event is sent to the terminal to stop sending data.	368
+MIPXON	This unsolicited event is sent to the terminal when the g20 has free memory in the accumulating buffer.	369

3.1   AT COMMANDS OVERVIEW

AT commands are sets of commands used for communication with the g20 cellular modem.

AT commands are comprised of assemblies of ASCII characters which start with the "AT" prefix (except the commands A/ and +++). The AT prefix is derived from the word Attention, which asks the modem to pay attention to the current request (command).

AT commands are used to request services from the g20 cellular modem, such as:

- Call services: dial, answer and hang up
- Cellular utilities: send/receive SMS
- Modem profiles: Auto Answer
- Cellular Network queries: GSM signal quality

3.1.1   General Symbols Used in AT Commands Description

The following syntax definitions apply in this chapter:

Table 4. Syntax Definitions

Syntax	Definition
<CR>	Carriage return character, specified by the value of the S3-register.
<LF>	Line-feed character, specified by the value of the S4-register.
<...>	Name enclosed in angle brackets is a syntax element. The brackets themselves do not appear in the command line.
[...]	Optional sub-parameter of a command or an optional part of terminal information response, enclosed in square brackets. The brackets themselves do not appear in the command line. When the sub-parameter is not provided in the parameter type commands, the new value equals its previous value. In action type commands, the action should be performed on the basis of the recommended default setting of the sub-parameter.
//	Denotes a comment, and should not be included in the command.

3.1.2   General System Abbreviations

The basic system configuration contains a modem and a terminal.

The g20 is the modem and may be referred to as the DCE, the phone, the mobile or the radio.

The terminal may be referred to as the DTE or the TE.

3.2   AT COMMANDS PROTOCOL

The figure below shows a general messaging sequence of AT commands protocol between the terminal and the g20.
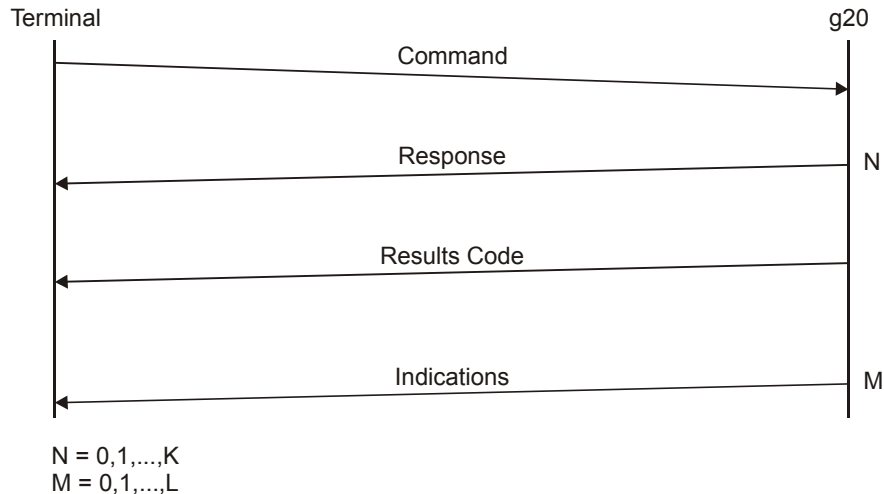
Figure 5. AT Commands Protocol

The AT commands interface is basically a Modem Services Upon Request.

Communication (almost) always begins from the terminal side. This means that any service should be requested from the terminal. Thus a request is called a "command".

Each command must be answered by a "results code" from the g20. The results code reports the command status to the terminal.

Some commands may include several "Response" requests (between 0 to K) to send data back to the terminal.

Some commands may initiate a mode in which, when specified events are generated in the g20, "Indicator" messages are sent asynchronously. Indicators can be between 0 to L.

The g20 can echo characters received from the terminal (commands) back to the terminal.

3.3   AT COMMANDS STRUCTURE

3.3.1   Command Structure

An AT command line may contain one or more commands. Delimiters are used to separate the commands from each other, according to the following structure:

Prefix	Command1	Delimiter	Command2	Delimiter	…	CommandN	Suffix

Each AT command has the "AT" prefix string.

Each AT command has the suffix <CR>.

The delimiter is either a semicolon ";" or none, meaning space (basic commands).

Each AT command has the following structure:

Token	Mode	Arguments

The following figure outlines the basic structure of an AT command line:

Command line prefix

Extended commands are delimited with semicolon

Command line termination character

Subparameter

Read command for checking current subparameter values

ATCMD1 CMD2=12; +CMD1; +CMD2=,,15; +CMD2?; +CMD2=?<CR>

Basic command (no + prefix)

Subparameters may be omitted

Extended command (prefixed with +)

Test command for checking possible subparameter values
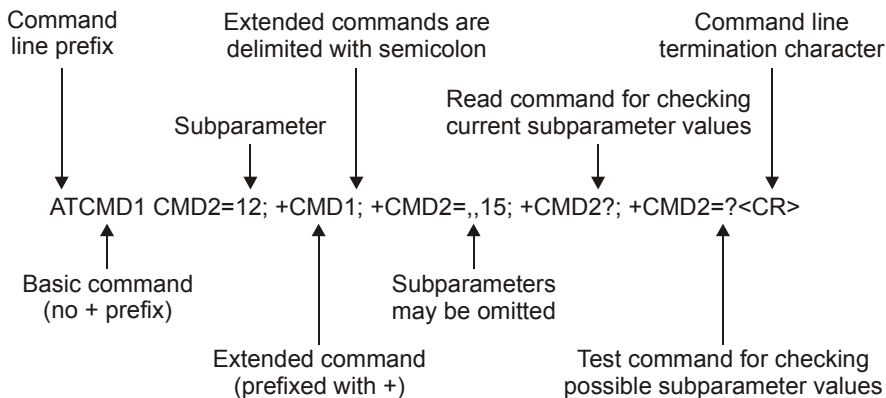
Figure 6. Basic Structure of a Command Line

The following rules must be observed when issuing a command line to the modem:

• Every command line must begin with the letters AT.

• Several commands can be concatenated as one line, as long as the total line does not exceed 140 characters with semicolon characters.

• Characters:

Spaces are ignored. You can leave spaces between each command and between characters of a command. You can also include punctuation in telephone numbers, and type commands in either UPPERCASE or lowercase. For example, the following commands are identical:

ATDT8005551234 < Enter > or

atdt (800) 555-1234 < Enter >

Backspace **<S5>** character is allowed.

- To cancel a dialing command in progress, send any ASCII character to the modem.
- To execute the command line, send the <CR> ASCII character.

3.3.2   Results Code Structure

When a command is issued, the g20 responds with a message, called a "Result Code", which tells the terminal the result of the command that was requested. Result codes can indicate, for example, the execution status of the command or the remote modem connection status.

Result codes can be represented either as numerical codes or as verbose responses. By default, the g20 responds with verbose response codes.

The result code has the following structure:.

Prefix	Code	Suffix

where:

The results code prefix is **<CR><LF>**.

The results code suffix is **<CR><LF>**.

3.3.3   Response and Indications Structure

The following is the information response and indications structure:

Token	Separator	Arguments

where:

The separator is ":".

The following is an example of Response and Results code:

Information Response to + CMD2=?   Also string type subparameters possible

    Information Response to + CMD2?

                <CR><LF>+CMD2: 3,0,15,"GSM"<CR><LF>
                <CR><LF>+CMD2: (0-3),(0,1),(0-12,15),("GSM","IRA")<CR><LF>
                <CR><LF>OK<CR><LF>

      Final result code   Shows acceptable ranges of each subparameter
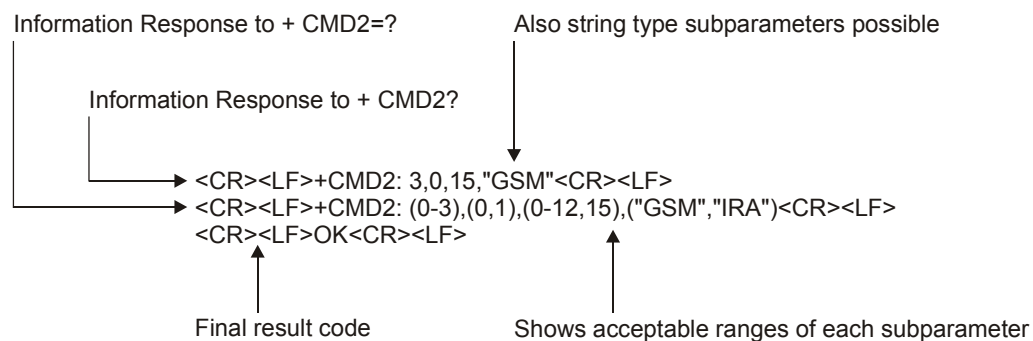
Figure 7. Response to a Command Line

If verbose responses are enabled (using the command V1) and all the commands in a command line have been performed successfully, the result code <CR><LF>OK<CR><LF> is sent from the g20 to the terminal. If numeric responses are enabled (using the command V0), the result code 0<CR> is sent instead.

If verbose responses are enabled (using the command V1) and sub-parameter values of a command are not accepted by the g20 (or if the command itself is invalid or cannot be performed for any reason), the result code <CR><LF>ERROR<CR><LF> is sent to the terminal and no subsequent commands in the command line are processed. If the numeric responses are enabled (using the command V0), the result code 4<CR> is sent instead. The ERROR (or 4) response may be replaced by +CME ERROR: <err> when the command was not processed due to an error related to g20 operation.

3.4   AT COMMANDS PROTOCOL & STRUCTURE CONFIGURATION

The AT commands message flow and structure may be configured by the terminal.

The g20 can be configured not to follow a command with an echo and/or results code. It can be configured to transmit the results code in either of two ways: Verbose or Numeric. This (and other) configurations can be set using the following commands:

S3=[<value>]   Command line termination character (default setting 0x13).

S4=[<value>]   Response formatting character (default 0x10).

S5=[<value>]   Command line editing character (default 0x 8).

E[<value>]   Command echo (default 0, meaning the g20 does not echo commands).

Q[<value>]   Result code suppression (default 0, meaning the g20 transmits result codes).

V[<value>]   g20 response format (default 1, meaning verbose format).

X[<value>]   Defines CONNECT result code format.

The figure below shows the flow and structure configuration commands:
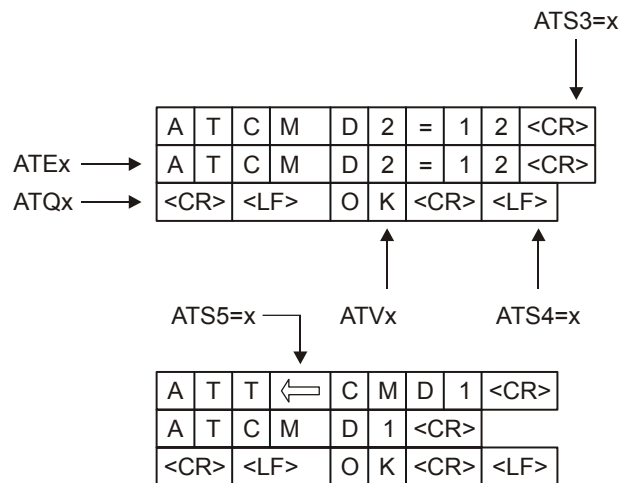
Figure 8. Flow and Structure Configuration Commands

3.5 COMMAND TOKEN TYPES

3.5.1 Basic Syntax Command Format

The format of Basic Syntax commands (except for the D and S commands) is: **<command>[<number>]**

where:

<command> is either a single character, or the "&" character (IA5 2/6) followed by a single character. Characters used in **<command>** are taken from the set of alphabetic characters.

<number> may be a string of one or more characters from "0" through "9" representing a decimal integer value.

3.5.2 S-parameters

Commands that begin with the letter S constitute a special group of parameters known as "S-parameters". These differ from other commands in important respects:

• The number following the S indicates the "parameter number" being referenced. If the number is not recognized as a valid parameter number, an ERROR result code is issued.

• Immediately following this number, either a "?" or "=" character (IA5 3/15 or 3/13, respectively) appears:

"?" is used to read the current value of the indicated S-parameter.

"=" is used to set the S-parameter to a new value. "<parameter_number>"
"<parameter_number" =[<value>]

If the "=" is used, the new value to be stored in the S-parameter is specified in decimal form following the "=".

3.5.3 Extended Syntax Command Format

Both actions and parameters have names, which are used in the related commands. Names always begin with the character "+" (IA5 2/11). Following the "+", from one to sixteen (16) additional characters appear in the command name.

All (GSM) cellular commands have the prefix "+C".

All Fax commands have the prefix "+F".

All General modem commands have the prefix "+G".

Most Motorola propriety commands have the prefix "+M".

3.6 COMMAND ARGUMENT TYPES

<value> consists of either a numeric constant or a string constant.

<compound_value> consist of several <value> parameters separated by commas.

Example of compound_value: **<value1>,<value2>,…,<valueN>**

3.6.1 Numeric Constants

Numeric constants are expressed in decimal, hexadecimal, or binary form. In the g20, the definition of each command specifies which form is used for values associated with that command.

3.6.2   String Constants

String constants consist of a sequence of characters, bounded at the beginning and end by the double-quote character (").

3.7   COMMAND MODE TYPES

3.7.1   Parameter Set Command Syntax

The terminal may store a value or values in a parameter by using the SET command.

The parameter definition indicates, for each value, whether the specification of that value is mandatory or optional. For optional values, the definition indicates the assumed (default) value if none is specified. The assumed value may be either a previous value (that is, the value of an omitted sub-parameter retains its previous value), or a fixed value (for example, the value of an omitted sub-parameter is assumed to be zero). Generally, the default value for numeric parameters is 0, and the default value for string parameters is "" (empty string).

The following syntax are used for:

- Actions that have no sub-parameters: **+\<name>**
- Parameters that accept a single value: **+\<name>=\<value>**
- Parameters that accept more than one value: **+\<name>=\<compound_value>**

3.7.2   Parameter Read Command Syntax

The terminal can determine the current value or values stored in a parameter by using the following syntax: **+\<name>?**

3.7.3   Parameter Test Command Syntax

The terminal can test whether a parameter is implemented in the g20, and determine the supported values, by using the following syntax: **+\<name>=?**

3.8 VALUES

3.8.1 Range of Values

When the action accepts a single numeric sub-parameter, or the parameter accepts only one numeric value, the set of supported values may be presented in the information text as an ordered list of values.

The following are some examples of value range indications:

(0)	Only the value 0 is supported.
(1,2,3)	The values 1, 2, and 3 are supported.
(1-3)	The values 1 through 3 are supported.
(0,4,5,6,9,11,12)	The several listed values are supported.
(0,4-6,9,11-12)	An alternative expression of the above list.

3.8.2 Compound Range of Values

When the action accepts more than one sub-parameter, or the parameter accepts more than one value, the set of supported values may be presented as a list of the parenthetically enclosed value range strings (described above), separated by commas.

For example, the information text in response to testing an action that accepts three sub-parameters, and supports various ranges for each of them, could appear as follows: **(0),(1-3),(0,4-6,9,11-12)**

3.9 ABORTING COMMANDS

Some action commands that require time to execute may be aborted while in progress. This is explicitly noted in the description of the command. Aborting a command is accomplished by transmitting any character from the terminal to the g20. A single character is sufficient to abort the command in progress. To ensure that the aborting character is recognized by the g20, it should be sent at the same rate as the preceding command line. The g20 may ignore characters sent at other rates. When an aborting event is recognized by the g20, it terminates the command in progress and returns an appropriate result code to the terminal, as specified for the particular command.

When a command is aborted, this does not mean that its operation is reversed. In the case of some network commands, when the abort signal is detected by the g20, although the command is aborted following g20-network negotiation, the operation might be fully completed, partially completed or not executed at all.

3.10   CORE AT COMMANDS

The g20 responds to a limited commands set when the SIM card is not functioning, or not present. These commands are referred to as the "Core AT commands".

In previous products, the Core AT commands were called "Basic AT commands". The name "Core" differentiates between the basic AT commands format and the limited service AT commands.

The following table lists the Core AT commands.

Table 5. Core AT Commands

AT Command	Description	Page
$	This command displays a list of all the AT commands supported by the g20.	53
%C	This command is supported for backward compatibility only, and has no effect.	312
&C	This command determines how the state of the DCD line relates to the detection of the received line signal from the distant end.	203
&D	This command determines how the g20 responds when the DTR (Data Terminal Ready) status is changed from ON to OFF during the online data state.	205
&F	This command restores the factory default configuration profile.	266
&G	This command is supported for backward compatibility only, and has no effect.	312
&K	This command configures the RTS/CTS flow control.	202
&L	This command is supported for backward compatibility only, and has no effect.	312
&M	This command is supported for backward compatibility only, and has no effect.	312
&P	This command is supported for backward compatibility only, and has no effect.	312
&Q	This command selects the asynchronous mode	89
&R	This command is supported for backward compatibility only, and has no effect.	312
&S	This command is supported for backward compatibility only, and has no effect.	312
&T	This command is supported for backward compatibility only, and has no effect.	312
?	This command displays the most recently updated value stored in the S-register.	266
\A	This command is supported for backward compatibility only, and has no effect.	312
\B	This command is supported for backward compatibility only, and has no effect.	312
\G	This command sets the use of the software flow control.	265
\J	This command adjusts the terminal auto rate.	265

Table 5. Core AT Commands *(Continued)*

AT Command	Description	Page
\K	This command is supported for backward compatibility only, and has no effect.	312
\N	This command displays the link type.	266
\S	This command displays the status of selected commands and S-registers.	265
+CEER	This command returns an extended error report containing one or more lines of information text, determined by the manufacturer, providing the reasons for the call-clearing errors.	279
+CGMM	This command requests the model identification.	46
+CGMR	This command requests the revision identification.	47
+CGSN	This command requests the product serial number identification.	47
+CKPD	This command enables the emulated pressing of keys, or virtual keycodes, as if entered from the g20 keypad or from a remote handset.	283
+CLAC	This command displays a list of all the AT commands supported by the g20.	53
+CLVL	This command sets the volume of the internal loudspeaker of the g20.	243
+CMEE	This command enables/disables the use of result code +CME ERROR: <err> as an indication of an error relating to the functionality of the g20.	274
+CMER	This command enables an external accessory to receive key press information from the g20's internal keypad.	287
+CPIN	This command is only relevant for phones that use SIM cards. It unlocks the SIM card when the proper SIM PIN is provided, and unblocks the SIM card when the proper SIM PUK is provided.	247
+CRC	This command controls whether to present the extended format of the incoming call indication.	67
+CSQ	This command returns the signal strength received by the g20.	184
+GCAP	This command requests the overall capabilities of the g20.	200
+GMI	This command requests manufacturer identification. The command is not supported when the SIM is missing.	45
+GMM	This command requests the model identification.	46
+GMR	This command requests the revision identification.	47
+GSN	This command requests the product serial number identification.	47

Table 5. Core AT Commands *(Continued)*

AT Command	Description	Page
A	This command answers an incoming call, placing the g20 into the appropriate mode, as indicated by the RING message.	66
B	This command is supported for backward compatibility only, and has no effect.	312
D	This command places a voice call on the current network, when issued from an accessory device.	60
E	This command defines whether the g20 echoes the characters received from the user, (whether input characters are echoed to output).	260
F	This command is supported for backward compatibility only, and has no effect.	312
H	This command hangs up, or terminates a particular call.	65
I	This command requests various g20 information items.	51
L	This command is supported for backward compatibility only, and has no effect.	312
M	This command is supported for backward compatibility only, and has no effect.	312
N	This command is supported for backward compatibility only, and has no effect.	312
O	This command returns a phone to the Online Data mode and issues a CONNECT or CONNECT <text> result code.	88
P	This command is supported for backward compatibility only, and has no effect.	312
Q	This command determines whether to output/suppress the result codes.	259
Sn	This command reads/writes values of the S-registers, and includes registers 1-49, 94, 96 (Audio) and 102 (Sleep mode).	262
T	This command is supported for backward compatibility only, and has no effect.	312
V	This command determines the response format of the data adapter and the contents of the header and trailer transmitted with the result codes and information responses.	257
X	This command defines the data adaptor response set, and the CONNECT result code format.	260
Y	This command is supported for backward compatibility only, and has no effect.	312
Z	This command resets the default configuration.	267

4.1 g18 BACKWARD COMPATIBILITY

In the g20 development, special care and thought were given to ensure g18 backward compatibility. Refer to Table 3 on page 19. For further details, please contact customer support.

4.2 MODEM ID

4.2.1 Subscriber Unit Identity

These commands allow the user to query the type of device that is attached, the technology used in the device, as well as basic operating information about the device.

4.2.1.1 +CGMI, +GMI, +FMI, Request Manufacturer ID

These commands display manufacturer identification. The g20 outputs a string containing manufacturer identification information, indicating that this is a Motorola device.

Command	Response/Action
AT+CGMI AT+CGMI?	+CGMI: "Motorola"
AT+GMI AT+GMI?	+CGMI: "Motorola"
AT+FMI AT+FMI?	+CGMI: "Motorola"

Example

AT+CGMI

+CGMI: "Motorola"

OK

AT+GMI

+CGMI: "Motorola"

OK

AT+FMI

+CGMI: "Motorola"

4.2.1.2   +CGMM, +GMM, +FMM, Request Model ID

These commands request the model identification. The g20 outputs a string containing information about the specific model, including a list of the supported technology used, and the particular model number.

Command	Response/Action
AT+CGMM AT+CGMM?	+CGMM: <list of supported technologies>,<model>
AT+GMM AT+GMM?	+GMM: <list of supported technologies>,<model>
AT+FMM AT+FMM?	+FMM: <list of supported technologies>,<model>

Example

AT+CGMM

+CGMM: "GSM900","GSM1800","MODEL=g20"   //In the European model

AT+GMM

+GMM: "GSM1900","GSM850","MODEL=g20"   //In the North American model

AT+FMM

+FMM: "GSM900","GSM1800","MODEL=g20"   //In the European model

The following table shows the+CGMM string parameters.

Table 6. +CGMM String Parameters

String	Description
"GSM900"	GSM at 900 MHz
"GSM1800"	GSM at 1800 MHz
"GSM1900"	GSM at 1900 MHz (North American PCS)
"GSM850"	GSM at 850 MHz

4.2.1.3   +CGMR, +GMR, +FMR, Request Revision

These commands request the revision identification. The g20 outputs a string containing the revision identification information of the software version contained within the device. Typically, the version is a quoted string with less than 255 characters.

Command	Response/Action
AT+CGMR AT+CGMR?	+CGMR: <revision>
AT+GMR AT+GMR?	+GMR: <revision>
AT+FMR AT+FMR?	+FMR: <revision>

Example

AT+CGMR

+CGMR: "G208_G_0C.01.11I"

AT+GMR

+GMR: "G208_G_0C.01.11I"

AT+FMR

+FMR: "G208_G_0C.01.11I"

4.2.1.4   +CGSN, +GSN, Request Product Serial Number Identification

This command displays the product serial number identification IMEI (International Mobile Equipment Identification). It can be used even when the SIM card is not inserted.

Command	Response/Action
AT+CGSN AT+CGSN?	+CGSN: <sn>
+GSN +GSN?	+GSN: <sn>

The following table shows the +CGSN, +GSN parameters.

Table 7. +CGSN, +GSN Parameters

<Parameter>	Description
<sn>	The IMEI (International Mobile Station Equipment Identity) number is comprised of 15 digits, as specified by GSM 03.03 [3]. IMEI numbers are composed of the following elements, all in decimal digits: Type Approval Code (TAC) 6 digits Serial Number (SNR) 6 digits Spare digit 1 digit The TAC and SNR are protected against unauthorized changes.

Example

AT+CGSN

+CGSN: "448954035283579"

AT+GSN

+GSN: "447764074608839"

OK

at+gsn

+GSN: "000000011234564"

OK

at+gsn?

+GSN: "000000011234564"

OK

4.2.1.5   +CSCS, Select Terminal Character Set

This command selects the g20 character set. The g20 supports the following character sets: GSM, UCS2, UTF8, 8859-1 and ASCII.

The default value, set upon system initialization, is ASCII.

Set Command

Command	Response/Action
+CSCS=[<chset>]	OK or: +CMS ERROR: <err>

Read Command

Command	Response/Action
AT+CSCS?	+CSCS: <selected character set>

Test Command

Command	Response/Action
AT+CSCS=?	+CSCS: (<supported character sets>)

The following table shows the +CSCS parameter optional values.

Table 8. +CSCS Parameter Optional Values

<chset>	Character Set	Input/Output Format
"ASCII"	ASCII (0x00 - 0x7F)	Quoted string. (For example, "AB" equals two 8-bit characters with decimal values 65, 66.)
"GSM"	GSM default alphabet (GSM 03.38 subclause 6.2.1)	HEX representation.
"UCS2"	Unicode (ISO/IEC 10646 [32])	HEX representation. (For example, 00410042 equals two 16-bit characters with decimal values 65, 66.)
"UTF8"	8-bit Unicode (ISO 10646 transformation format)	HEX representation.
"8859-1"	LATIN (ISO 8859-1)	Quoted string.

Example

AT+CSCS=?

+CSCS: ("8859-1","ASCII","GSM","UCS2","UTF8")

OK

AT+CSCS?

+CSCS: "ASCII"

OK

AT+CPBS = "ME"

AT+CPBW=1,"8475763000",129,"Lin Zhao"

OK

AT+CSCS="UCS2"

OK

AT+CPBR=1

+CPBR: 1,"8475763000",129,004C006E006E0020005A00680061006F

OK

AT+CSCS="ASCII"

OK

AT+CPBR=1

+CPBR: 1,"8475763000",129,"Lin Zhao"

OK

4.2.1.6   +CIMI, Request IMSI

This command displays the International Mobile Subscriber Identity number.

Command	Response/Action
AT+CIMI AT+CIMI?	+CIMI: <imsi> or: +CMS ERROR: <err>

Example

AT+CIMI

+CIMI: 314566320021400

4.2.1.7 I, Request Identification Information

This command displays various g20 information items.

Command	Response/Action
ATIn	\<information item n> or: +CMS ERROR: \<err>

The following table shows the information items that are supported by the g20.

Table 9. Supported Information Items

ATIn	Description	Output
3	Reports Product Title	Motorola Mobile Phone
5	Reports Software Architecture	P2K
7	Reports Product Description	G20 OEM Module
8	Reports Software Version	\<current revision>

Example

ATI3

Motorola Mobile Phone

ATI5

P2K

ATI7

G20 OEM Module

ATI8

G208_G_0C.00.0BI

4.2.1.8 +CNUM, Request MSISDN(s)

This command displays up to five strings of text information that identify the g20. The output string contains double quotes.

On platforms supporting MSISDN numbers, the string(s) returned are the MSISDN numbers and their associated data.

On platforms not supporting MSISDN numbers, this command returns the current phone number of the g20.

Read Command

Command	Response/Action
+CNUM (MSISDN supported)	+CNUM: [<MSISDN1 string>],<MSISDN1>, <MSISDN1 type> [+CNUM: [<MSISDN2 string>],<MSISDN2>, <MSISDN2 type>] [...]
+CNUM (MSISDN not supported)	+CNUM: <phone_number>

The following table shows the +CNUM parameters.

Table 10. +CNUM Parameters

<Parameter>	Description
<MSISDN type>	Phone number type 129 Use for local call 145 Use "+" for international access code 128 Unknown

Example

at+cnum?

+CNUM: "David","035558278",129

AT+CNUM   //MSISDNs supported

+CNUM: "PHONENUM1","2173848500",129

+CNUM: "PHONENUM2","2173848501",129

+CNUM: "PHONENUM3","2173848502",129

+CNUM:"","",0

+CNUM:"","",0

AT+CNUM   //MSISDNs not supported

+CNUM: "Motomix","2233445",129

+CNUM:"","",0

+CNUM:"","",0

+CNUM:"","",0

4.2.1.9 $, List of All Available AT Commands

This command displays a list of all the AT commands supported by the g20.

Command	Response/Action
AT$	List of available AT commands

4.2.1.10   +CLAC, List of All Available AT Commands

Execute Command

The Execute command displays a list of all the AT commands supported by the g20.

Command	Response/Action
+CLAC	List of available AT commands

Example

AT+CLAC

$

%C

&C

&D

&F

&G

&K

&L

&M

&P

&R

&S

&T

*D

+CACM

+CALC

+CALM

+CAMM

+CAOC

+CBAND

+CBAUD

+CBC

+CBST

+CCFC

+CCLK

+CCWA

+CEER

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S

T

V

X

Y

Z

\A

\S

OK

4.2.2   Capability Reporting

This set of commands enables a user to determine g20's protocol level. It also enables other support provided by the g20, such as information about the currently implemented protocol version (used to detect older g20s that may not support all commands), as well as determining which optional commands are implemented in a particular g20 software load.

4.2.2.1   +MAID, Get Accessory Feature Review

This command displays the AT Feature Review that is supported by the g20. The Motorola Available ID (+MAID) read-only command provides a means for an application to obtain a list of available features in a phone. The parameter list output is based on the list of features available in the phone. The ones and zeros indicate whether the particular feature is turned on or off, respectively. This command has been designed for future expansion. Additional features can be added to the end of the string, if required.

Read Command

Command	Response/Action
+MAID	+MAID: <feature 1 status>,<feature 2 status>, ... <feature 11 status>

The following table describes the accessory features that are supported in the g20.

Table 11. Accessory Features Supported in the g20

Feature	Description
<feature 1 status>	Indicates the presence of a phone book in the phone. True Phone book is present. False Phone book is not present.
<feature 2 status>	Indicates the presence of a date book in the phone. True Date book is present. False Date book is not present.
<feature 3 status>	Indicates the presence of an SMS AT Accessory code in the phone. True SMS AT Accessory code is present. False SMS AT Accessory code is not present.
<feature 4 status>	Indicates the presence of Mobile Originated SMS AT (MO-SMS AT) support in the phone. True MO-SMS AT is present. False MO-SMS AT is not present.
<feature 5 status>	Indicates the presence of email addresses in the phone book and the MO-SMS Destination Address Field. True Email addresses are present. False Email addresses are not present.

Table 11. Accessory Features Supported in the g20 *(Continued)*

Feature	Description
\<feature 6 status\>	Indicates the presence of multiple phone books in the phone, enabled by inserting a memory stick in the phone. Note: The feature status is an indication of the state of a feature ID, not the actual presence or absence of the memory stick. True Multiple phone books may be present. False Multiple phone books are not present.
\<feature 7 status\>	Indicates the presence of a SIM card in the phone. Note: The feature status is an indication of the state of a feature ID, not the actual presence or absence of a SIM card. True SIM card may be present. False SIM card is not present.
\<feature 8 status\>	Indicates the presence of a shared phone/date book. True Shared dynamic memory phone book/date book is present. False Shared dynamic memory phone book/date book is not present.
\<feature 9 status\>	Indicates the availability of an SMS Multiple Destination Address feature. True SMS Multiple Destination Addresses feature is available. False SMS Multiple Destination Addresses feature is not available.
\<feature 10 status\>	Indicates the availability of the Distinctive Alert feature, where a specific ring tone can be assigned to an entry in the phone book True Distinctive Alert feature is available. False Distinctive Alert feature is not available.

\<feature 11 status\>	Indicates the availability of the Phone Book Voice Tags Transferring feature.
	True Supports Voice Recognition and Phone Book Voice Tags Transferring.
	False Does not support Voice Recognition,
	        or
	        Supports Voice Recognition, but not Phone Book Voice Tags Transferring.

\<feature 12 status\>	Indicates the availability of the To Do List feature. True To Do List feature is available. False To Do List feature is not available.
\<feature 13 status\>	Indicates the availability of the Phonebook Category feature. True Phonebook list can be grouped into categories. False Phonebook List feature is not available.
\<feature 14 status\>	Indicates the availability of the Group Messaging feature. True Phonebook entries can be mailing lists. False Group Messaging feature is not available.
\<feature 15 status\>	Indicates the availability of the Profiling Icons feature. True Profiling icons can be associated with phonebook entries. False Profiling Icons feature is not available.
\<feature 16 status\>	Indicates the availability of First and Last Name attributes feature. True First and Last Name attributes feature is available. False First and Last Name attributes feature is not available.

Table 11. Accessory Features Supported in the g20 *(Continued)*

Feature	Description
<feature 17 status>	Indicates the availability of the Profiling Pictures feature. True Profiling pictures can be associated with phonebook entries. False Profiling Pictures feature is not available.
<feature 18 status>	Indicates the availability of the PDU Mode AT Commands for SMS. True PDU Mode AT Commands for SMS are supported. False PDU Mode AT Commands for SMS is not supported.
<feature 19 status>	Indicates the availability of the Funlights feature. True Funlights feature is available. False Funlights feature is not available.
<feature 20 status>	Indicates 3G SIM (USIM) card insertion. True 3G SIM (USIM) card is inserted. False 3G SIM (USIM) card is not inserted or not supported.
<feature 21 status>	Indicates the availability of the VST VR (Voice Recognition for Voice Signal Technologies, Inc.) Transferring feature. True Phone supports VST VR and transferring of the voice recognition tags associated with the phonebook entries. False Phone does not support VST VR and transferring of the voice recognition tags associated with the phonebook entries.

Example

AT+MAID?

+MAID: 1,1,1,1,1,1,1,0,0,1,0,0,1,1,0,0,0,1,0,0,0

OK

4.2.2.2   +MAPV, Get Accessory Protocol Version

This command displays the version of the accessory protocol that is supported in the g20. This version consists of a major version number and a minor version number, and should correspond with the protocol version number reported by the first g20 release including that command. A version of software claiming to support an accessory protocol version must support all commands in accordance with that version of the accessory protocol, as well as all commands for lower numbered versions of the protocol.

Execute Command

Command	Response/Action
+MAPV	+MAPV: <major>.<minor>.<sub_version>

The following table shows the +MAPV parameters.

Table 12. +MAPV Parameters

<Parameter>	Description
<major>	Major protocol version number
<minor>	Minor protocol version number
<sub_version>	Sub-version number

Example

AT+MAPV

+MAPV: 2.8.0

OK

4.3   CALL CONTROL

4.3.1   Managing a CSD (Data) Call

The g20 working modes can be divided into two modes of operation.

• Data Mode: In this mode, once the g20 has established a link with the remote modem, it does not respond to any data passing through it (except for the Escape Sequence search). The g20 becomes a transparent link, connecting the terminal with the remote side.

• Command Mode: In this mode, the g20 responds to the AT commands issued by the terminal. This is the default working mode.

Note

It is possible to switch between the operating modes.

The operating modes can operate simultaneously using the Mux.

The Terminal mode allows you to instruct the modem to dial a remote modem by issuing the Dial command followed by the phone number. You can also include dial string modifiers in your command line to give the modem additional instructions. The following dial modifiers are available on most modems:

• ","- Pause
• ";" - Return to the Command mode after dialing - used for a voice call.

4.3.1.1   Simple Dialing

In order to instruct the modem to dial a remote modem from an ordinary tone-dialing telephone line, enter the Dial command followed by the phone number. For example, type the following command:

ATD 876-5555 <Enter>

After issuing the Dial command, and if the remote modem answers the call, the two modems send high-pitched carrier tones to one another which establish the transmission speed and other parameters for the data connection. This process is called negotiation.

	If you receive characters which were sent, you can disable this with using the Echo command (ATE0 <Enter>).
Note	

After the negotiation process, the message, "OK" followed by the connection speed, is received.

If the other phone line is busy, the message "NO CARRIER" is received.

If the other modem does not answer, the message "NO CARRIER" is received.

Once a connection has been established, the modem is ready to immediately begin transmitting and receiving data. This may vary from sending messages to each other, sending or receiving files, logging on to an information service, or any other data communication task you wish to perform.

4.3.1.2   Switching From Data Mode to Command Mode

To switch the connection from Data mode to Command mode, send the Escape Sequence command (+++).

If the modem responds with "OK" to the Escape command, the modem is in Command mode and the dial connection is still active, and you can use the AT command set.

	The character '+' in the Escape Sequence pattern can be changed using the S2 S-register. Refer to "S, Bit Map Registers", page 262.
Note	Escape is detected only by the g20 and not by the remote side. The remote side stays in the Data mode.

4.3.1.3   Hanging Up

If you are using a communications program, use the "Hang up" or "Disconnect" AT command in the program to disconnect the call.

When using computers in the "Dumb Terminal mode", return to the Command mode by typing the Escape Sequence, +++, and then hang up by typing the Hang up command as follows:

ATH <Enter>

If the g20 responds with "OK", the dial connection is closed.

4.3.1.4   Dialing to an Electronic Telephone Service

When you dial to an electronic telephone service such as telephone banking, you must typically instruct the modem to dial a number, then to wait for call establishment, and then send the password for entering the banking account. A typical command line might look like this:

ATD876-5555,123456; <Enter>

The modem dials the number, then pauses to wait for the call connection (the comma in the command line causes the pause).

You can also create a longer pause by including several commas in a row in the command line, and then send the password to the service.

4.3.2   Receiving a Data Call

ATA <Enter>

This command instructs the modem to be the "answering modem". Either party may be the answering or the originating modem, but both parties cannot be the same modem at the same time.

You hear the modem handshake and see the result code "CONNECT".

4.3.3   Call Control AT Commands

4.3.3.1   D, Dial Command

This command places a FAX/DATA/VOICE call on the current network.

The default call type is a data call (CSD). If the +FCLASS command was used to set the call type to be FAX, then the outgoing call is a fax call.

There must be an explicit request in order to make a VOICE call. This request bypasses the +FCLASS setting.

If a DATA/FAX call was originated and answered by the remote side, a "OK" notification is sent to the terminal from the g20, and it moves to the online Data/Fax state (respectively).

For more information about call failure, use the AT+CEER command, described in "+CEER, Extended Error Report" on page 279.

Note	If there is an active voice call and the terminal sends another ATD voice call command to the g20, the active call is put on hold and the new number is called.

Command	Response/Action
ATD<number>[;]	VOICE CALL: 1st response - Voice call place begins OK 2nd response - Voice call connected: OK DATA/FAX: 2nd response only - Data/Fax call connected CONNECT When MO call fails: 1. Connection Failure - NO CARRIER or BUSY or NO ANSWER 2. General Failure - ERROR 3. Security reason (such as SIM not present) - OPERATION NOT ALLOWED 4. Unknown reason - UNKNOWN CALLING ERROR

The following table shows the D parameters.

Table 13. D Parameters

<Parameter>	Description
<number>	Valid phone digits are: 0 1 2 3 4 5 6 7 8 9 * # + and , The following characters are ignored: A B C D - ( ) / and <space>. The comma <,> digit: When dialing a voice call, digits until the comma are considered addressing information (phone number). Any digits after the comma are sent as DTMF tones after the voice call is connected. More than one comma causes a pause in sending the tones. When dialing a data/fax call, the comma digit is ignored, and all other digits before and after the comma are considered addressing information (phone number). The plus <+> digit: Indicates that the international access code exists in the number.
semicolon (;)	When given after <number string>, a voice call is originated to the given address, otherwise a data call is originated.

Note

ATDP, ATDT, AT*D, <T>, <P> and <*> are ignored. The command is handled as ATD.

The control of supplementary services through the Dial command is not supported as these are controlled through the specific supplementary service commands (CCFC, CLCK, and so on.)

Initiating a GPRS connection is done through ATD*99#, as described in "D*99, Request GPRS Service "D"" on page 307.

Example

atd44345678;   //VOICE call (with semicolon)

OK

OK

atd44345678   //DATA/ FAX call (without semicolon)

...

CONNECT   //Move to online Data state

4.3.3.2   D>, Direct Dialing from Phone Books

This command places a FAX/DATA/VOICE call on the current network by dialing directly from the g20 phone book.

Note

+CME ERROR: "NOT FOUND" is returned when no match is found in an existing phone book.

"FD" phone book supports the (?) wild card character. Telephone numbers containing this character cannot be dialed directly from the phone book.

The following table shows a detailed description for the D> commands.

Table 14. D> Commands

Command	Detailed Description
D><alpha>[;]	Originates a call to a phone number with the corresponding alphanumeric field <alpha>. The MT (or AD) phonebook is searched for the entry that begins with the alphanumeric pattern <alpha>.
D>mem<n>[;]	Originates a call to a phone number in memory (phone book) mem and stored in entry location <n>. Available memories may be queried with Select Phone Book Storage Test command +CPBS=?, described on page 121. Note: This command does not change the used memory set.
D><n>[;]	Originates a call to a phone number from entry location <n> in the MT (or AD) phonebook.

Note

Current used memory (phone book) set/read is done through the memory command +CPBS=/+CPBS? respectively.

If the g20 powers up, and no default used memory is set, then, if ATD><alpha> or ATD><n> is sent from the terminal, a +CME ERROR: "NOT FOUND" is returned.

The following table shows the D> parameters.

Table 15. D> Parameters

<Parameter>	Description
<"alpha">	String type value, which should be equal to an alphanumeric field in a phone book entry. The used character set should be the one selected with Select Terminal Character Set +CSCS. <alpha> is case-sensitive, and should be placed in quotes ("alpha").
<n>	This parameter is also called "speed dial location". It is an integer type memory location. <n> should be in the range of locations available in the memory used.
<"mem">	Mem is not case-sensitive, and should be place in quotes ("mem"). Note: Mem can be used without quotes as well.

Example

at+cpbs="me"   //Phone flash memory

OK
at+cscs="ASCII"   //ASCII characters

OK
at+cpbw=1,"035659090",129,"VoiceMail"

OK
at+cpbr=1

+CPBR: 001,"035659090",129,"VoiceMail"

OK
atd>"VoiceMail";   //Phonebook by name

OK

OK
ath
NO CARRIER

OK

atd>1;   //Speed dial from phonebook

OK

OK
ath

NO CARRIER

OK

atd>1   //Speed dial from phonebook

+CME ERROR: //Invalid characters in dial string

atd>"Motorola Internal"

+CME ERROR: //Invalid characters in dial string

For more examples, refer to "Call Control" on page 405 and "Data Call" on page 410.

4.3.3.3   DL, Dial Last Number

The DL command places a data/voice call to the last number dialed. The call progress information (success/failure) is reported in the same way as for the Dial command. (Refer to "D, Dial Command", page 60.)

Command	Response/Action
ATDL[;]	Initial Response - Last Number retrieved: ATDL: "DIAL DIGITS" 2nd response - Data/Fax call connected CONNECT 1st response - Voice call placement begins OK 2nd response - Voice call connected OK

The following table shows the DL parameters.

Table 16. DL Parameters

<Parameter>	Description
semicolon (;)	If the semicolon (;) is given, a voice call is originated to the last dialed number. If the semicolon (;) is not given, a Fax/Data call is originated. Note: The last dialed call type is irrelevant to the DL command.

Note

When ATDL is issued after a dialed number with comma digit:

•ATDL; (Voice) dials the exact number that was last dialed, including the DTMF tones sent.

•ATDL (Data/Fax) dials the addressing information only (comma and tones are discarded).

•If ATDL is sent before any Dial command was issued (mainly after Power On, when the last number is an empty field), the g20 will return NO CARRIER, as mentioned in the ITU V.25-ter standard.

Example

atdl	//Last called number is "035658278"
ATDL: "035658278"	
OK	//DATA call
atdl;	
ATDL: "035658278"	
OK	
OK	//VOICE call
atdl	//Last called number is "035658278,123,78;"
ATDL: "035658278"	
CONNECT	//DATA call
atdl;	//Last called number is "035658278,123,78"
ATDL: "035658278p123p78"	
OK	
OK	//VOICE call
1 2 3	//Sent as DTMF tones
...	//Pause
7 8	//Sent as DTMF tones

4.3.3.4   H, Hang-up Call

This command hangs up a call. The g20 terminates the call whether it is a data or voice call, and whether it is an incoming, originating, waiting, or connected call.

A NO CARRIER message is returned to the terminal before the regular OK approval.

Note	To terminate (hang-up) a MO data/fax call while call is placed: Any character sent from the terminal to the g20 causes the Data/Fax call termination, and NO CARRIER is sent from the g20 to the terminal. To terminate a held Voice call or to terminate a call out of a MTPY call, refer to "+CHLD, Call Related Supplementary Services Command" on page 77.

The following table shows the call states of the H command.

Table 17. H Call States

Call State	Response/Action
IDLE	Error 3 ("operation not allowed")
Single Active	Call released
MTPY Active	Call released (all calls)
Incoming call (RING)	Call released
Single Active and Waiting Call	Single Active released (waiting not affected)
MTPY Active and Waiting Call	MTPY Active released (waiting not affected)
Single Held or MTPY Held	Error 3
Single (or MTPY) Active and Single (or MTPY) Held	Single (or MTPY) Active released
Held (Single or MTPY) and Waiting Call	Waiting call released
Single (or MTPY) Active and Single (or MTPY) Held & Waiting call	Single (or MTPY) Active released

Example

RING	//Incoming call
RING	//Incoming call
ath	//Hang-up incoming call
NO CARRIER	
OK	//Incoming call has been terminated - user determined user busy

RING

ata

OK   //Voice call connected

ath   //Hang-up connected call

NO CARRIER

OK   //Active call has been hung-up - terminated

(... Active multi party call, with 3 numbers …)

ath

NO CARRIER

NO CARRIER

NO CARRIER

OK

atd035659260;

OK

ath   //Terminate MO voice call while placed

NO CARRIER

OK

Example - Hanging up a data call:

atd035659260

CONNECT   //Data call connected - Online Data mode

…

+++   //ESC Sequence is sent from the terminal to the g20

OK   //The g20 is in Command mode

ath   //Terminate Data call

NO CARRIER

OK

4.3.3.5   **A, Answer Incoming Call**

This command answers an incoming VOICE/DATA/FAX call after a RING/+CRING indication is sent to the terminal.

If the incoming call is answered (connected), the g20 sends a CONNECT notification to the terminal.

If the MT call fails, the possible notifications are:

- NO CARRIER - Connection Failure
- ERROR - General Failure

Note	A waiting call (an incoming call during another call) is announced by +CCWA rather than RING. A waiting call can be answered only if it is a voice call. The waiting voice call should be answered using the AT+CHLD command, even though ATA will put the active call on hold and connect the waiting call, making it the active call. This ATA action is the same action as AT+CHLD=2
	Exception: In the case of an intruder call (Call Waiting), the ATA command is issued and accepts this call. By all standards, ATA in this case (one active call and one CW call) should be rejected.

Example

Example - Answering a voice call:

AT+CRC=1

+CRING: VOICE

+CRING: VOICE

ata

OK   //VOICE call connected - g20 is in Command mode

ath

NO CARRIER

OK

Example - Answering a data call:

+CRING: REL ASYNC

+CRING: REL ASYNC

ata

...   //Connecting (dots are not displayed)

OK   //DATA call connected - g20 is in Online Data mode

Note	In a CSD call, call release is not valid during the phase of call negotiation (from OK until connect call).

4.3.3.6   +CRC, Cellular Result Codes and RING, +CRING - Incoming Call Indication

This command controls whether or not to present the extended format of an incoming call indication. The RING/+CRING indication is sent from the g20 to the terminal when the g20 is alerted by an incoming call from the network. Once this indication is sent, information is available on the calling line via +CLIP. When +CRC is disabled, the indication is RING, and when +CRC is enabled, the indication is +CRING.

Set Command

The Set command enables/disables the extended format of an incoming call indication. When enabled, an incoming call is indicated to the terminal with an unsolicited result code +CRING:<type> instead of the normal RING.

Command	Response/Action
+CRC=<n>	OK

Read Command

The Read command queries the current settings for the cellular result code.

Command	Response/Action
+CRC?	+CRC: <n> OK

Test Command

The Test command returns the possible <n> values.

Command	Response/Action
+CRC=?	+CRC: (list of supported <n>s)

RING/+CRING INDICATION
+CRING: <type> or: RING

The following table shows the +CRC parameters.

Table 18. + CRC Parameters

<Parameter>	Description
<n>	0 Extended format disabled 1 Extended format enabled The default value is 0.

Table 18. + CRC Parameters *(Continued)*

<Parameter>	Description
<type>	Type of incoming call: ASYNC CSD asynchronous transparent REL ASYNC CSD asynchronous non-transparent FAX Fax class 1 VOICE Normal voice ALT Fax/voice

Example

at+crc?

+CRC: 0

OK

at+crc=?

+CRC: (0-1)

OK

Example - RING/+CRING indication

(..Incoming Data Call..)

RING

RING

RING

at+crc=1   //Enable extended ring format

OK

+CRING: REL ASYNC

+CRING: REL ASYNC

ath

at+CRC=1

OK   //Mobile fax call terminated (multi-numbered scheme) from PSTN fax machine

+CRING: ALT Voice/Fax

NO CARRIER

OK

4.3.3.7   +CLIP, Calling Line Identification

This command controls the Calling Line Identity (CLI) presentation indication to the terminal when an incoming call is detected by the g20.

This command allows the user to query the provisioning status of the CLI by the network and by the g20. The command also allows the user to enable/disable the CLI presentation by the g20 to the terminal.

The +CLIP indication information varies depending on what is provided by the network and what information is stored in the g20 phone book.

Set Command

The Set command enables or disables the presentation of the CLI indication from the g20 to the terminal.

Command	Response/Action
AT+CLIP=<n>	OK +CME ERROR: <err>

> **Note**
>
> The Set command does not address the network.

Read Command

The Read command returns the +CLIP enable/disable state in the g20 as well as in the network provisioning state of the CLI presentation.

Command	Response/Action
AT+CLIP?	+CLIP: <n>, <m> OK

Test Command

The Test command returns the Set command options (0,1).

+CLIP Indication

When the CLI presentation indication is enabled by the g20 (<n>=1), this unsolicited indication is sent to the terminal after the RING indication.

CLIP Indications
+CLIP:<number>, <type>[, <subaddr>, <satype>[,[<alpha>][, <CLI validity>]]]

The following table shows the +CLIP parameters.

Table 19. +CLIP Parameters

<Parameter>	Description
<n>	Enables/disables the CLI presentation indication after the ring indication: 0 Disable CLI presentation 1 Enable CLI presentation The default is 0.
<m>	Shows the subscriber CLIP service status in the network: 0 CLIP not provisioned 1 CLIP provisioned 2 Unknown (for example, no network and so on)
<"number">	Calling line number. The number format is specified by <type>.
<type>	Type of address octet in integer format: 145 Default when the dialing string includes the international access code character "+". 129 Default when making a local call. 128 Type of number is unknown (usually the output when the number itself is unknown).
<subaddr>	NULL, field not used (String type subaddress of format specified by <satype>)
<satype>	Field not used. Value is always 128 (unknown) - type of sub address octet in integer format.
<"alpha">	Name of the calling party (if provided by the network or if the number is found in the g20 phone books).

Table 19. +CLIP Parameters *(Continued)*

<Parameter>	Description
<CLI validity>	The Validity of the Calling Line Identity presentation: 0 CLI valid. 1 CLI has been withheld by the originator. 2 CLI is not available due to networking problems or limitations of the originating network.

Example

at+clip=?

+CLIP: (000,001)   //CLI presentation is disabled by the g20 (0) and is enabled by the network (1)

OK

at+clip=1

OK

Example +CLIP indication:

(…incoming call…)

RING

+CLIP: "2173845400",129,,128,"Doe John",0

Example +CLIP indication with restricted CLI:

at+crc=1

OK

(…incoming call…, caller restricted the CLI presentation (used at+clir)…)

+CRING: VOICE

+CLIP: "",128,,128,"",1

4.3.3.8   +CCWA, Call Waiting Command

This command controls the Call Waiting supplementary service, including the settings and the queries of the g20 and the network. When the Call Waiting indication is enabled by the g20 and there is a waiting call, a +CCWA: indication is sent from the g20 to the terminal.

Note	The g20 supports only one of the services at a time: Voice, Data or Fax. Multiparty is a voice-only functionality. A CCWA indication is sent to the terminal only during a voice call-waiting event. A CCWA indication is not sent for a fax/data call during in a voice session.

Set Command

The Set command enables/disables the Call-Waiting indication in the g20 and in the network. Activation, deactivation and status query are supported.

Note

When the <mode> parameter is set to 2 (network query), the <n> parameter is ignored. This means that no enable/ disable is performed while querying the network.

Command	Response/Action
+CCWA=[<n>[,<mode>[,<class>]]]	OK If <mode>=2 and the command succeeds: +CCWA: <status>,<class1> [<CR><LF>+CCWA: <status>,<class2> [...]] OK

Read Command

The Read command returns the enable/disable status of the call waiting indication in the g20 (<n>).

Command	Response/Action
+CCWA?	+CCWA: <n> OK

Test Command

The Test command returns <n> values supported by the g20 as a compound value.

Command	Response/Action
+CCWA=?	+CCWA: (list of supported <n>s)

+CCWA Indication

When a call-waiting indication is enabled by the g20 (<n>=1), the following unsolicited indication is sent to the terminal from the g20:

+CCWA Indication
+CCWA:<number>,   <type>,   <class>,   [<alpha>]   [,<CLI validity>]

Note

During the call waiting state, a RING indication is not sent to the terminal. This means that when <n> is set to 0, the terminal will not be aware of the waiting call. In addition, it is not possible during this state to release a single party from a multiparty call. Any attempt to do so results in the following message: "+CME ERROR: operation not allowed".

The maximum number of waiting calls at one time, per mobile access, is one. This means that no further calls are offered to the g20 (and to the terminal) while a call is waiting.

If CLI is NOT provisioned by the network but CCWA: presentation to the terminal is enabled, the g20 sends one of the following indications to the terminal:
+CCWA: "",128,,"",1
or
+CCWA: "",128,,"",2

The following table shows the +CCWA parameters.

Table 20. +CCWA Parameters

<Parameter>	**Description**
<n>	Enables/disables the call waiting indication to the terminal by the g20. 0 Disable 1 Enable The default is 0.
<mode>	Call waiting service request to the network. When the <mode> parameter is not given, the network is not interrogated. 0 Disable 1 Enable 2 Query status The default is 0.
<class>	Sum of integers each representing a class of information. 1 Voice (telephony) 2 Data (refers to all bearer services) 4 Fax (facsimile services) The default value is 7.

Table 20. +CCWA Parameters *(Continued)*

<Parameter>	Description
<"number">	Calling line number. The number format is specified by <type>.
<type>	Type of address octet in integer format: 145 Default when the dialing string includes the international access code character "+". 129 Default when making a local call. 128 Type of number is unknown (usually the output when the number itself is unknown)
<status>	Call waiting support by the network (output for <mode>=2). 0 Not active 1 Active
<"alpha">	Name of the calling party (if provided by the network or if the number is found in the g20 phone books).
<CLI validity>	The Validity of the Calling Line Identity presentation: 0 CLI valid. 1 CLI has been withheld by the originator. 2 CLI is not available due to networking problems or limitations of the originating network.

Note

When the parameter <mode> is 2 (Query status), the first parameter is ignored and the third parameter is always treated as class = 7.

Example

at+ccwa=1   //Enable call waiting on g20

OK

at+ccwa=?

+CCWA: (0,1)

OK

at+ccwa?

+CCWA: 1

OK

Examples of +CCWA set command - network interrogation

at+ccwa=1,2   //Class parameter is considered as 7

+CCWA: 1,1   //Call waiting is active for class 1, voice

+CCWA: 2,0   //Call waiting is not active for class 2, data
+CCWA: 4,0   //Call waiting is not active for class 4, fax
OK

at+ccwa=1,2,2   //Class parameter is 2
+CCWA: 2,0   //Call waiting is not active for class 2, data
+CCWA: 4,0   //Call waiting is not active for class 4, fax
OK

at+ccwa=1,0
OK   //Disable the call waiting feature in the network, enable it in the g20

at+ccwa=,,1
OK   //Enable the call waiting feature in the network

Example +CCWA indication
atd9311234567;   //Originate a voice call
OK
OK   //Voice call connected

(...conversation...)
(… call waiting indication received by the g20 …)
+CCWA: "+358317654321",145,1,"Bob"
+CCWA: "+358317654321",145,1,"Bob"

at+chld=0   //Release the waiting call
OK
NO CARRIER
at+crc=1   //RING indication is not relevant to CCWA indication
OK
(…waiting call…, caller restricted to its CLI presentation (used at+clir)…)
+CCWA: "",128,1,"",1   //CLI is restricted, but call type recognized as voice
+CCWA: "",128,1,"",1

4.3.3.9 +CHLD, Call Related Supplementary Services Command

This command controls the Call Hold and Multiparty Conversation services. This command manipulates voice calls only.

Set Command

The Set command allows the control of the following call related services:

• Call HOLD: A call can be temporarily disconnected from the g20, but the connection is retained by the network.

• MTPY (Multi party) Conversation: Conference calls.

The network does not reserve more than one traffic channel for a mobile station, therefore the g20 can have only one call on hold at a time.

Note

Only voice calls can be put on HOLD.

A precondition for the multi-party service is that the g20 is in control of one active call and one call on hold. In this situation, the g20 can request the network to begin the MTPY (Multi Party) service. Once a MTPY call is active, remote parties may be added, disconnected or separated (removed from the MTPY call, but remain connected to the served mobile subscriber).The maximum number of remote parties is 5.

In this command, the term CALL refers to a single or MTPY call.

A single Active call is considered an MTPY call with one call index numbered as 1.

Command	Response/Action
+CHLD=<n>	If the call is terminated: OK (approve request was submitted) NO CARRIER If the call state is changed (link, split, from active to hold, and so on): OK (approve request was done) If the call is terminated and another call is answered: OK (approve request was submitted) NO CARRIER OK (call answered and is now connected)

Test Command

The Test command returns <n> values supported by the g20 to the terminal.

Command	Response/Action
+CHLD=?	+CHLD: (list of supported <n>s) OK

The following table shows the +CHLD parameters.

Table 21. +CHLD Parameters

<Parameter>	Description

<n>	Call hold operation:
	0 Releases all held calls
	     OR
	     Sets User Determined User Busy for a waiting call
	1 Releases all active calls and accepts the held or waiting call
	1x Release specific call x, where x is the serial number of a call participating in an active MTPY call.
	2 Places all active calls on hold and accepts the held or waiting call
	2x In the case of an active MTPY call, places all active calls on hold, except for call x. Call x remains active.
	3 Adds a held call to the conversation - MTPY
	Note: "Held calls" or "active calls" means a held or active single or MTPY call. There cannot be two or more different held/active single/MTPY calls.

The following table shows the +CHLD actions according to state and operation:

Table 22. +CHLD Actions According to Call State and Operation

Call State	CHLD <operation>					
	0 -Release Held Call	1 - Release Active Call, Accept Held Call	1x - Release Active Call x from MTPY Call	2 - Switch Between Held and Active Call	2x - Active MTPY Call to Hold, Except for Call x	3 - Add Held Call to Active Call
IDLE	Error 3					
Single Active Call	Error 3.	Releases active call.	If x=1, releases active call, otherwise error 22.	Puts active call on hold.	Error 3.	Error 3.
MTPY Active Call	Error 3.	Releases active call.	Releases specific active call x. If x does not exist, then error 22.	Puts active call on hold.	Split. If call x does not exist, then error 22.	Error 3.
Incoming Call (RING)	Error 3.					

Table 22. +CHLD Actions According to Call State and Operation *(Continued)*

Call State	CHLD <operation>					
	0 -Release Held Call	**1 - Release Active Call, Accept Held Call**	**1x - Release Active Call x from MTPY Call**	**2 - Switch Between Held and Active Call**	**2x - Active MTPY Call to Hold, Except for Call x**	**3 - Add Held Call to Active Call**
Single Active Call and Waiting Call	Releases waiting call.	Releases active call, accepts waiting call.	Releases specific active call x. If x does not exist, then error 22.	Puts active call on hold, accepts waiting call.	Error 3.	Error 3.
MTPY Active Call and Waiting Call	Releases waiting call.	Releases active call, accepts waiting call.	Releases specific active call x. If x does not exist, then error 22.	Puts active call on hold and accepts waiting call.	Split. If x does not exist, then error 22.	Error 3.
Single Held Call or MTPY Held Call	Releases held call.	Accepts held call.	Error 3.	Accepts held call.	Error 3.	Error 3.
Single (or MTPY) Active Call and Single (or MTPY) Held Call	Releases held call.	Releases active call and accepts held call.	Releases specific active call x. If x does not exist, then error 22.	Switches.	Error 3.	Makes a conference call.
Held (Single or MTPY) Call and Waiting Call	Releases waiting call.	Accepts waiting call.	Error 3.	Accepts waiting call.	Error 3.	Error 3.
Single (or MTPY) Active Call and Single (or MTPY) Held and Waiting Call	Releases waiting call.	Releases active call, and accepts waiting call.	Releases specific active call x. If x does not exist, then error 22.	Error 3 (too many calls on hold.	Error 3.	Makes a conference call. Waiting call is not touched.
Split: Places the active MTPY call on hold, except for a specific call x. Switch: Places the active call on hold and accepts the Held call Error 3: "Operation not allowed" Error 22: "Not found"						

Example

at+chld=?

+CHLD: (0,1,1x,2,2x,3)

OK

at+ccwa=1 //Enable call waiting

OK

atd9311234567; //Originate a voice call

OK

OK

(...conversation...)

+CCWA: "+358317654321",145,1,"Bob" //Awaiting call alerts

at+chld=2 //Put first call on hold and answer the second call

OK

(...conversation...)

at+chld=3 //Add the held call to the conversation

OK

(...MTPY conversation...)

at+chld=22 //Split: Place the MO active call on hold, MT call remains active

OK

at+chld=0 //Release the held call

OK

NO CARRIER

ath //Release the active call

NO CARRIER

OK

atd9311234567; //Originate a voice call

OK

OK

+CCWA: "055728386",129,1,"",0 //Waiting call alerts

at+chld=1 //Release the active call, accept the waiting call

OK

NO CARRIER //Active 9311234567 was released

OK //Waiting 055728386 was answered

4.3.3.10   +CCFC, Call Forwarding Number and Conditions

This command enables control of the call-forwarding supplementary service. Registration, erasure, activation, deactivation, and status query are supported.

Set Command

The Set command instructs the g20 which call forwarding settings to request from network. The Set command, in query mode, interrogates the network about the subscriber current call forwarding status.

Command	Response/Action
+CCFC=<reason>,<mode> [,<number>[,<type>[,<class> [,<subaddr>[,<satype>[,<time>]]]]]]	If the command succeeds: +CCFC: <status>,<class1>[,<number>,<type> [,<subaddr>,<satype>[,<time>]]][<CR><LF> +CCFC: <status>,<class2>[,<number>,<type> [,<subaddr>,<satype>[,<time>]]][...]] +CCFC: (list of supported <reason>s)

Test Command

The Test command returns <reason> values supported by the g20 to the terminal.

Command	Response/Action
+CCFC=?	+CCFC:<reason> OK

The following table shows the +CCFC parameters.

Table 23. +CCFC Parameters

<Parameter>	Description
<reason>	0 Unconditional 1 Mobile busy 2 No reply 3 Not reachable 4 All call forwarding 5 All conditional call forwarding
<mode>	0 Disable 1 Enable 2 Query status 3 Registration 4 Erasure
<"number">	Calling line number. The number format is specified by <type>.

Table 23. +CCFC Parameters *(Continued)*

<Parameter>	Description
<type>	Type of address octet in integer format-. 145 Default when dialing string includes international access code character "+". 129 Default when making a local call.
<subaddr>	NULL, field not used. (String type subaddress of format specified by <satype>)
<satype>	Field not used. Value is always 128 (unknown) - type of sub address octet in integer format.
<classx>	The sum of integers each representing a class of information. 1 Voice 2 Data - refers to all bearer services. 4 Fax The default value is 7.
<time>	1-30 The number of seconds to wait before calls are forwarded, when "no reply" is enabled or queried. The default value is 20. Note: The parameter must be a multiple of 5, for example, 5, 10, 15 and so on. If not, the modulo of 5 will be ignored.
<status>	0 Not active 1 Active

Note

A forward-to phone <number> (and the optional fields <type>, <subaddr> and <satype>) are tied to a <reason> and a <class>. This means that there can be a different <number> for the same <reason> because of a different <class>. When registering without mentioning a <class>, <class>=7 is selected.

A <number> field is mandatory when registering (<mode>=3) and it is irrelevant (ignored) in all other <mode>s.

Example

at+ccfc=?

+CCFC: (0,1,2,3,4,5)

OK

at+ccfc=0,3,"01256316830",129,1

OK

at+ccfc=1,3,"0545658278",129,1   //Register UC forward-to of all classes.

OK

at+ccfc=1,1   //Activate UC forward-to of all classes.

OK

at+ccfc=1,2   //Interrogate reason not-reachable of all classes.

+CCFC: 1,1,"+97254151200",145

+CCFC: 0,2,"",0

+CCFC: 0,4,"",0

OK   //For <reason>=3, forward only voice calls is activated.

at+ccfc=4,2   //Interrogate reason all-call-forwarding for all classes.

+CME ERROR: "no network service"   //Interrogation of <reason>=30 is not supported by network.

at+ccfc=2,3,"+972545658278"

OK

at+ccfc=2,0   //Disable call-forwarding for reason no-reply of all classes.

OK

at+ccfc=2,2

+CCFC: 0,1,"+972545658278",145,,25

+CCFC: 0,2,"+972545658278",145,,25

+CCFC: 0,4,"+972545658278",145,,25

OK

4.3.3.11   +CLIR, Calling Line Identification Restriction

This command instructs the g20 to query, enable or disable the presentation of the CLI (calling line ID) of a MO call to the called party. The restriction of the CLI (disable presentation) is dependent both on the g20 and on the network.

The network enables three possible provisions of CLIR:

• Not provisioned (CLIR Off - presentation allowed)

• Provisioned permanently

• Provisioned with Temporary mode

The provision is fixed and cannot be changed by an AT command.

Temporary Mode:

Temporary mode can be in one of two states:

• A - Presentation restricted (CLIR On) as default.

• B - Presentation allowed (CLIR Off) as default. A subscriber to Temporary mode always has a default subscription to state A or B. Temporary-mode provisioning means that the terminal can request the g20 to switch the default mode from A to B, and vice versa.

Note

When a service is in state A, and the terminal wants to enable the CLI presentation (turn CLIR off) for a single call, it can do so using the ATD command. This does not change the Temporary mode state. This can also be done when the service is in state B and the terminal wants to disable the CLI presentation (turn CLIR on) for a single call.

When setting the g20 through the handset (or by using +CKPD), the settings are valid only for the next mobile originated call. After the call, the settings return to default.

Set Command

The Set command instructs the g20 to enable/disable CLI restriction for all MO calls.

> **Note**
> The Set command deals only with Temporary mode. Therefore, if the network provisioning is not in Temporary mode, the Set command setting is irrelevant.
>
> It is recommended to run the CLIR Read command and get the network status before the Set command is issued.

Command	Response/Action
+CLIR=<n>	OK

Read Command

The Read command returns the current setting of CLIR on the network <m> and on the g20 <n>.

Command	Response/Action
+CLIR?	+CLIR:<n>,<m> OK

Test Command

The Test command returns <n> values supported by the g20.

Command	Response/Action
+CLIR=?	+CLIR: (list of supported <n>s)

The following table shows the +CLIR parameters.

Table 24. +CLIR Parameters

<Parameter>	Description
<n>	Adjustment for outgoing calls 0 Disable (CLIR Off = CLI Presented) 1 Enable (CLIR On = CLI Restricted) 2 Disable (CLIR Off = CLI Presented) The default is 2. Note: The standard demand for the Set command (+CLIR =0) is not supported by the g20. (Presentation indicator is used according to the subscription of the CLIR service in the network.)

Table 24. +CLIR Parameters *(Continued)*

<Parameter>	Description
<m>	Subscriber CLIR service status in the network 0 CLIR not provisioned 1 CLIR provisioned in permanent mode 2 Unknown (for example, no network and so on) 3 CLIR Temporary mode presentation restricted (can be the default) 4 CLIR Temporary mode presentation allowed (can be the default)

Example

at+clir=?

+CLIR: (0,1,2)

OK

at+clir?

+CLIR: 1,4

at+clir=2

OK

atd054565195;   //MO voice call

OK

(… calling …)

(… a g20 that has 054565195 SIM and is CLIP enabled will receive the following on the terminal:

RING

+CLIP: "",128,,128,"",1

RING

+CLIP: "",128,,128,"",1)

ath

NO CARRIER

OK

at+clir=0

OK

atd054565195;   //MO voice call

OK

(… calling …)

(… a g20 that has 054565195 SIM and is CLIP enabled will receive the following on the terminal:

RING

+CLIP: "054565006",129,,128,"",0

RING

+CLIP: "054565006",129,,128,"",0 …)

ath

NO CARRIER

OK

4.3.3.12   +CBST, Select Bearer Service Type

This command sets the GSM bearer service (data circuit duplex asynchronous and synchronous). It chooses one of the bearer services, the data rate of the service (actually the modulation when modem IWFs are used), and enables or disables the Radio Link Protocol.

Set Command

The Set command selects the bearer service <name> with data rate <speed> and the connection element <ce> to be used when data calls are originated (refer to GSM 02.02). Values may also be used during mobile terminated data call setup, especially in the case of single numbering scheme calls.

Note	For incoming calls, the bearer service will be taken automatically from incoming parameters and not according to the CBST Set command. **g18 Compatibility Note:** The CBST Set command selects the bearer service (data circuit duplex asynchronous and synchronous, PAD access circuit asynchronous, or data packet duplex synchronous) to be used when data calls are originated. (GSM 07.07 version 7.5.0 Release 1998). For incoming calls, the bearer service will be taken automatically from incoming parameters and not according to the CBST Set command.

In "g18 behavior" the following exists:

at+cbst=?

+CBST: (006,007,070,071),(000),(000-001)

The g20 does not change the output (to be compatible with the g18), but for incoming calls, the phone works in automatic mode.

Command	Response/Action
AT+CBST=[<speed>[,<name> [,<ce>]]]	OK +CME ERROR: <err>

Read Command

Command	Response/Action
AT+CBST?	+CBST: <speed>,<name>,<ce> OK

Test Command

The Test command returns values supported by the MA as compound values.

Command	Response/Action
AT+CBST=?	+CBST: (list of supported <speed>s),(list of supported <name>s),(list of supported <ce>s) OK

The following table shows the +CBST parameters.

Table 25. +CBST Parameters

<Parameter>	Description
<speed>	0 Auto-bauding (automatic selection of the speed; this setting is possible in case of 3.1 kHz modem and non-transparent service) 6 4800 bps (V.32) 7 9600 bps (V.32) 68 2400 bps (V.110 or X.31 flag stuffing) 70 4800 bps (V.110 or X.31 flag stuffing) 71 9600 bps (V.110 or X.31 flag stuffing) The default value is 7. Note: Currently the g20 supports: 2 baud rates: 4800 and 9600 bps 2 protocols: V.110 and V.32
<name>	0 Data circuit asynchronous (UDI or 3.1 kHz modem) 1 Data circuit synchronous (UDI or 3.1 kHz modem) The default value is 0.
<ce>	0 Transparent 1 Non-transparent (default)

Example

At+cbst=?

+CBST: (000,004,006,007,014,068,070,071,075),(000-001),(000-003)

OK

At+cbst?

+CBST: 007,000,001

OK

at+cbst=6

OK

at+cbst?

 +CBST: 006,000,001

OK

4.3.3.13   O, Return to Online Data State

This command returns the g20 from the Command mode to the Online Data mode and issues a CONNECT or CONNECT <text> result code.

After dialing or answering (atd/ata commands and connect), the phone enters the Online Data mode where it is able to transfer data, but not to enter AT commands.

The ESC command +++, transfers the phone to the Command mode (able to input AT commands, while preserving the Data call). The O command returns the phone to the fully Online Data mode (as it was before using the ESC command).

> **Note**
>
> The escape character '+' can be changed using the S2-register.
>
> The time delay between two consecutive "+s" is configured using the S12-register.

Execute Command

Command	Response/Action
ATO	CONNECT
	+CME ERROR: <err> If phone is not in Data Call
	NO CARRIER: If connection is not successfully resumed.

Example

ATD035684072	//Calling a remote modem - data call
CONNECT	//g20 is in Data mode
	//Escaping back to Command mode using the +++ sequence
OK	
AT	//g20 is in Command mode
OK	
ATO	//Returning to Data mode
CONNECT	

4.3.3.14 &Q, Asynchronous Mode

This command selects the asynchronous mode.

Qn	Description
Q0	Normal asynchronous operation (no error correction)
Q5	Error corrected operation (default)
Q6	Normal asynchronous operation (no error correction)

4.3.3.15 +CHUP, Hang Up Call

This command causes the TA to hang up the current GSM call of the g20.

Set Command

The Set command hangs up the current GSM call.

Command	Response/Action
+CHUP	OK +CME ERROR <err>

Read Command

The Read command for +CHUP is not defined by ETSI, and therefore is not supported by the g20. The g20 returns an error.

> **Note**
>
> The current version of the g20 does not support alternating mode calls. Therefore, the behavior of +CHUP and ATH are the same.

4.3.3.16 +CSNS, Single Numbering Call Scheme

This command handles the selection of the bearer or teleservice to be used when a mobile terminated single numbering scheme call is established. If the calling party specifies the required bearer capability, this capability is used for the call setup attempt. If the calling party does not specify the required bearer capability (for example, because the call originated in the PSTN), the network attempts to determine it, as described below.

Some cellular networks use a multi-numbering scheme, where several mobile station ISDN numbers, or MSISDNs, are associated with one IMSI in order to define the bearer capability by the MSISDN. Each MSISDN is used for a different bearer capability. If the network uses a multi-numbering scheme and the calling party has not specified the required bearer capability, then the network uses the bearer capability associated with the called party MSISDN.

However, some networks omit the bearer capability associated with the called party MSISDN, when this MSISDN is associated with voice service and the calling party has not specified the required bearer capability (for example, because the call originated in the PSTN). In these cases, the +CSNS command is used to select the desired bearer or teleservice for a single-numbering scheme, in which one MSISDN is associated with each IMSI. The +CSNS command has a default mode, so is not mandatory to set it.

If the network uses a single-numbering scheme and the calling party has not specified the required service, then the network omits the bearer capability information.

Set Command

The Set command selects the bearer or teleservice to be use when a mobile-terminated single numbering scheme call is established.

Command	Response/Action
+CSNS=<mode>[,<repeated>]	OK +CME ERROR: <err>

Read Command

The Read command displays the currently active CSNS mode.

Command	Response/Action
+CSNS?	+CSNS: <mode>

Test Command

The Test command displays the list of supported CSNS modes.

Command	Response/Action
+CSNS =?	+CSNS: (list of supported mode>s), <repeated>

The following table shows the AT+CSNS parameters.

Table 26. +CSNS Parameters

<Parameter>	Description
<mode>	CSNS mode: 0 Voice (default) 2 Fax (TS 62) 4 Data

Table 26. +CSNS Parameters

<Parameter>	Description
<repeated>	Defines how long to save the new setting: 0 One shot (new setting is not saved) 1 CSNS mode is saved until new +CSNS command issued or next power cycle

Note

Any mobile-terminated call lacking bearer capability information is handled according to the current CSNS setting.

When <mode> is set to data service, the parameter values set with the +CBST command are used (Refer to "+CBST, Select Bearer Service Type" on page 86). If the +CBST parameter is set to a value that is not applicable to single numbering calls, the g20 maps the value to the matching one, according to the Mapping Table (see below).

If <repeated> is set to 0, any call indication (RING, CRING, CLCC, and so on) sets the CSNS back to the default value (voice).

The only +CBST parameter that needs mapping for mobile terminated calls is <speed>, as described in the table below. The V.110 protocol is replaced by the analog protocol regardless of the +CBST setting. All other parameters are set by the +CBST command.

Table 27. Mapping Table

+CBST setting		Mapped value for mobile terminated call	
0	autobauding	0	autobauding
4	2400 bps (V.22bis)	4	2400 bps (V.22bis)
6	4800 bps (V.32)	6	4800 bps (V.32)
7	9600 bps (V.32)	7	9600 bps (V.32)
14	14400 bps (V.34)	14	14400 bps (V.34)
68	2400 bps (V.110 or X.31 flag stuffing)	4	2400 bps (V.22bis)
70	4800 bps (V.110 or X.31 flag stuffing)	6	4800 bps (V.32)
71	9600 bps (V.110 or X.31 flag stuffing)	7	9600 bps (V.32)
75	14400 bps (V.110 or X.31 flag stuffing)	14	14400 bps (V.34)

Note

CSNS has read-only access to CBST data.

4.3.3.17 +MDC, Selection of Desired Message to Be Displayed Upon Connection of a Voice Call

This AT command enables you to select the desired messages to be displayed upon connection of a voice call with a remote party. The OK and CONNECT messages are available.

Set Command

The Set command selects which of the supported messages will be displayed upon connection of a voice call.

Command	Response/Action
+MDC=<mode>	OK or: ERROR

<mode> Command Parameters:

0	Display OK on voice call connection
1	Display CONNECT on voice call connection

Default Values:

Power Up	As previously saved in NVM FLEX bit
0	Before Set command is first used

Read Command

The Read command should return the current selection of <mode>.

Command	Response/Action
+MDC?	+MDC: <mode> OK

Test Command

The Test command returns the possible <mode> values.

Command	Response/Action
+MDC=?	+MDC: (list of supported <mode>s) OK

Example

AT+MDC=?

+MDC: (0-1)

OK

AT+MDC=1

OK

ATD<number>;

OK

CONNECT

AT+MDC?

+MDC: 1

OK

AT+MDC=0

OK

ATD<number>;

OK

OK

AT+MDC?

+MDC: 0

OK

4.3.3.18   +CTFR1, Divert an Incoming Call When User Busy

This command terminates an incoming call and diverts the caller to the number previously defined in CCFC, or to a voice mail if one exists for the subscriber. This is done by sending a user-defined User Busy message to the network.

Set Command

The Set command will hand up (terminate) the incoming call, causing the network to divert the incoming call to the number that was set by the CCFC command for "User Busy", or the voice mail, if one exists for the subscriber.

Command	Response/Action
+CTFR1	OK and NO CARRIER or: +CME ERROR: \<err>

Example

RING   //Incoming call indication

AT+CTFR1

OK

NO CARRIER

AT+CTFR1   //When an active call exists and another call is waiting

OK

NO CARRIER

AT+CTFR1   //When there is no incoming call or waiting call

+CME ERROR: "operation not allowed"

4.3.4   Call Status Messages

The g20 provides detailed information about the call progression and the error states to privileged accessories. This information is sent to the accessories as unsolicited responses when enabled from the g20. Accessories can request the current state of the call processing engine by using the query form of this command. When a change occurs in the call processing engine state, this information is broadcast to all the accessories.

The following table shows the Call Processing State codes. These codes are transmitted by the g20 when the call processing engine (or equivalent) changes state, for example when exiting a call. These codes are generic information codes that are intended to be reused, as much as possible, among all technologies. States 1 - 17 are call processing states, and can be queried. States 64 to 72 announce various phases of call origination.

Table 28. Call Processing State Codes

Code	Description
1	Idle call state
2	Single incoming call
3	Single call active

Table 28. Call Processing State Codes *(Continued)*

Code	Description
4	Single call held
5	Multi-party call active
6	Multi-party call held
7	Dual call (fully connected active call and held call)
8	Dual multi-party call active
9	Dual multi-party call held
10	Single active call plus call waiting
11	Multi-party call active plus call waiting
12	Single call held plus call waiting
13	Multi-party call held plus call waiting
14	Dual calls plus call waiting
15	Dual multi-party calls active plus call waiting
16	Dual multi-party calls held plus call waiting
17	Call control busy
64	Calling
65	Call Failed (with Exit and Retry softkeys displayed)
66	Redialing (with Cancel softkey on left)
67	Waiting for Service (TDMA specific)
68	No Service
69	No Redial
70	Outgoing Calls Restricted (with OK softkey on right)
71	Outgoing Calls Phone Book Only (with OK softkey on right)
72	Security Fail

4.3.4.1   +CPAS, Phone Activity Status

This command displays the current activity status of the g20, for example, call in progress, or ringing.

Execute Command

The Execute command returns the activity status <pas> of the g20. It can be used to interrogate the g20.

Command	Response/Action
AT+CPAS	+CPAS: <pas> OK or: +CME ERROR: <err>

Test Command

Command	Response/Action
AT+CPAS=?	+CPAS: (list of supported <pas>s) OK or: +CME ERROR: <err>

The following table shows the +CPAS parameters

Table 29. +CPAS Parameters

<Parameter>	Description		
<pas>	0	Ready	The g20 allows commands from the terminal
	1	Unavailable	The g20 does not allow commands from the terminal
	2	Unknown	The g20 is not guaranteed to respond to instructions
	3	Ringing (MT calls)	The g20 is ready for commands from the terminal, but the ringer is active
	4	Call in progress	The g20 is ready for commands from the terminal, but a call is in progress
	5	Asleep	The g20 is unable to process commands from the terminal as it is in a low functionality state

g18 backward compatibility <pas> supports values 0,3,4.

Note

Example

at+CPAS

+CPAS: 0

OK

at+CPAS=?

+CPAS: (0,2-4)

OK

at+CPAS?

+CPAS: 4

OK

AT+CPAS   //Voice call active state

+CPAS: 4

OK

4.3.4.2   +CLCC, List Current Calls

This command displays a list of all current g20 calls and their statuses, and also enables/disables the unsolicited indication of the call list. (If no calls are received, no information response is sent to the terminal.)

If the command succeeds but no calls are available, no information response is sent to the terminal.

The maximum number of simultaneous multiparty calls is 5+1 (5 in active group and 1 in hold).

On all platforms besides Telematics-enabled GSM platforms, this command responds with a +CME error indicating that the operation is not supported.

Set Command

The Set command enables/disables unsolicited indications.

Command	Response/Action
AT+CLCC=<state>	OK or: +CME ERROR: <err>

Execute Command

The Execute command enables the receiving of data about current calls.

Command	Response/Action
AT+CLCC	+CLCC: <idx>,<dir>,<call state>, <mode>, <mpty>[,<number>,<type>,<alpha>] [<CR><LF>+ CLCC: <idx>,<dir>,<call state>, <mode>,<mpty>[,<number>,<type>,<alpha>] […]] OK

Read Command

The Read command returns the call status.

Command	Response/Action
AT+CLCC?	+CLCC: <state> OK or: +CME ERROR <err>

Test Command

Command	Response/Action
AT+CLCC=?	+CLCC: (List of supported <state>s) OK or: +CME ERROR <err>

The following table shows the +CLCC parameters.

Table 30. +CLCC Parameters

<Parameter>	Description
<state>	0 Disable CLCC unsolicited indication 1 Enable CLCC unsolicited indication The default value is 0.
<idx>	Integer type, call identification number
<dir>	0 Mobile originated call (MO) 1 Mobile terminated call (MT)

Table 30. +CLCC Parameters *(Continued)*

<Parameter>	Description
<call state>	The state of the call 0 Active 1 Held 2 Dialing (MO call) 3 Alerting (MO call) 4 Incoming (MT call) 5 Waiting (MT call) 6 Released
<mode>	Bearer/Teleservice 0 Voice Call 1 Data 2 Fax
<mpty>	Multiparty status 0 Call is not part of a multiparty call 1 Call is one of multiparty call parties
<number>	Phone number in the format specified by <type>. Contains a string of up to 32 characters.
<type>	Phone number display format. Type of address octet in integer format (refer to GSM 04.08 [8] subclause 10.5.4.7) 129 Local number 145 International number with access character +
<alpha>	Text representation of the phone book entry. String type alphanumeric representation of <number> corresponding to the entry found in the phone book. Contains a string of up to 20 characters.

Note When a mobile-originated call is routed to PSTN (PABX), no ALERT indication is prompted.

Example

AT+CLCC=?

+CLCC: (0,1)

OK

AT+CLCC

+CLCC: 1,0,0,0,0,"01256316830",129,"Shmuel"

OK

AT+CLCC?

+CLCC: 0

OK

AT+CLCC=1   //Example with unsolicited indication

OK

ATD055490698;

OK

+CLCC: 1,0,2,0,0,"055490698",129,"Alpha"

+CLCC: 1,0,3,0,0,"055490698",129," Alpha "

OK

+CLCC: 1,0,0,0,0,"055490698",129," Alpha "

ATH

NO CARRIER

OK

+CLCC: 1,0,6,0,0,"055490698",129," Alpha "

4.3.5   Call Advice of Charge Commands

This set of commands enables GSM operators to offer Advice of Charge (AoC) services that calculate call charges. These charges are expressed in terms of home units.

4.3.5.1 +CAOC, Advice of Charge

This command displays information about the cost of calls. If supported, this command also activates/deactivates unsolicited event reporting of the CCM (Current Call Meter) information.

The unsolicited report +CCCM:<ccm> is sent when the CCM value changes, but not more than once every 10 seconds.

	The CCM value depends on the network properties (charge for MO or/and MT calls).
	There are two states in which the command can be activated:
Note	• In IDLE state - returns the last call cost.
	• In a voice/data state - returns the accumulated cost, including the current call.

Set Command

The Set command returns the CCM value from the g20, or activates/deactivates unsolicited reports.

Command	Response/Action
+CAOC=<mode>	OK or: [+CAOC:<ccm>] or: +CME ERROR:<err>

Read Command

The Read command returns the current CAOC mode.

Command	Response/Action
+CAOC?	+CAOC: <mode> OK
+CAOC	OK or: [+CAOC: <ccm>] or: +CME ERROR: <err>

Test Command

The Test command returns the supported mode values.

Command	Response/Action
+CAOC=?	+CAOC: (list of supported <mode>s) OK

The following table shows the +CAOC parameters.

Table 31. +CAOC Parameters

<Parameter>	Description
<mode>	0 Queries the CCM value 1 Deactivates unsolicited reporting of the CCM value 2 Activates unsolicited reporting of the CCM value

Note

<CCM>: String type value representing three bytes of the current call meter value in hexadecimal format (for example, "00001E" indicates decimal value 30).

Example

Example with prepaid SIM card with 56700.00L prepaid before the test.

at

OK

at+caoc=2

OK

atd+97254565190;

OK

OK

+CCCM: "000000"

+CCCM: "000006"

at+caoc

+CAOC: "000009"

OK

+CCCM: "00000e"

+CCCM: "000016"

at+caoc

+CAOC: "00001d"

OK

+CCCM: "00001e"

+CCCM: "000027"

at+caoc=0
+CAOC: "00002d"

OK
at+caoc=2
OK

+CCCM: "00003d"
at+caoc
+CAOC: "00003f"

OK

+CCCM: "000046"
at
+CCCM: "00004e"
+caoc
+CAOC: "00004f"

OK

+CCCM: "000056"
at+caoc
+CAOC: "00005d"

OK

+CCCM: "00005e"

NO CARRIER

at+caoc
+CAOC: "000066"

OK

//567 (prepaid SIM value) - 102 (price per call unit by provider) x 66 (call units) = 465 left in prepaid SIM

OK

There is now 46500.00L prepaid remaining on the SIM card.

Note

The above example shows first time activation of the AOC feature using the g20. Therefore, the accumulated cost is equal to the current call cost.

4.3.5.2   +CACM, Accumulated Call Meter

This command resets the Advice of Charge accumulated call meter value in the SIM file, EFACM. ACM contains the total number of home units for both the current call and preceding calls.

Refer to "+CAMM, Accumulated Call Meter Maximum", page 105.

Set Command

The Set command resets the accumulated call meter value. SIM PIN2 is required.

Command	Response/Action
+CACM=<passwd>	OK
	+CME ERROR: <err>

Read Command

The Read command displays the current value of ACM.

Command	Response/Action
+CACM?	+CACM: <acm>
	+CME ERROR: <err>

Test Command

The Test command indicates whether the +CACM command is functioning.

Command	Response/Action
+CAMM=?	OK

The following table shows the +CACM parameters.

Table 32. +CACM Parameters

<Parameter>	Description
<passwd>	SIM PIN2 password Maximum string length is 8 characters. If this value is exceeded, the command terminates in an error. If PIN2 is incorrect, "+CME ERROR: incorrect password" is displayed.
<acm>	Accumulated call meter maximum value (similar to CCM; Refer to "+CAOC, Advice of Charge", page 101). The default is 0. <ccm> String type; three bytes of the current call meter value in hexadecimal format (for example, 00001E indicates a decimal value of 30). Value is given in home units; bytes are similarly coded as the ACMmax value in the SIM.

Example

AT+CACM=?

OK

AT+CACM?

+CACM:"000000"

OK

AT+CACM="2222"

OK

4.3.5.3   +CAMM, Accumulated Call Meter Maximum

This command sets the Advice of Charge accumulated call meter maximum value in the SIM file, EFACMmax. ACMmax contains the maximum number of home units the subscriber is able to consume. When the ACM (Refer to "+CACM, Accumulated Call Meter", page 104) reaches ACMmax, additional calls (mobile-originated and mobile-terminated calls that incur charges) are prohibited, except for emergency calls. Refer to GSM 02.24.

Set Command

The Set command sets the accumulated call meter maximum value. SIM PIN2 is required. The value that is set remains after a power cycle.

Note

This command is activated if Advice of Charge is supported by the network.

Command	Response/Action
+CAMM=[<acmmax>,<passwd>]	OK +CME ERROR: <err>

Read Command

The Read command displays the current value of ACMmax.

Command	Response/Action
+CAMM?	+CAMM: <acmmax> +CME ERROR: <err>

Test Command

The Test command indicates whether the +CAMM command is functioning.

Command	Response/Action
+CAMM=?	OK

The following table shows the +CAMM parameters.

Table 33. +CAMM Parameters

<Parameter>	Description
<acmmax>	Accumulated call meter maximum value (similar to CCM; Refer to "+CAOC, Advice of Charge", page 101) <ccm> String type; three bytes of the current call meter value in hexadecimal format (for example, 00001E indicates a decimal value of 30). Value is given in home units; bytes are similarly coded as the ACMmax value in the SIM. Range is from 00001 to FFFFFF. 0 Disables ACMmax (default)
<passwd>	SIM PIN2 password Maximum string length is 8 characters. If this value is exceeded, the command terminates in an error. If PIN2 is incorrect, "+CME ERROR: incorrect password" is displayed.

Example

AT+CAMM=?

OK

AT+CAMM="FFFFFF","2222"

OK

AT+CAMM?

+CAMM: "FFFFFF"

OK

4.3.5.4 +CPUC, Price per Unit and Currency Table

This command sets the parameters of the Advice of Charge-related price per unit and currency table found in the SIM file, EFPUCT. PUCT information is used to convert the home units (used in +CAOC, +CACM and +CAMM) into currency units.

Set Command

The Set command sets the price per unit and the currency table. SIM PIN2 is required. The new value is retained after a power cycle.

Command	Response/Action
+CPUC=<currency>,<ppu>,<passwd>	OK +CME ERROR: <err>

Read Command

The Read command displays the current price per unit and currency table.

Command	Response/Action
+CPUC?	+CPUC: <currency>,<ppu> +CME ERROR: <err>

Test Command

The Test command indicates whether the +CPUC command is functioning.

Command	Response/Action
+CPUC=?	OK

The following table shows the +CPUC parameters.

Table 34. +CPUC Parameters

<Parameter>	Description
<currency>	Currency code character set (3 characters) defined by +CSCS command. (Refer to "+CSCS, Select Terminal Character Set", page 48.) If the string begins with an alphanumeric character, it may be entered with or without quotation marks, for example, "GBP", "DEM".
<ppu>	Price per unit A dot is used as a decimal separator (precision of 1/1000; 15 digit maximum), for example,"2.667". [See notes below]
<passwd>	SIM PIN2 password Maximum string length is 8 characters. If this value is exceeded, the command terminates in an error. If PIN2 is incorrect, "+CME ERROR: incorrect password" is displayed.

Example

AT+CPUC=?

OK

AT+CPUC="GBP","0.125","2222"

OK

AT+CPUC?

+CPUC: "GBP","0.125"

OK

Note

- If <ppu> contains a dot, a maximum of three digits may appear after the dot, otherwise an error is generated. For example, if <ppu>=0.61, the Read command displays 0.610. <ppu>=1.2345 terminates in an error.
- If <ppu> does not contain a dot, the number is divided by 1000. For example, if <ppu>=1, the Read command displays 0.001.
- Due to storage constraints, the <ppu> value is limited to a range of 0 to 4095. Values beyond this range may result in rounding errors. For example, if <ppu>=4095, the Read command displays 4.095. However, if <ppu>=4096, the Read command displays 4.090 (the last digit is replaced by 0). If <ppu>=456789, the Read command displays 456.000.

4.3.5.5   +CR, Service Reporting Control

This command controls whether or not the extended format of an outgoing call is displayed or not. The +CR indication is sent from the g20 to the terminal whenever a data call is initiated by the g20.

Set Command

The Set command enables/disables the extended format of an outgoing data call. When enabled, the outgoing data call is indicated to the terminal through the unsolicited result code +CR:<serv>. When the command is disabled, no +CR is sent to the terminal.

Command	Response/Action
+CR=[<mode>]	OK

Read Command

The Read command displays the current service reporting control setting.

Command	Response/Action
+CR?	+CR:<mode>

Test Command

The Test command displays the list of supported CR modes.

Command	Response/Action
+CR=?	+CR:<mode>

The following table shows the +CR parameters.

Table 35. +CR Parameters

<Parameter>	Description
<mode>	0 Extended format disabled (default) 1 Extended format enabled
<serv>	Type of outgoing data calls: ASYNC Asynchronous transparent SYNC Synchronous transparent REL ASYNC Asynchronous non-transparent REL SYNC Synchronous non-transparent

Examples

AT+CR=1   //Enable reporting

OK

ATD1234567890

+CR: REL ASYNC

4.3.6   Supplementary Services

This set of commands enables control over supplementary service notifications, including Structured and Unstructured Supplementary Service Data (USSD) data.

4.3.6.1   +CSSN, Supplementary Service Notifications

This command handles the enabling and disabling of supplementary service-related, network-initiated, notifications.

Set Command

The Set command enables/disables the display of notification result codes from the TA to the TE.

Command	Response/Action
+CSSN=[<n>[,<m>]]	OK +CME ERROR: <err>

When <n>=1 and a supplementary service notification is received after a mobile-originated call setup, the +CSSI: notification is sent to the TE before any other mobile-originated call setup result codes. When several different <code1>s are received from the network, each of them receives its own +CSSI result code.

When <m>=1 and a supplementary service notification is received during a mobile-terminated call setup or during a call, or when a forward check supplementary service notification is received, the unsolicited result code +CSSU: is sent to the TE. In case of a mobile-terminated call setup, a CSSU is sent after every +CLIP result code (Refer to "+CLIP, Calling Line Identification", page 70). When several different events are received from the network, each of them receives its own +CSSU result code.

> **Note**
>
> The values for <n> and <m> are not saved after power cycle.

Read Command

The Read command displays the current supplementary service notification setting.

Command	Response/Action
+CSSN?	+CSSN: <n>,<m>

Test Command

The Test command displays the list of supported CSSN values.

Command	Response/Action
+CSSN=?	+CSSN: (0-1), (0-1)

The following table shows the +CSSN parameters.

Table 36. +CSSN Parameters

<Parameter>	Description
<n>	Sets/displays the +CSSI result code presentation status in the TA. This value must be specified. 0 Disable (default) 1 Enable
<m>	Sets/displays the +CSSU result code presentation status in the TA. This value is optional, but cannot be specified without <n>. 0 Disable (default) 1 Enable

Table 37. +CSSI: Notification Values

Value	Description	g20 Support
0	Unconditional call forwarding is active	Yes
1	Some conditional call forwarding is active	Yes
2	Call has been forwarded	Yes (cannot be tested)
3	Call is waiting	Yes (GSM only)
4	CUG call (<index> is present)	Yes (cannot be tested)
5	Outgoing calls are barred	Yes
6	Incoming calls are barred	Yes (cannot be tested)
7	CLIR suppression rejected	Yes (cannot be tested)
8	Call has been deflected	No (not implemented)

Table 38. +CSSU: Notification Values

Value	Description	g20 Support
0	This is a forwarded call (mobile-terminated call setup).	Yes
1	CUG call (<index> is present; mobile-terminated call setup).	Yes (cannot be tested)
2	Call has been put on hold (during a voice call)	Yes
3	Call has been retrieved (during a voice call)	Yes
4	Multiparty call has been entered (during a voice call)	Yes
5	Call on hold has been released (during a voice call; not a supplementary service notification)	Yes
6	Forward check supplementary service message received (can be received at any time)	Yes (cannot be tested)
7	Call is being connected with the remote party in an alerted state using an explicit call transfer operation (during a voice call).	Yes (cannot be tested)
8	Call has been connected with the other remote party using an explicit call transfer operation (during a voice call or during mobile-terminated call setup). Number and subaddress parameters may be present: <number> String type phone number of format defined by <type> <type> Type of address octet in integer format (refer to GSM 04.08 [8], subclause 10.5.4.7) <subaddr> String type subaddress of format defined by <satype> <satype> Type of subaddress octet in integer format (refer to GSM 04.08 [8], subclause 10.5.4.8)	Yes (cannot be tested)
9	Deflected call (mobile-terminated call setup)	No (not implemented)

Examples

AT+cssn=?   // test command

+CSSN: (0-1),(0-1)

OK

AT+cssn=0,0   // disable both options

OK

AT+cssn=1,0   // set n value as enabled, m disabled

OK

AT+cssn?

+CSSN: 1,0   // display the current n & m values

OK

+CSSI: 1   // displayed after mobile originated call setup of call forward and n enable

+CSSU: 2   //displayed when a call has been placed on hold (during the call) using the +CHLD AT command and m enable

4.3.6.2   +CUSD, Unstructured Supplementary Service Data

This command allows control of Unstructured Supplementary Service Data (USSD), according to GSM 02.90. Mobile-initiated operations are supported.

Set Command

The Set command enables/disables the display of the following unsolicited result code, +CUSD: <m>[,<str>] (the USSD response from the network), to the TE. The new value is not retained after a power cycle.

Command	Response/Action
+CUSD=<n>[,<str>]	OK
	+CME ERROR: <err>

Read Command

The Read command displays the current value of <n>.

Command	Response/Action
+CUSD?	+CUSD: <n>
	+CME ERROR: <err>

Test Command

The Test command displays the supported values of <n>.

Command	Response/Action
+CUSD=?	+CUSD: (list of supported <n>s)
	+CME ERROR: <err>

The following table shows the +CUSD parameters.

Table 39. +CUSD Parameters

<Parameter>	Description
<n>	Sets/displays the result code presentation status of the g20. 0 Disable (default) 1 Enable
<str>	A USSD string that, when included, causes a mobile-initiated USSD string or response USSD string to be sent to the network. The response USSD string is returned in a subsequent unsolicited +CUSD result code. <str> starts with either "*" or "#". The maximum length is 200 characters, based on +CSCS. When <str> is not included, the network is not queried.
<m>	Whether further user action is required. 0 No further user action required (either network-initiated USSD-Notify, or no further information needed after a mobile-initiated operation) 1 Further user action required (either network-initiated USSD-Request, or further information needed after a mobile-initiated operation 2 USSD terminated by the network (the reason for the termination is indicated by the index, as described in Table 40)

Example

AT+CUSD=?

+CUSD: (0,1,2)

OK

AT+CUSD=1,"*#100#"OK

+CUSD: 2,26   //Response of the command <m>=2, reason = 26 (SIGNALING ERROR)

AT+CUSD?

+CUSD: 1

OK

Note

When the mobile-initiated operation is successful, the MS is implemented according to the required version. It waits for the USSD response from the network and then sends it to the TE before the final result code.

Table 40. CUSD Termination Cause Table Index

Termination Cause	Index
NO_CAUSE	0
CC_BUSY	1
PARAMETER_ERROR	2
INVALID_NUMBER	3
OUTGOING_CALL_BARRED	4
TOO_MANY_CALLS_ON_HOLD	5
NORMAL	6
DROPPED	10
NETWORK	12
INVALID_CALL_ID	13
NORMAL_CLEARING	14
TOO_MANY_ACTIVE_CALLS	16
UNASSIGNED_NUMBER	17
NO_ROUTE_TO_DEST	18
RESOURCE_UNAVAILABLE	19
CALL_BARRED	20
USER_BUSY	21

Table 40. CUSD Termination Cause Table Index *(Continued)*

Termination Cause	Index
NO_ANSWER	22
CALL_REJECTED	23
NUMBER_CHANGED	24
DEST_OUT_OF_ORDER	25
SIGNALING_ERROR	26
NETWORK_ERROR	27
NETWORK_BUSY	28
NOT_SUBSCRIBED	29
SERVICE_UNAVAILABLE	31
SERVICE_NOT_SUPPORTED	32
PREPAY_LIMIT_REACHED	33
INCOMPATIBLE_DEST	35
ACCESS_DENIED	43
FEATURE_NOT_AVAILABLE	45
WRONG_CALL_STATE	46
SIGNALING_TIMEOUT	47
MAX_MPTY_PARTICIPANTS_EXCEEDED	48
SYSTEM_FAILURE	49
DATA_MISSING	50
BASIC_SERVICE_NOT_PROVISIONED	51
ILLEGAL_SS_OPERATION	52
SS_INCOMPATIBILITY	53
SS_NOT_AVAILABLE	54
SS_SUBSCRIPTION_VIOLATION	55

Table 40. CUSD Termination Cause Table Index *(Continued)*

Termination Cause	Index
INCORRECT_PASSWORD	56
TOO_MANY_PASSWORD_ATTEMPTS	57
PASSWORD_REGISTRATION_FAILURE	58
ILLEGAL_EQUIPMENT	59
UNKNOWN_SUBSCRIBER	60
ILLEGAL_SUBSCRIBER	61
ABSENT_SUBSCRIBER	62
USSD_BUSY	63
CANNOT_TRANSFER_MPTY_CALL	65
BUSY_WITH_UNANSWERED_CALL	66
UNANSWERED_CALL_PENDING	68
USSD_CANCELED	69
PRE_EMPTION	70
OPERATION_NOT_ALLOWED	71
NO_FREE_BEARER_AVAILABLE	72
NBR_SN_EXCEEDED	73
NBR_USER_EXCEEDED	74
Call Control by SIM Causes	
NOT_ALLOWED_BY_CC	75
MODIFIED_TO_SS_BY_CC	76
MODIFIED_TO_CALL_BY_CC	77
CALL_MODIFIED_BY_CC	78
App. Cause	
FDN_FAILURE	90

4.3.6.3   +COLP, Connected Line Identification Presentation

This command relates to the GSM supplementary service called COLP (Connected Line Identification Presentation), which enables a calling subscriber to obtain the connected line identity (COL) of the called party after setting up a mobile-originated call with the g20. For example, after setting up a mobile-originated call to one number that is forwarded to another number, the calling party will see the number of that third party.

When this command is enabled (and the called subscriber permits it), the following intermediate result code is returned from the TA to the g20: +COLP: <number>,<type>[,<subaddr>,<satype>[,<alpha>]].

Note   This command is activated when COLP is supported by the network.

Set Command

The Set command enables/disables the display of the COL at the TE on the g20. It has no effect on the execution of the COLR supplementary service on the network.The value set by this command is not retained after a power cycle.

Command	Response/Action
+COLP=<n>	OK
	+CME ERROR: <err>

Read Command

The Read command displays the status of <n>. It also initiates a query of the COLP service provision status and displays <m>.

Command	Response/Action
+COLP?	+COLP: <n>,<m>
	+CME ERROR: <err>

Test Command

The Test command displays the supported values of <n>.

Command	Response/Action
+COLP=?	+COLP: (list of supported <n>s)
	+CME ERROR: <err>

The following table shows the +COLP parameters.

Table 41. +COLP Parameters

<Parameter>	Description
<n>	Sets/displays the result code presentation status of the g20. 0 Disable (default) 1 Enable
<m>	Displays the subscriber's COLP service status in the network. 0 COLP not provisioned 1 COLP provisioned 2 Unknown (for example, no network, and so on)
<number>	Sets the phone number, using the format specified by <type>.
<type>	Sets the address octet type in integer format (refer to GSM 04.08 [8] subclause 10.5.4.7). 129 Unknown 145 International (used when dialing string includes "+" international access code character)
<subaddr>	Sets the subaddress, using the format specified by <satype>.
<satype>	Sets the address octet type in integer format (refer to GSM 04.08 [8] subclause 10.5.4.8).
<alpha>	An optional, string-type, alphanumeric representation of <number> corresponding to the entry found in the phonebook. The character set is defined by +CSCS. (Refer to "+CSCS, Select Terminal Character Set", page 48.)

Example

At+colp=0

OK

At+colp=2

+CME ERROR "Numeric parameter out of bounds"

4.4   PHONE AND DATE BOOKS

4.4.1   Directory Access Commands

This set of commands enables read/write access to the phone book contained within the g20, including both the numeric and the alpha information contained in the location. The presentation is according to GSM 07.07.

In some cases, it may be possible to use these commands to access the dialed and received call stacks. However, as these phone books cannot be edited, the +CPBW command does not work on them.

4.4.1.1   +CPBS, Select Phone Book Memory

This command handles the selection of the memory to be used for reading and writing entries in the g20's phone books' memory. (When there is separate storage on the SIM card and in the g20's internal EEPROM).

Set Command

The Set command selects the phone book memory storage which is to be used by other phone book commands.

Command	Response/Action
AT+CPBS=<storage>	OK or: +CME ERROR: <err>

Read Command

The Read command returns the currently selected phone book memory, number of used entries and total number of entries in the phone book memory.

Command	Response/Action
+CPBS?	+CPBS: <storage>[,<used>,<total>]

Note

Read format of +CPBS joins RC and MC, therefore the united list will be prompted.

Test Command

Test command returns the supported storages as a compound value.

Command	Response/Action
+CPBS=?	+CPBS: (list of supported <storage>s) OK

The following table shows the +CPBS parameters.

Table 42. +CPBS Parameters

<Parameter>	Description
<storage>	List of supported phone books and their storage IDs FD SIM Fixed dialing phone book. LD SIM Last dialed phone book (the same as "DC"). MC g20 missed (unanswered received) calls list (+CPBW may not be applicable for this storage). ME g20 phone book. MT Combined g20 and SIM phone book. RC g20 received calls list (+CPBW may not be applicable for this storage). SM SIM phone book. DD Quick Dial phone book.
<used>	Integer type value indicating the number of used locations in the selected memory.
<total>	Integer type value indicating the total number of entries in the selected phone book memory.

Example

At+cpbs=?

+CPBS: ("FD","LD","ME","MI","SM","DD","RC","MC")

OK

At+cpbs?   //Read default <storage> after power up

+CPBS: "",000,000   //Before reading SIM

OK

+CPBS: "MT",<used>,<total>   //After reading SIM

OK

At+cpbs="MT"   //Select phone memory storage

OK

4.4.1.2   +CPBR, Read Phone Book Entries

This command recalls phone book entries from a specific entry number or from a range of entries. If only one entry is specified, and that entry is empty, OK is returned. If a range of entries is requested, all entries that contain data within that range are returned. If a listing fails in a g20 error, +CME ERROR: <err> is returned.

This command can also be used to obtain information about the number of entries and the maximum size of a phone number and alpha tag fields in the phone book.

This command acts on the currently active phone book, as selected with the +CPBS command (Refer to "+CPBS, Select Phone Book Memory", page 121.)

Set Command

The Set command returns phone book entries.

Command	Response/Action
+CPBR=<index1>[,<index2>]	[+CPBR: <index1>,<number>,<type>,<text> [<CR><LF> +CPBR: <index2>,<number>,<type>,<text>]] OK or: +CME ERROR: <err>

Test Command

The Test command returns the entry range supported by the current storage as a compound value and the maximum lengths of the <number> and <text> fields.

Command	Response/Action
+CPBR=?	+CPBR: (list of supported <index>s),[<nlength>], [<tlength>] OK

The following table shows the +CPBR Parameters.

Table 43. +CPBR Parameters

<Parameter>	Description
<index1> <index2>	Index for a given phone book entry
<number>	Phone number of a given entry

Table 43. +CPBR Parameters *(Continued)*

<Parameter>	Description
<type>	The address type of a phone number 129 Use for local call 145 Use "+" for international access code 128 Unknown Note that "128" is used to represent an email address or a mailing list. In this case, <ph_type> can be used to further differentiate between the two.
<text>	Text identifier for a phone book entry, according to the character set as specified by command +CSCS.
<nlength>	The maximum number of digits in the <number>.
<tlength>	The maximum number of characters in the <text> entry

Note   The MC and RC have the same memory storage area, therefore there are only 10 entries in total. Some of the entries are listed if the MC phone book is selected, and others are listed if the RC phone book is selected. The phone book selection is done using the AT+CPBS command.

Example

At+cpbs="ME"

OK

At+cpbr=?

+CPBR: (1-100,40,24)

OK

At+cpbr=1

OK

At+cpbr=1,3   //There is nothing written in entry 1,2,3

OK

At+cpbs="MT"

OK

At+cpbr=?

+CPBR: (1-350,40,24)

OK

At+cpbr=1,3

OK

At+cpbr=1,350

+CPBR: 101,"+97252999080",145,"Voice Mail"

OK

4.4.1.3   +MPBR, Read Extended Phone Book Entries

This command is similar to the +CPBR command, except that it returns several extra fields, including: phone type, voice tag and index, alert tone, backlight, indication of whether number is the primary number, category and profiling icon.

This command can also be used to obtain information about the number of locations and the maximum size of the phone number and alpha tag fields in the phone book.

Note	In mailing lists, the <number> field specifies a list of speed dial numbers corresponding to other phone book entries. These speed dial numbers cannot specify other mailing list entries. Each mailing list should have at least one speed dial number. Also, a non mailing list phone book entry can be a member of more than one mailing lists.

A mailing list is represented by a list of speed dial numbers separated by spaces. For a mailing list, only the following fields apply: <index>,<number>,<type>, <text>,<ph_type>,<voice_tag> and <category>. All the other fields are ignored.

Additionally, this command can be used to associate first name and last name attributes with the record. This data is used by SyncML.

This command acts on the currently active phone book, as selected with the +CPBS command (Refer to "+CPBS, Select Phone Book Memory", page 121).

Profiling icons, categories and mailing list features are not supported on all platforms.

In MODE 14, only the following fields apply: <index>, <number>, <type>, <text>, <ph_type> and <voice_tag>. All the other fields are ignored.

Some versions of this command return a boolean value for the voice tag indicating whether it is present. Other versions return a range (0-21) indicating its location.

Refer to the corresponding +MAID bits to determine the specific behavior for each of these features.

Set Command

Command	Response/Action
+MPBR=<index1>[,<index2>]	+MPBR: <index>,<number>,<type>,<text>, <ph_type>,<voice_tag>,<alert_tone>,<backlight>, <is_primary>,<category>, <profiling_icon>, <first_last_enabled>,<sub_field_index> [<CR><LF>+ MPBR=<index1>[,<index2>] +MPBR: <index>,<number>,<type>,<text>, <ph_type>,<voice_tag>,<alert_tone>,<backlight>, <is_primary>,<category>,<profiling_icon>, <first_last_enabled>,<sub_field_index> […]] OK

Test Command

Command	Response/Action
+MPBR=?	+MPBR: <index range>,<nlength>,<tlength>, <ptypes>,<voice tag range>,<email_length>, <dr_range>,<bl_range>,<is_primary_range>, <ctegory_range>,<icon_range>, <num_of_mailing_list_enteries>, <first_last_enabled_range>

The following table shows the +MPBR parameters.

Table 44. +MPBR Parameters

<Parameter>	Description
<index1> <index2>	Index for a given phone book entry.
<index range>	Range of phone book indexes.
<nlength>	Maximum size of a phone number, in digits.
<tlength>	Maximum number of characters in the <text> entry.
<ptypes>	Maximum number of allowed phone types
<voice_tag range>	Lists the range of valid values for <voice_tag>.
<email_length>	Maximum string length for the email address in the <number> field when phone type is "email".
<dr_range>	Range of distinctive ringer (alert) tones. This range only represents the valid (flexed) alert tones for the specific g20. Note that 255 is the setting for no ringer tone and is always present.
<bl_range>	Range of backlight styles.
<is_primary_range>	Lists the range of valid values for the <is_primary> field.
<category_range>	Lists the maximum range of phone book categories. 1 General category and default.
<icon_range>	Lists the range of pre-defined icons associated with the phone book entries. 255 Invalid icon and default.
<num_of_mailing_ list_entries>	Lists the maximum number of speed dial numbers in the <number> field when phone type is "mailing list".

Table 44. +MPBR Parameters *(Continued)*

<Parameter>	Description
<first_last_enabled_range>	Lists the range of valid values for the <first_last_enabled> field.
<number>	A phone number, unless: If ph_type is "Email", it is an Email address. If ph_type is "Mailing list", it is a set of speed dial numbers.

Example

AT+CPBS="ME"

OK

AT+MPBR=?   //Ring tones 0-31, 101-131, 255 flexed on

+MPBR: (1-79),32,20,8,0-21,50,(0-31,101-131,255),(0-2),(0-1),(1-30),(0-14,255),25,(0-1,255),0,(0)

OK

AT+MPBR=?   //Ring tones 1, 15, 20-30, 101-131, 255 flexed on

+MPBR: 1-79,32,20,8,0-21,50,(1,15,20-30,101-131,255),(0-2),(0-1),(1-30),(0-14,255),25,(0-1,255)

OK

AT+MPBR=?   //Ring tones 1, 255 flexed on

+MPBR: 1-79,32,20,8,0-21,50,(1,255),(0-2),(0-1),(1-30),(0-14,255),25,(0-1,255)

OK

AT+MPBR=?   //Ring tones 1, 3, 5, 7, 101, 255 flexed on

+MPBR: 1-79,32,20,8,0-21,50,(1,3,5,7,101,255),(0-2),(0-1),(1-30),(0-14,255),25,(0-1,255)

OK

AT+MPBR=21   //A mailing list "Friends" with 4 members and voice_tag set to 1 and category set to 3

+MPBR: 21,"1 2 5 10",128,"Friends",7,1,255,0,1,3,255,255,0

AT+MPBR=22   //A mailing list "Business" with 3 members and voice_tag set to 5 and category set to "General"

+MPBR: 22,"7 9 10",128,"Business",7,5,255,0,1,1,255,255,0

AT+MPBR=23   //Entry with "Clinton" with last name designation

+MPBR: 23,"18007598888",129,"Clinton",3,2,255,0,0,1,0,1,0

OK

AT+MPBR=1,20   //Entries without first name/last name information

+MPBR: 2,"8475767800",129,"Moto Voicemail",4,0,23,0,1,2,14,255,0

+MPBR: 10,"8475551212",129,"",1,1,6,0,1,1,255,255,0

OK

AT+MPBR=25   //Entry with first and last name information ("Clinton" is the last name)

+MPBR: 25,"18887598888",129,"George Clinton",3,2,255,0,0,1,0,0,7

OK

AT+MPBR=25   //Entry with first and last name information ("George" is the last name)

+MPBR: 25,"18887598888",129,"George Curious",3,2,255,0,0,1,0,1,7

OK

4.4.1.4   +CPBF, Find Phone Book Entries

This execution command enables the user to search for a particular entry, by name, in the currently active phone book. If no matching entry is found, the command returns OK. If multiple matches are found, all are returned.

Set Command

Command	Response/Action
+CPBF=\<findtext>	[+CPBF: \<index1>,\<number>,\<type>,\<text>[[...] \<CR>\<LF> +CBPF: \<index2>,\<number>,\<type>,\<text>]] OK or: +CME ERROR: \<err>

Test Command

Command	Response/Action
AT+CPBF=?	+CPBF: [\<nlength>],[\<tlength>] OK

The following table shows the +CPBF parameters.

Table 45. +CPBF Parameters

<Parameter>	Description
<findtext>	Case-sensitive text substring to search for, according to the character set specified by the +CSCS command.
<index1> <index2>	Index for a given phone book entry
<number>	Phone number of a given entry
<type>	The address type of a phone number 129 Use for local call 145 Use "+" for international access code 128 Unknown Note that "128" is used to represent an email address or a mailing list. In this case, <ph_type> can be used to further differentiate between the two.
<text>	Text identifier for a phone book entry that starts with the substring <findtext>, according to the character set as specified by command +CSCS.

Example

AT+CPBS="MT"   //Selecting phone book

OK

AT+CPBF="k"   //Searching for "k" and not finding it

OK

AT+CPBF="Voice"   //Searching for string "Voice" and finding Voice Mail

+CPBF: 101,"+97252999080",145,"Voice Mail"

OK

AT+CPBF=""   //Searching for everything in phone book, and finding nothing

OK

AT+CPBF="Moto"

+CPBF: 2,"8475767800",129,"Moto Voicemail"

4.4.1.5   +MPBF, Find Extended Phone Book Entries

This command is similar to +CPBF, except that it also returns the extra fields that are unique to Motorola phones. These fields include the phone type, voice tag, alert tone, backlight, is_primary field, category and profiling icon, as described in Table 46, below.

Set Command

Command	Response/Action
+MPBF=<findtext>	+MPBF: <index>,<number>,<type>,<text>, <ph_type>,<voice_tag>,<alert_tone>,<backlight>, <is_primary>,<category>, <profiling_icon>, <first_last_enabled>,<sub_field_index> [<CR><LF>+MPBF=<findtext> +MPBF: <index>, <number>, <type>,<text>,<ph_type>,<voice_tag>, <alert_tone>,<backlight>,<is_primary>,<category>, <profiling_icon>,<first_last_enabled>, <sub_field_index> [...]] OK or +CME ERROR: <err>

The following table shows the +MPBF parameters.

Table 46. +MPBF Parameters

<Parameter>	Description
<findtext>	Text identifier for a phone book entry, according to the character set as specified by command +CSCS.
<index>	Index for a given phone book entry
<number>	Phone number of a given entry
<type>	The address type of a phone number 129　Use for local call 145　Use "+" for international access code 128　Unknown Note that "128" is used to represent an email address or a mailing list. In this case, <ph_type> can be used to further differentiate between the two.
<ph_type>	Type of phone number to be stored in the entry: 0　Work 1　Home 2　Main 3　Mobile 4　Fax 5　Pager 6　Email 7　Mailing list

Table 46. +MPBF Parameters *(Continued)*

<Parameter>	Description
<voice_tag>	Voice tag index associated with a phone book entry 0 Invalid voice tag 1-21 Valid voice tag The range upper bound is a variable. +MPBR=? should be used to determine the upper bound.
<alert_tone>	The distinctive alert tone style that represents the number of the originator of an incoming call 255 Invalid alert tone entry indicating that no ringer is set
<backlight>	This field is reserved to support future implementation of the backlight feature
<is_primary>	Indicates whether the number is the primary number for the user 0 Non-primary number 1 Primary number
<profiling_icon>	Indicates the index of the icon associated with the phone book entry 0-14 Valid pre-defined icons 255 Invalid icon
<category>	Category associated with the phone book entry. 1-30 Number of categories that can be defined. Maximum number of categories is 30. The default value is 1.
<first_last_enabled>	This field determines whether the phone book record contains information about the split between the first name and the last name. 0 Second sub-field is the last (family) name. 1 Second sub-field in <text> is the first (given) name. 255 Record does not contain information about the first name and last name fields.
<sub_field_index>	A zero based index pointing to the first character in the second subfield. 0 First sub-field does not exist. If the <first_last_enabled> field is 255, then the value in this field is ignored. The second sub-field is defined as all characters following the first sub-field.

Example

AT+CPBS="MT"

OK

AT+MPBF="Moto"

+MPBF: 2,"8475767800",129,"Moto",3,

OK

AT+MPBF=""   //Example of searching for everything in the phonebook and finding nothing (no data in g20)

+MPBF:102,"01234567890",129,"Motorola",8,0,255,0,0,1,255,255,0,"""""",0,0

4.4.1.6   +CPBW, Write Phone Book Entry

This command enables the user to store a new entry in the phone book, or edit/delete an existing entry from the phone book. A particular entry in the phone book can be stored, or the next available entry is used.

This command writes the entry in the currently active phone book, selected with the +CPBS command (Refer to "+CPBS, Select Phone Book Memory", page 121). The entry is selected by <index>, the phone number is entered into the <number> field and text associated with the number is entered into the <text> field. If these fields are omitted, the phone book entry is deleted. If the <index> field is omitted, but a number is entered in the <number> field, the phone number is entered into the first available entry in the phone book. If the writing fails in a g20 error, +CME ERROR: <err> is returned.

In the case of SIM storage, the length of the field may not be available. If the g20 is not currently reachable, +CME ERROR: <err> is returned. If the storage does not offer format information, the format list should not have parentheses.

Note

The "FD" phone book supports single wild card characters (?) in the telephone number. In cases of fixed dialing, this entry in the "FD" phone book defines a group of permitted numbers.

Call indications related to a fixed dialing entry containing wild cards do not display any <alpha> identifier.

Set Command

Command	Response/Action
AT+CPBW=[<index>][,<number>[,<type>[,<text>]]]	OK or: +CME ERROR: <err>

Test Command

This command queries the allowable command field and sizes.

Command	Response/Action
AT+CPBW=?	+CPBW: (list of supported <index>s),[<nlength>], (list of supported <type>s),[<tlength>] OK

The following table shows the +CPBW parameters.

Table 47. +CPBW Parameters

\<Parameter\>	Description
\<index\>	Index for a given phone book entry
\<number\>	Phone number of a given entry
\<type\>	The address type of a phone number 129 Use for local call 145 Use "+" for international access code 128 Unknown Note that "128" is used to represent an email address or a mailing list. In this case, \<ph_type\> can be used to further differentiate between the two.
\<text\>	Text identifier for a phone book entry, according to the character set as specified by command +CSCS.
\<nlength\>	The maximum size of a phone number, in digits. There is a limited number of PB records that can be stored with this length. The number of "long" PB records depends on the size of the SIM card EXT1 extension file. If the extension file is full, an attempt to store a new record with more than 20 digits returns an error.
\<tlength\>	The maximum number of characters in the \<text\> entry

Example

At+cpbs="MT"

OK

At+cpbw=?

+CPBW: (1-350),40,(129,145),16

OK

AT+cpbw=92,"+123456",145,"Test"

OK

AT+cpbr=92

+CPBR: 92,"+123456",145,"Test"

OK

AT+CPBW=,"8005551212",129,"Sam Spade"   //Store information in first available location

OK

AT+CPBW=21   //Erase location 21

OK

AT+CPBS="FD"   //Select "FD" phone book

OK

AT+CLCK="FD",1,"1111"   //Setup fixed dialing

OK

AT+CLCK="FD",0,"1111"   //Unsetup fixed dialing

OK

AT+CPBW=1,"03565??05",129,"Motorola Internal"

OK

AT+CLCK="FD",1,"1111"   //Setup fixed dialing

OK

ATD035659405;   //Successful call

OK

ATD035652305;   //Successful call

OK

ATD035651805;   //Successful call

OK

ATD035659406;   //Call rejected

+CME ERROR: operation not allowed

4.4.1.7   +MPBW, Write Extended Phone Book Entry

This command enables the user to store a new entry in the phone book, or to delete an existing entry from the phone book. An entry can be stored in a particular location in the phone book, or in the next available location.

This command differs from the GSM 07.07 "+CPBW" command in that it accepts the input from several extra fields, including phone type, voice tag and index, alert tone, backlight, is_primary field, category and profiling icon.

Additionally, this command can be used to associate the first name and last name attributes with the record. This data is used by SyncML.

> **Note**
>
> In mailing lists, the <number> field specifies a list of speed dial numbers corresponding to other phone book entries. Refer to "+MPBR, Read Extended Phone Book Entries", page 125, for further details.

In mailing lists, only the following fields apply: <index>,<number>,<type>, <text>, <ph_type>,<voice_tag> and <category>. All the other fields are ignored.

Email addresses cannot contain the `#' character.

Profiling icons, categories and mailing list features are not supported on all platforms.

Some versions of this command return a boolean value for the voice tag indicating whether it is present or not. Other versions return a range (0-21) indicating its location.

Refer to the corresponding +MAID bits to determine specific behaviors for each of these features on different implementations.

Set Command

Command	Response/Action
+MPBW=[<index>][,<number> [,<type>[,<text>[,<ph_type> [, <voice_tag>[,<alert_tone> [,<backlight>[,<is_primary> [,<category>[,<profiling_icon> [,<first_last_enabled>, <sub_field_index>]]]]]]]]]]]	OK or: CME ERROR.

The following table shows the +MPBW parameters.

Table 48. +MPBW Parameters

<Parameter>	Description
<index>	Index for a given phone book entry
<index range>	Range of phone book indices
<number>	A phone number, unless: If ph_type is "Email", it is an Email address. If ph_type is "Mailing list", it is a set of speed dial numbers.
<type>	The address type of a phone number 129 Use for local call 145 Use "+" for international access code 128 Unknown Note that "128" is used to represent an email address or a mailing list. In this case, <ph_type> can be used to further differentiate between the two.
<text>	Text identifier for a phone book entry, according to the character set as specified by command +CSCS.
<ph_type>	Type of phone number to be stored in the entry: 0 Work 1 Home 2 Main 3 Mobile 4 Fax 5 Pager 6 Email 7 Mailing list

Table 48. +MPBW Parameters *(Continued)*

<Parameter>	Description
<voice_tag>	Voice tag index associated with a phone book entry 0 Invalid voice tag 1-21 Valid voice tag The range upper bound is a variable. +MPBR=? should be used to determine the upper bound.
<alert_tone>	The distinctive alert tone style that represents the number of the originator of an incoming call 255 Invalid alert tone entry indicating that no ringer is set
<backlight>	This field is reserved to support future implementation of the backlight feature
<is_primary>	Indicates whether the number is the primary number for the user 0 Non-primary number 1 Primary number
<profiling_icon>	Indicates the index of the icon associated with the phone book entry 0-14 Valid pre-defined icons 255 Invalid icon
<category>	Category associated with the phone book entry. 1-30 Number of categories that can be defined. Maximum number of categories is 30. The default value is 1.
<first_last_ enabled>	This field determines whether the phone book record contains information about the split between the first name and the last name. 0 Second sub-field is the last (family) name. 1 Second sub-field in <text> is the first (given) name. 255 Record does not contain information about the first name and last name fields.
<sub_field_ index>	A zero based index pointing to the first character in the second subfield. 0 First sub-field does not exist. If the <first_last_enabled> field is 255, then the value in this field is ignored. The second sub-field is defined as all characters following the first sub-field.

Example

AT+CPBS="MT"

OK

AT+MPBW=,"8005551212",129,"Sam Spade",2,3,0,1,1,3,0,0,4 //Store the primary number for user "Sam Spade" in first available location and provide first name/last name information ("Spade" is the last name)

OK

AT+MPBW=12,"+5551212",145,"Sam Spade",0,0,12,0,0,1,255,255,0 //Store the non-primary number for user "Sam Spade" in index 12 and omit first name/last name information

OK

AT+MPBW=15,"2345678",129,"Matt",0,0,12,0,0,1,255,1,0 //Store the non-primary number for user "Matt" in index 15 and provide first name/last name information ("Matt" is the first name)

OK

AT+MPBW=16,"7891011",129,"Smith",0,0,12,0,0,1,255,0,0 //Store the non-primary number for user "Smith" in index 16 and provide first name/last name information ("Smith" is the last name)

OK

AT+MPBW=20,"1 3 5 12",128,"Friends",7,1,255,0,0,3 //Store a mailing list "Friends" in index 20 and provide the fields that apply

AT+MPBW=21 //Erase location 21

OK

4.4.1.8 +CSVM, Set Voice Mail Server

This command handles the selection of the number to the voice mail server. The new value should also remain after power cycle.

Set Command

The Set command sets the number to the voice mail server.

Command	Response/Action
+CSVM=<mode>[,<number>[,<type>]]	OK +CME ERROR: <err>

Read Command

The Read command displays the currently selected voice mail number and status (enabled or disabled).

Command	Response/Action
+CSVM?	+CSVM:<mode>,<number>,<type> +CME ERROR: <err>

Test Command

The Test command displays the list of supported <mode>s and <type>s.

Command	Response/Action
+CSVM=?	+CSVM: (list of supported <mode>s), (list of supported <type>s) +CME ERROR: <err>

The following table shows the +CSVM parameters.

Table 49. +CSVM Parameters

<Parameter>	Description
<mode>	0 Disables the voice mail number (default) 1 Enables the voice mail number
<number>	Voice mail number in string. String can be up to 32 characters long, starting with a digit, or "+" or "*". Allowed characters are (0..9, +,#,,,).
<type>	Address octet type. 129 ISDN/telephony marketing plan; national/ international number unknown 145 ISDN/telephony numbering plan; international number When the dialing string includes the international access code character (+), the default is 145. Otherwise, the default <type> is 129.

Note

If <mode> is set to 0, <number> and <type> are ignored. If <mode> is set to 1, <number> is mandatory.

Example

AT+CSVM=?

+CSVM: (0,1),(129,145)

OK

AT+CSVM=1,"+972555123456","145"

OK

AT+CSVM?

+CSVM: 1,"972555123456",145

OK

4.4.1.9 +MFS, Motorola Frequency of Search

This command is used to determine how long the g20 waits before attempting to reregister after a registration attempt has failed and the g20 is not registered. The available settings are Slow Search, Medium Search, Fast Search or Continuous Search.

See Table 50, "+MFS Parameters", for the minimum interval lengths for every frequency of search. The interval between attempts can vary, depending on the number of operators displayed in the preferred operator list.

This command sets or reads Frequency of Search and Search mode settings. After a Set command has been executed, new Frequency of Search and Search mode values are active.

This command is a non-basic command, which means that the g20 module rejects the command with an appropriate error message when the SIM is not present and/or the phone is in lock state.

Set Command

This command enables you to change and store in Flex the new values of Frequency of Search <freq> and Search mode <mode>.

If only the <freq> value is given, then the Set command is interpreted as follows:

• Store new <freq> value. The <mode> value remains unchanged.

If <freq> and <mode> values are given, then the Set command is interpreted as follows:

• Store new <freq> and <mode> values.

Otherwise, an error message is sent to the DTE.

> If the phone is not registered, then a set operation of Search mode to Manual is refused and ERROR is sent to the DTE.

Note

Command	Response/Action
+MFS=<freq> [,<mode>]	OK or: +CME ERROR: <err>

Read Command

The Read command returns the current settings for values of <freq> and <mode>.

Command	Response/Action
+MFS?	+MFS: <freq>,<mode> OK or: +CME ERROR: <err>

Test Command

The Test command returns the possible <freq> and <mode> values.

Command	Response/Action
+MFS=?	+MFS: (List of supported <freq>,(List of supported <mode>s) OK or: +CME ERROR: <err>

The following table shows the +MFS parameters.

Table 50. +MFS Parameters

<Parameter>	Description
<freq>	This value defines the frequency of search. 0 Continuous. Minimum interval between subsequent search attempts is 1 second. 1 Medium. Minimum interval between subsequent search attempts is 10 seconds. 2 Slow. Minimum interval between subsequent search attempts is 30 seconds. 3 Fast. Minimum interval between subsequent search attempts is 5 seconds. The default value is already stored in NVM (FLEX) and thus is flex dependent.

Table 50. +MFS Parameters *(Continued)*

<Parameter>	Description
<mode>	This value defines the search mode. The mode defines whether network selection and registration are performed automatically by the g20, or whether the selection is forced to the specific operator to which the g20 is registered to at a given moment. 0 Automatic 1 Manual The default value is already stored in NVM (FLEX) and thus is flex-dependent.

Example

at+mfs=?   //Test command

+MFS: (0-3),(0,1)

OK

at+mfs?   //Read command

+MFS: 1,0

OK

at+mfs=3   //Set only Frequency of search

OK

at+mfs?

+MFS: 3,0

OK

at+mfs=2,1   //Set Frequency of search and search mode.

OK

at+mfs?

+MFS: 2,1

                                //POWER CYCLE phone

at+mfs?   //Previous values restored after power up.

+MFS: 2,1

OK

at+mfs=0

OK

at+mfs?

+MFS: 0,1

OK

4.4.1.10   +MDSI, Motorola Deactivate SIM Card Indication

This command enables unsolicited reporting of indications of SIM deactivation and invalidation. The indications include the cause for deactivation and invalidation.

This command is a basic command, which means the g20 module should accept the command and act according to received parameters regardless of SIM presence and phone lock state.

In MUX mode, this AT command is allowed on DLC2 only.

Set Command

Command	Response/Action
+MDSI=<mode>	When mode is 1 and SIM was invalidated or deactivated: [+MDSI: <type>, <cause>, <type text>, <cause text>] OK +CME ERROR: <err>

The table below defines mode values for the Set command.

<mode> = 1	Defines that unsolicited +MDSI messages will be sent to the DTE. If the SIM card was invalidated or deactivated, the current status will be sent to the DTE.
<mode> = 0	No unsolicited message is sent to the DTE.

Read Command

The Read command queries the current settings for <mode>.

Command	Response/Action
+MDSI?	+MDSI: <mode> OK +CME ERROR: <err>

Test Command

The Test command returns the possible <mode> values.

Command	Response/Action
+MDSI=?	+MDSI: (list of supported <mode>s) OK +CME ERROR: <err>

The following table shows the +MDSI parameters.

Table 51. +MDSI Parameters

<Parameter>	Description
<mode>	0 Unsolicited indications off 1 Unsolicited indications on
<type>, <type text>	0 "DEACTIVATE". SIM deactivate request was sent with <cause> 1 "GSM". Invalidate SIM for GSM services was sent with <cause> 2 "GPRS". Invalidate SIM for GPRS services was sent with <cause>
<cause>, <cause text>	<cause> and <cause text> related to <type> = 0 ("DEACTIVATE"): 0 "SIM card power-off" 1 "Bad SIM" <cause> and <cause text> related to <type> = 1 ("GSM") and <type> = 2 ("GPRS"): 0 "No reject cause" 2 "IMSI unknown in HLR" 3 "Illegal MS" 4 "IMSI unknown in VLR" 6 "Illegal ME" 7 "GPRS service not allowed" 8 "GPRS and non-GPRS services not allowed" 9 "MS identity cannot be derived by the network" 11 "PLMN not allowed" 12 "Location area not allowed" 13 "Roaming not allowed in this location area" 14 "GPRS services not allowed in this PLMN" 240 "Location update failure" 241 "Combined LU failure" 242 "Authentication and ciphering reject" 243 "Authentication reject" 244 "Attach failure"

Example

at+mdsi?

+MDSI: 0

OK

at+mdsi=?

+MDSI: (000,001)

OK

at+mdsi=1

OK

          //Until now there was no deactivation or invalidation of SIM card.

at+mdsi?

+MDSI: 1

OK

          //SIM card does not support GPRS

+MDSI: 2, 7, "GPRS", "GPRS services not allowed"

          //Insert a SIM card that is no longer subscribed

at+cpin="1764"

OK

at+cops=0

OK

          //Unsolicited messages

+MDSI: 1, 2, "GSM", "IMSI unknown in HLR"

+MDSI: 0, 1, "DEACTIVATE", "Bad SIM"

          // Insert a good SIM card, and roam to a NW that doesn't have a
          GPRS roaming agreement.

//Unsolicited messages

+MDSI: 2, 14, "GPRS", "GPRS services not allowed in this PLMN"

at+cgatt?

+CGATT: 0

OK

4.4.1.11   +MCSN, Motorola Change Subscriber Number

This AT command sets EFmsisdn in the SIM. The setting is placed in the given <index>, using <number> and <alpha> as the values to be set.

Additionally, when setting the number in a specific storage space, the <mode> parameter defines whether that <number> and corresponding <alpha>should be presented after entering the correct PIN number.

After entering the correct PIN number, the last <index>, whose <mode> was set to 1, is sent to the DTE. This indication is unsolicited and appears when SIM information is ready.

Note	At any given time, only one <index> or no <index> can have <mode> = 1. Therefore, setting <mode> = 1 for one of the supported <index>es implicitly means that all other <index>es have <mode> = 0.

Set Command

The Set command sets EFmsisdn in the SIM. The setting is placed in the given <index>, using <number> and <alpha> as the values to be set.

If only the <mode> value is given, then the Set command is interpreted as follows:

<mode> = 0	Do not show any number on next +CPIN insertion command
<mode> = 1	Default <index> (equals 1) is set to <mode> = 1

If only a pair of <mode> and <index> values are given, then the Set command is interpreted as follows:

<mode> = 0, <index> = any valid index	Set mode for given index to 0
<mode> = 1, <index> = any valid index	Set mode for given index to 1

If only <mode>, <index> and <number> values are given, then the Set command is interpreted as follows:

• Store in <index> of EFmsisdn in the SIM, the <number>. Since no <alpha> was given, corresponding <alpha> will be identical to the <alpha> already stored in this <index>. Also store the <mode> value for this <index>.

If all parameters are given, then the Set command is interpreted as follows:

• Store in <index> of EFmsisdn in the SIM, the <number> and corresponding <alpha>. In case an empty string was given as the <alpha> parameter, the corresponding <alpha> will be an empty string. Also store the <mode> value for this <index>.

Note Only the last <index> whose mode was set to 1 will be sent to the DTE.

Command	Response/Action
+MCSN=<mode> [,<index>[,<number>[,<alpha>]]]	OK or: +CME ERROR: <err>

Read Command

The Read command queries the current settings for the <index> of the storage place in which the <mode> is equal to 1. If no index has its <mode> set to 1, then the response <index> will be equal to 0.

Command	Response/Action
+MCSN?	+MCSN: <index> OK or: +CME ERROR: <err>

Test Command

The Test command returns the possible <mode> and <index> values.

Command	Response/Action
+MCSN=?	+MCSN: (list of supported <mode>s),(list of supported <index>es) OK or: +CME ERROR: <err>

The following table shows the +MCSN parameters.

Table 52. +MCSN Parameters

<Parameter>	Description
<mode>	This value defines whether <number> and corresponding <alpha> tag are presented after entering a correct PIN number. 0 Do not show <number> and <alpha> in <index> after entering correct PIN number 1 Show <number> and <alpha> in <index> after entering correct PIN number The default value is 0 (before MCSN has been set for the first time.
<index>	An integer value between 1 and 5 representing the storage place in EFmsisdn in the SIM. 1 - 5 Index of the storage place The default value is 1. **Note:** The number of records in EFmsisdn is SIM-dependent and can be less than 5.
<number>	Phone number to set in the phonebook. The string type representing the phone number is written within double quotes. Valid input characters are: 0-9 and + (at start only) The number of digits the <number> parameter is built of can vary from a minimum of 0 to a maximum of 20 digits.
<alpha>	Text related to <number>. The string type text associated with the phone number is written within double quotes. The character set used for text is the one selected by the command Select TE Character Set (AT+CSCS). The number of characters comprising the <alpha> parameter can vary from a minimum of 0 to a maximum of 14.

Example

at+cnum   // Reading EFmsisdn from the SIM

+CNUM: "","",0

+CNUM: "","",0

+CNUM: "","",0

+CNUM: "","",0

+CNUM: "","",0

OK

at+mcsn=1,1,"054444444","VOICE"   // Setting record 1 in EFmsisdn in the SIM

                                             // Enable unsolicited indication

OK

at+mcsn=0,2,"039999999","OFFICE"   // Setting record 2 in EFmsisdn in the SIM

OK

at+mcsn=0,3,"1111","PIN1"   // Setting record 3 in EFmsisdn in the SIM

OK

at+mcsn=0,4,"8523","PIN2"   // Setting record 4 in EFmsisdn in the SIM

OK

at+cnum   // Reading EFmsisdn from the SIM

+CNUM: "VOICE","054444444",129

+CNUM: "OFFICE","039999999",129

+CNUM: "PIN1","1111",129

+CNUM: "PIN2","8523",129

+CNUM: "","",0

OK

at+mcsn?

+MCSN: 1

OK

// Restart Phone

at+cpin="1111"

OK

// Unsolicited information of record 1 in EFmsisdn in the SIM

+MCSN: "VOICE","054444444"

at+mcsn=0   // Disable unsolicited indication

OK

// Restart Phone

at+cpin="1111"

OK

at+mcsn=0,3,,"ada"

ERROR

at+mcsn=0,3,"3456346"   // Update the \<number\> of record 3 same \<alpha\>

OK

at+cnum   // Reading EFmsisdn from the SIM

+CNUM: "VOICE","054444444",129

+CNUM: "OFFICE","039999999",129

+CNUM: "PIN1","3456346",129

+CNUM: "PIN2","8523",129

+CNUM: "","",0

OK

at+mcsn=0,3,"","FAX"   // Update the \<alpha\> of record 3 same \<number\>

OK

at+cnum   // Reading EFmsisdn from the SIM

+CNUM: "VOICE","054444444",129

+CNUM: "OFFICE","039999999",129

+CNUM: "FAX","",0

+CNUM: "PIN2","8523",129

+CNUM: "","",0

OK

at+mcsn=0,3,"",""   // Resetting record 3 in EFmsisdn in the SIM

OK

at+cnum   // Reading EFmsisdn from the SIM

+CNUM: "VOICE","054444444",129

+CNUM: "OFFICE","039999999",129

+CNUM: "","",0

+CNUM: "PIN2","8523",129

+CNUM: "","",0

OK

4.4.1.12   +MPDPM, Motorola Phonebook Dynamic Percentage Memory

This command returns the collective percentage of memory used by the phonebook and datebook in their shared dynamic memory storage. A single percentage value is returned representing the combined percentage used by both the phonebook and datebook.

Read Command

The Read command queries the current (combined) percentage used by the phonebook and datebook in their shared dynamic memory storage.

Command	Response/Action
+MPDPM?	+MPDPM: <n> OK or: +CME ERROR: <err>

The following table shows the +MPDPM parameters.

Table 53. +MPDPM Parameters

<Parameter>	Description
<n>	The percentage of memory used together by both the phonebook and datebook in their shared dynamic memory storage.

Example

AT+mpdpm?

+MPDPM: 0

OK

at+cpbs="mt"

OK

at+cpbr=?

+CPBR: (001-350),040,016

OK

at+cpbr=1,100

OK

at+cpbw=,"035658020",129,"Phone0"

OK

at+cpbw=,"035658021",129,"Phone1"

OK

at+cpbw=,"035658022",129,"Phone2"

OK

at+cpbw=,"035658023",129,"Phone3"

 OK

at+cpbw=,"035658024",129,"Phone4"

OK

at+cpbw=,"035658025",129,"Phone5"

OK

at+cpbw=,"035658026",129,"Phone6"

OK

at+cpbw=,"035658027",129,"Phone7"

OK

at+cpbw=,"035658028",129,"Phone8"

OK

at+cpbw=,"035658029",129,"Phone9"

OK

at+cpbw=,"035658030",129,"Phone10"

OK

AT+mpdpm?

+MPDPM: 2

OK

4.4.2   Date Book Access Commands

This set of commands enables read/write access to the date book contained in the g20. These commands are optional, and are only supported if the g20 offers date book operations.

4.4.2.1   +MDBL, Lock/Unlock Date Book

This command locks/unlocks the date book database. It is used primarily to synchronize the date book with PIM (Personal Information Management) software.

Set Command

The set command forces a lock/unlock of the date book database.

Command	Response/Action
+MDBL=<n>	OK or: +CME ERROR: <err>

Read Command

The Read command returns the current date book lock/unlock status.

Command	Response/Action
+MDBL?	MDBL: <n>

Test Command

The Test command returns the current lock/unlock settings.

Command	Response/Action
+MDBL=?	MDBL: <n>

The following table shows the +MDBL parameters.

Table 54. +MDBL Parameters

<Parameter>	Description
<n>	0 Unlock date book 1 Lock date book

Example

AT+MDBL=?

+MDBL: (0-1)

OK

AT+MDBL=1

OK

AT+MDBL?

+MDBL: 1

4.4.2.2   +MDBR, Read Date Book Entry

This command reads an entry or range of entries stored in the date book.

Set Command

The set command returns an entry or a range of entries.

Command	Response/Action
+MDBR=<i1>[,<i2>]	+MDBR:<i>,<ev_title>,<timed>,<al_en>,<start_time>, <start_date>,<duration>,<al_time>,<al_date>, <repeat>

Test Command

The Test command returns all the pertinent date book parameters required for the PIM software.

Command	Response/Action
+MDBR=?	+MDBR: <entries>,<used>,<strlen>,<ex_max>, <ex_type_max>

The following table shows the +MDBR parameters.

Table 55. +MDBR Parameters

<Parameter>	Description
<i1>,<i2>	Entry or range of entries (integer format)
<entries>	Total number of datebook entries
<used>	Number of entries currently used
<strlen>	Maximum string length of event title
<ex_max>	Maximum number of event exceptions
<ex_type_max>	Maximum number of event exception types
<i>	Entry index Event index
<ev_title>	Text representing the event title
<timed>	0 Alarm not timed 1 Alarm timed
<al_en>	0 Alarm disabled 1 Alarm enabled

Table 55. +MDBR Parameters *(Continued)*

<Parameter>	Description
<start_time>	Event start time
<start_date>	Event start date
<duration>	Event duration, in minutes
<al_time>	Event alarm time
<al_date>	Event alarm date
<repeat>	0 Non-recurring event 1 Repeat daily 2 Repeat weekly 3 Repeat monthly on date 4 Repeat monthly on day 5 Repeat yearly
<ex_no>	Occurrence of event (0 = first)
<ex_type>	Type of event exception
<1>	Remove occurrence <ex_no> only

Example

AT+MDBR=?

+MDBR: 375,12,64,64,1

OK

4.4.2.3   +MDBAD, Date Book Auto Delete User Preference

This command sets/reads the auto-delete user preference setting in the date book database. The setting controls the length of time that date book records are stored after the event has occurred, and the length of time that the To Do list items are stored once they have been completed, or are overdue.

Set Command

The Set command sets the auto-delete value.

Command	Response/Action
+MDBAD=<n>	Ok or: +CME ERROR: <err>

Read Command

The Read command returns the current auto-delete setting.

Command	Response/Action
+MDBAD?	MDBAD: <n>

Test Command

The Test command returns the possible +MDBAD settings.

Command	Response/Action
+MDBAD=?	MDBAD: (list of supported <n>s)

The following table shows the +MDBAD parameters.

Table 56. +MDBAD Parameters

<Parameter>	Description
<n>	The number of weeks to wait before auto-deleting records 0 Never auto-delete this record 1 Auto-delete after one week 2 Auto-delete after two weeks 4 Auto-delete after four weeks 8 Auto-delete after eight weeks

Example

AT+MDBAD=?

+MDBAD: (0,1,2,4,8)

OK

AT+MDBAD=1

OK

AT+MDBAD?

+MDBAD: 1

OK

4.4.3   System Date and Time Access Commands

4.4.3.1   +CCLK, Read/Set System Date and Time

This command reads/sets the g20's current date and time settings. It is compliant with the GSM 07.07 Specification's +CCLK command.

Set Command

The Set command sets the date and time on the system clock.

Command	Response/Action
+CCLK=<time>	OK or: +CME ERROR: <err>

Read Command

The Read command returns the current date and time setting.

Command	Response/Action
+CCLK?	+CCLK: <time>

Test Command

The Test command returns valid parameters for the +CCLK Set command.

Command	Response/Action
+CCLK=?	+CCLK (list of supported <time>s) OK

The following table shows the +CCLK parameters.

Table 57. +CCLK Parameters

<Parameter>	Description
<time>	ASCII string of format yy/MM/dd,hh:mm:ss±zz or yy/MM/dd,hh:mm:ss yy 2-digit year [1970-2069] MM 2-digit month [01-12] dd 2-digit day of month [00-31] hh 2-digit hour [00-23] mm 2-digit minute [00-59] ss 2-digit seconds [00-59] zz (optional) time zone offset from GMT, in quarter-hours [-47...+48]. If this value is not specified, the time zone offset will default to the value currently stored in the g20.

Example

AT+CCLK=?

+CCLK: "99/12/31,23:59:59,(-47-+48)"

OK

AT+CCLK="00/12/25,08:30:00"

OK

AT+CCLK?

+CCLK: "00/12/25,08:30:05-08"

AT+CCLK="01/07/04,21:00:12+43"

OK

AT+CCLK?

+CCLK: "01/07/04,21:00:34+43"

OK

4.5   SMS

4.5.1   SMS Commands

Support of SMS data transmission and reception is according to the GSM 07.05 specification. This standard provides for an external terminal unit to send and receive information in an SM. This standard also provides for the transferring of messages between the g20 and the terminal, and the reporting of SM reception events.

g20 supports both text mode and PDU mode SMS.

> **Note** PDU mode SMS currently supports data coding schemes GSM (7 bit) and UCS2. 8 bit (data) coding scheme will be supported in future releases.

4.5.1.1   +CSMS, Select Message Service

This command handles the selection of the messaging service. It returns the types of messages that are supported by the g20.

Set Command

The Set command sets the type of service and returns the types of messages supported by the g20.

Command	Response/Action
+CSMS=<service>	+CSMS: <mt>,<mo>,<bm> or: +CMS ERROR: <err>

Read Command

The Read command returns the supported message types along with the current service setting.

Command	Response/Action
+CSMS?	+CSMS: <service>,<mt>,<mo>,<bm>

Test Command

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

Command	Response/Action
+CSMS=?	+CSMS: <service>

The following table shows the +CSMS parameters.

Table 58. +CSMS Parameters

<Parameter>	Description
<service>	Integer that defines the type of service 1-127 Not supported 128 Supported (manufacturer-specific)
<mt>	Mobile terminated messages 0 Not supported by the g20 1 Supported by the g20
<mo>	Mobile originated messages 0 Not supported by the g20 1 Supported by the g20
<bm>	Broadcast type messages 0 Not supported by the g20 1 Supported by the g20

Only the 128 (manufacturer-specific) messaging service is supported by the g20. The service is supported for all messaging types (mobile terminated, mobile originated and broadcast).

Example

AT+CSMS=128

+CSMS: 001,001,001

OK

AT+CSMS?

+CSMS: 128,001,001,001

OK

AT+CSMS=?

+CSMS: (128)

OK

4.5.1.2 +CPMS, Preferred Message Storage

This command handles the selection of the preferred message storage area. The message storage area is divided into three parts, mem1, mem2 and mem3 and each part is used for storing different types of messages.

Set Command

The Set command sets the memory storage.

Command	Response/Action
+CPMS=<mem>	+CPMS: <used>,<total>,<used>,<total> or: +CMS ERROR: <err>

Read Command

The Read command displays the selected memory storage type for the three memory areas.

Command	Response/Action
+CPMS?	+CPMS: <mem>,<used>,<total>, <mem>,<used>,<total> or: +CMS ERROR: <err>

Test Command

The Test command lists the supported memory storage for <mem1>, <mem2> and <mem3>.

Command	Response/Action
+CPMS=?	+CPMS: (list of supported <mem>s)

The following table shows the +CPMS parameters.

Table 59. +CPMS Parameters

<Parameter>	Description
<mem>	SM SU memory

Example

AT+CPMS="SM"

+CPMS: 17,352,17,352

OK

AT+CPMS=?

+CPMS: ("SM","SM")

OK

4.5.1.3 +CMGF, Message Format

The Set command handles the selection of the message format used with send, list, read and write commands, as well as the format of unsolicited result codes resulting from message receipts. The g20 supports both PDU mode (where entire TP data units are used) and text mode (where the body of the message and its headers are given as separate parameters).

Set Command

The Set command sets the message format to use.

Command	Response/Action
+CMGF=<mode>	OK or: +CMS ERROR: <err>

Read Command

The Read command displays the current message format.

Command	Response/Action
+CMGF?	+CMGF:<mode>

Test Command

The Test command lists all the supported message formats.

Command	Response/Action
+CMGF=?	+CMGF:(list of supported <mode>s)

The following table shows the +CMGF parameters.

Table 60. +CMGF Parameters

<Parameter>	Description
<mode>	Message format: 0 PDU mode 1 Text mode (default)

Example

AT+CMGF=1

OK

AT+CMGF?

+CMGF: 1

OK

AT+CMGF=?

+CMGF: (0,1)

OK

4.5.1.4   +CSCA, Service Centre Address

This command handles the selection of the SCA and the TOSCA. The SCA is the phone number of the SC (Service Center). The TOSCA can be 129 (local) or 145 (international), where 129 is the default value. The TOSCA parameter of the Set command is optional, and can be omitted. If the SCA parameter of the Set command is prefixed by the "+" character, it indicates that TOSCA is 145.

The following table shows the +CSCA input characters and their hexadecimal values.

Table 61. +CSCA Input Characters and Hexadecimal Values

Character	Description	Hexadecimal
+	International, allowed at start only	0x2B
0-9	Digits	0x30 0x31 0x32 0x33 0x34 0x35 0x36 0x37 0x38 0x39
* #	Instructions	0x2A 0x23
/ - ( ) blank A B C D	Other characters, allowed and ignored, not saved	0x2F 0x2D 0x28 0x29 0x20 0x41 0x42 0x43 0x44
,	Pause control	0x2C
;	Allowed at end of number, ignored, not saved	0x3B

Set Command

The Set command sets the service center address.

Command	Response/Action
+CSCA=<sca>[,<tosca>]	OK or: +CMS ERROR: <err>

Read Command

Command	Response/Action
+CSCA?	+CSCA: <sca>,<tosca>

Test Command

The Test command for +CSCA is not defined by ETSI, and therefore is not supported by the g20. The g20 returns an error.

The following table shows the +CSCA parameters.

Table 62. +CSCA Parameters

<Parameter>	Description
<sca>	Service Center Address
<tosca>	Type of Service Center Address is the current address format setting

Example

AT+CSCA="4252833433"

OK

AT+CSCA?

+CSCA: "4252833433",129

OK

4.5.1.5   +CNMI, New Message Indications to Terminal

This command handles enabling of unsolicited notifications to the terminal when an SM is received by the g20.

Set Command

Command	Response/Action
+CNMI=[<mode>[,<mt>[,<bm> [,<ds>[,<bfr>]]]]]	OK or: +CMS ERROR: <err>

Read Command

Command	Response/Action
+CNMI?	+CNMI:<mode>,<mt>,<bm>,<ds>,<bfr>

Test Command

Command	Response/Action
+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)

The following table shows the +CNMI parameters.

Table 63. +CNMI Parameters

<Parameter>	Description
<mode>	0,3 Forward unsolicited result codes directly to the terminal
<mt>	0 No SMS-DELIVER indications are routed to the terminal 1 If SMS-DELIVER is stored in the g20, the memory location indication is routed to the terminal using the unsolicited result code: +CMTI: <mem>,<index> 2 SMS-DELIVER is routed directly to the terminal
<bm>	0 No CBM indications are routed to the terminal 2 New CBMs are routed directly to the terminal Note: The CBM of multipage "CB" and "QuickView" are not supported.
<ds>	0 No SMS-STATUS reports are routed to the terminal
<bfr>	0 No SMS-STATUS reports are buffered.

Example

AT+CNMI=?

+CNMI: (000,003),(000-002),(000,002),(000),(000)

OK

AT+CNMI?

+CNMI: 000,000,000,000,000

OK

AT+CNMI=003,001,000,000,000

OK

4.5.1.6   +CNMA, New Message Acknowledgment

This command acknowledges the receipt of a +CMT response from the terminal to the g20. It confirms the correct reception of a new SMS-DELIVER message, which was routed directly to the terminal. When the g20 sends a +CMT response to the terminal, it waits a predefined timeout of 60 seconds for the +CNMA acknowledgment. The g20 will not send another +CMT result code to the terminal before the previous one is acknowledged, or the timeout expires. Upon receipt of the +CNMA command, the g20 sends RP-ACK to the network. The acknowledged SM will not be saved in message storage.

If the g20 does not receive acknowledgment within the required time, it sends RP-ERROR to the network. The g20 automatically disables routing to the terminal by setting both <mt> and <ds> values of +CNMI to zero. The unacknowledged SM is saved in message storage.

If the command is executed but no acknowledgment is expected, or some other g20 related error occurs, the final result code +CMS ERROR: <err> is returned.

Set Command

Command	Response/Action
AT+CNMA	OK or: +CMS ERROR: <err>

Read Command

The Read command for +CNMA is not defined by ETSI, and therefore is not supported by the g20. The g20 returns an error.

Test Command

The Test command for +CNMA is not defined by ETSI, and therefore is not supported by the g20. The g20 returns an error.

Example

AT+CNMI=3,2

OK

+CMT: "+97254565132","2003/4/9,17:14:33"

new message text

AT+CNMA

OK

4.5.1.7 +CMTI, Unsolicited Responses (New MT Message Receipt Indication)

The +CMTI unsolicited response is sent to the TE upon receipt of a new mobile-terminated SM, if the +CNMI parameter <mt> is set to 1. Refer to "+CNMI, New Message Indications to Terminal" on page 164.

This unsolicited message indicates that a new MT message was received, and is stored in location <index>.

Unsolicited Response
+CMTI: <mem>,<index>

The following table shows the +CMTI parameters.

Table 64. +CMTI Parameters

<Parameter>	Description
<mem>	Message memory space.
<index>	Location of the new message.

Example

AT+CNMI=3,1

OK

+CMTI: "SM",004

4.5.1.8 +CMT, Unsolicited Response (New MT Message Receipt)

The +CMT unsolicited response is sent to the TE upon receipt of a new mobile-terminated SM if the +CNMI parameter <mt> is set to 2. Refer to "+CNMI, New Message Indications to Terminal" on page 164.

This unsolicited message displays the received MT message.

Unsolicited Response
In text mode: (+CMGF=1): +CMT: <oa>,<scts><CR><LF><data>
In PDU mode: (+CMGF=0): +CMT: [<alpha>],<length><CR><LF><pdu>

The following table shows the +CMT parameters.

Table 65. +CMT Parameters

<Parameter>	Description
<oa>	Message origination address.
<scts>	Service center time stamp.
<data>	Message contents.

<Parameter>	Description
<alpha>	Alpha ID of message.
<length>	Size of message in PDU mode format, in octets, excluding SMSC data.
<pdu>	Message header and contents in PDU mode format.

After sending a +CMT unsolicited response to the TE, the g20 will expect a +CNMA (new message acknowledgement) from the TE within a predefined timeout of 60 seconds. The g20 will not send another +CMT unsolicited response to the TE before the previous one is acknowledged. If the +CMT is acknowledged within the timeout, the new SM is not saved in the message storage. If the +CMT is not acknowledged and the timeout has expired, the new SM is saved in the message storage and +CNMI parameter <mt> is set to 0.

4.5.1.9   +CBM, Unsolicited Response (New CB Message Receipt)

The +CBM unsolicited response is sent to the TE upon receipt of a new cell broadcast message if +CNMI parameter <bm> is set to 2. Refer to "+CNMI, New Message Indications to Terminal" on page 164.

This unsolicited message displays the received CB message. The displayed CBM is not saved in message storage.

Unsolicited Response
In text mode: (+CMGF=1):   +CBM: <sn>,<mid>,<dcs>,<page>,<page><CR><LF><data>
In PDU mode: (+CMGF=0):   +CBM: <length><CR><LF><pdu>

The following table shows the +CBM parameters..

Table 66. +CBM Parameters

<Parameter>	Description
<sn>	Message serial number.
<mid>	Message ID.
<page>	Current page number.
<pages>	Total number of pages.
<data>	Message contents in text mode.
<length>	Size of message in PDU mode format, in octets.
<pdu>	Message header and contents in PDU mode format.

4.5.1.10   +CMGL, +MMGL, List Messages

These commands display a list of all SMs with the status value <stat>, from the g20 message storage <mem1> (selected using the +CPMS command). The command returns a series of responses, one per message, each containing the message index, status, and data. If the status of a message is "RECEIVED UNREAD", execution of the +CMGL command changes the status of the message to "RECEIVED READ".

The +MMGL command does not change the message status. In addition, +MMGL includes a <stat> selection that can be used to query the g20 for a list of message headers without attendant message data.

Set Command

Command	Response/Action
+CMGL [=<stat>]	In text mode (+CMGF=1): +CMGL: index>,<stat>,<oa/da><CR><LF><data>[<CR><LF> +CMGL: <index>,<stat>,<da/oa><CR><LF><data>[...]] In PDU mode (+CMGF=0): +CMGL: index>,<stat>,[<alpha>],<length><CR><LF><pdu>[<CR><LF> +CMGL:<index>,<stat>,[<alpha>],<length><CR><LF><pdu>[…]] Or +CMS ERROR: <err>
+MMGL [=<stat>]	In text mode (+CMGF=1): +MMGL: <index>,<stat>,<oa/da><CR><LF><data>[<CR><LF> +MMGL: <index>,<stat>,<da/oa><CR><LF><data>[...]] In PDU mode (+CMGF=0): +MMGL: <index>,<stat>,[<alpha>],<length><CR><LF><pdu>[<CR><LF> +MMGL:<index>,<stat>,[<alpha>],<length><CR><LF><pdu>[...]] Or +CMS ERROR: <err>

Test Command

The Test command lists all the supported <stats>.

Command	Response/Action
+CMGL=?	+CMGL: (list of supported <stat>s
+MMGL=?	+MMGL: (list of supported <stat>s

The following table shows the +CGML/+MMGL parameters.

Table 67. +CGML/+MMGL Parameters

<Parameter>	Description
<index>	1-352 Index of message in storage.
<stat>	Status of message in memory: **PDU mode** **Text mode** **Description** 0 "REC UNREAD" Received unread messages (default) 1 "REC READ" Received read messages 2 "STO UNSENT" Stored unsent messages 3 "STO SENT" Stored sent message 4 "ALL" All messages 5 "HEADER ONLY" Header only (applies to +MMGL only)
<oa/da>	Original/destination address.
<data>	Message contents in text mode.
<length>	Size of message in PDU mode format, in octets, excluding SMSC data.
<pdu>	Message header and contents in PDU mode format.

Example

AT+CMGL="ALL"

+CMGL: 1,"REC READ","+358501234567"

Message text

+CMGL: 2,"STO UNSENT","+358501234567"

Message text

OK

AT+CMGL=?

+CMGL: ("REC UNREAD","REC READ","STO UNSENT","STO SENT","ALL")

OK

4.5.1.11 +CMGR, +MMGR, Read Message

These commands handle the reading of SMs. The command displays the message in location <index> of the preferred message storage <mem1> (selected using the +CPMS command). If the status of the message is "RECEIVED UNREAD", the +CMGR command changes the status to "RECEIVED READ". The +MMGR command does not change the message status.

Set Command

The Set command reads the SM located at <index> in the g20 message storage and displays it.

Command	Response/Action
+CMGR=<index>	In PDU mode (+CMGF=0): +CMGR: <stat>,[<alpha>],<length><CR><LF><pdu> In text mode (+CMGF=1): +CMGR: <stat>,<da/oa>[,<scts>]<CR><LF><data>
+MMGR=<index>	In PDU mode (+CMGF=0): +MMGR: <stat>,[<alpha>],<length><CR><LF><pdu> In text mode (+CMGF=1): +MMGR: <stat>,<da/oa>[,<scts>]<CR><LF><data>

The following table shows the +CMGR parameters.

Table 68. +CMGR Parameters

<Parameter>	Description
<index>	1-352 Index in storage of the message. to be retrieved.
<stat>	Status of message in memory: **PDU mode** **Text mode** **Description** 0 "REC UNREAD" Received unread messages (default) 1 "REC READ" Received read messages 2 "STO UNSENT" Stored unsent messages 3 "STO SENT" Stored sent message 4 "ALL" All messages 5 "HEADER ONLY" Header only (applies to +MMGL only)
<alpha>	Alpha ID of message.
<length>	Size of message in PDU mode format, in octets, excluding SMSC data.
<pdu>	Message header and contents in PDU mode format.
<oa/da>	Original/destination address.
<data>	Message contents in text mode.

Example

AT+CMGR=2

+CMGR: "REC UNREAD","+358507654321","95/07/03,17:38:15+04"

Message contents

OK

4.5.1.12   +MMAR, Motorola Mark As Read

This command handles changing the <stat> attribute of an SM in the g20 memory location <index>, preferred message storage <mem1>, from "REC UNREAD" to "REC READ". (<mem1> is selected using the +CPMS command.) If the status change fails, +CMS ERROR: <err> is returned.

Set Command

Command	Response/Action
+MMAR=<index>	OK or: +CMS ERROR: <err>

Read Command

The Read command for +MMAR is not defined, and therefore is not supported by the g20. The g20 returns an error.

Test Command

The Test command for +MMAR is not defined, and therefore is not supported by the g20. The g20 returns an error.

The following table shows the +MMAR parameters.

Table 69. +MMAR Parameters

<Parameter>	Description
<index>	Index of the message to be marked as read, in the SMS memory.

Example

AT+MMAR=76

OK

4.5.1.13   +CMSS, Send Message From Storage

This command sends a pre-stored message, written previously using the +CMGW command. The <da> parameter is optional. If a DA is given, the message is sent to that address. Otherwise the message is sent to the DA it was stored with (if any was entered), and remains in the Drafts folder. If no DA is found, an error occurs.

Set Command

The Set command sends a message from storage to the network.

Command	Response/Action
+CMSS=<index>[,<da>[,<toda>]]	+CMSS: <mr> or: +CMS ERROR: <err>

Note

A message that was written with a destination address will be moved to the Outbox folder only if sent using +CMSS=<index> command (without a destination address parameter).

The following table shows the +CMSS parameters.

Table 70. +CMSS Parameters

<Parameter>	Description
<index>	1-352 Index in storage of the message to be sent.
<da>	Destination address in quoted string. This field contains a single phone number.
<toda>	Type of DA. 129: Local. 145: International.
<mr>	Sent message reference number.

Example

AT+CMSS=7

+CMSS: 12

OK

AT+CMSS=7,"054565132",129

+CMSS: 13

OK

4.5.1.14   +CMGW, Write Message to Memory

This command is used to write and save a message to the g20 message storage. The message is saved in memory, and the message index is displayed to the user.

By default, messages are saved with the status of "STO UNSENT", but status "STO SENT" can be applied using the <stat> parameter

Set Command

The Set command writes a message and stores it.

Note
A message that was written without a destination address will remain in the Drafts folder.

Command	Response/Action
If text mode (+CMGF=1): +CMGW[=<da>[,<toda>[,<stat>]]]<CR>text is entered<ctrl-Z/ESC> if PDU mode (+CMGF=0): +CMGW=<length>[,<stat>]<CR>PDU is given<ctrl-Z/ESC>	+CMGW: <index> or: +CMS ERROR: <err>

The following table shows the +CMGW parameters.

Table 71. +CMGW Parameters

<Parameter>	Description
<da>	Destination address in quoted string. This field contains a single phone number.
<toda>	Type of DA. 129: Local. 145: International.
<stat>	Status of new message In text mode: "STO UNSENT" (default) or "STO SENT" In PDU mode: 2 (default) or 3
<length>	Size of message in PDU mode fromat, in octects, excluding SMSC data.
<index>	1-352 Index in storage of the stored message.

Example

AT+CMGW="5124335432"

>This is the message body <CTRL+Z>   //<CTRL+Z> ends the prompt text mode and returns to regular AT command mode

+CMGW: 126

OK

AT+CMGF=1

OK

AT+CMGW

> TEST <CTRL+Z>

+CMGW: 195

OK

AT+CMGF=0

OK

AT+CMGW=24

>07917952120100951FF0B917962543940F200080014004100420043004400 45 <CTRL+Z>

+CMGW: 128

OK

4.5.1.15   +CMGD, Delete Message

This command handles deletion of a single message from memory location <index>, or multiple messages according to <delflag>. If the optional parameter <delflag> is entered, and is greater than 0, the <index> parameter is practically ignored. If deletion fails, result code +CMS ERROR: <err> is returned.

	The deletion of multiple commands is a time-consuming process that may require more than 60 seconds to complete.
Note	

Set Command

Command	Response/Action
+CMGD=<index>[,<delflag>]	OK or: +CMS ERROR: <err>

Read Command

The Read command for +CMGD is not defined by ETSI, and therefore is not supported by the g20. The g20 returns an error.

Test Command

Command	Response/Action
+CMGD=?	+CMGD: (list of valid <index>s), (list of valid <deflag>s)

The following table shows the +CMGD parameters.

Table 72. +CMGD Parameters

<Parameter>	Description
<index>	1-352 Index in the SMS memory of the message to be deleted.
<delflag>	0 Deletes the message specified in <index> 1 Deletes all read messages 2 Deletes all read messages and sent MO messages 3 Deletes all read messages, sent and unsent MO messages 4 Deletes all messages

Example

AT+CMGD=4

OK

AT+CMGD=1,3

OK

4.5.1.16   +CGSMS, Select Service for MO SMS Messages

This command handles the selection of the service or service preference used by the g20 to send mobile-originated SMS messages.

This command is network dependent, which means that the network must support SMS over GPRS.

Note

Set Command

The Set command selects the service or service preference used to send SMS messages. The value that is set is not retained after a power cycle.

Command	Response/Action
+CGSMS=[<service>]	OK
	+CME ERROR: <err>

Read Command

The Read command displays the current SMS service preference setting.

Command	Response/Action
+CGSMS?	+CGSMS: <service>
	+CME ERROR: <err>

Test Command

The Test command displays a list of currently available <service>s on the network.

Command	Response/Action
+CGSMS=?	+CGSMS: (list of currently available <service>s)
	+CME ERROR: <err>

The following table shows the +CGSMS parameters.

Table 73. +CGSMS Parameters

<Parameter>	Description
<service>	Indicates the service or service preference to be used. 0 GPRS 1 Circuit switched (default) 2 GPRS preferred (use circuit switched if GPRS is not available) 3 Circuit switched preferred (use GPRS if circuit switched is not available) Other values are reserved and will result in an ERROR response to the Set command.

Example

AT+CGSMS=?

CGSMS:(0-3)

OK

AT+CGSMS?

CGSMS: 1

OK

4.5.1.17   +CMGS, Send SM to Network

This command sends an SM from the g20 to the network. The message reference value <mr> is returned to the g20 upon successful delivery of the message.

Set Command

The Set command validates the input parameters, sends the SM to network and reports the result of the operation to the g20.

Command	Response/Action
If text mode (+CMGF=1): +CMGS=<da>[,<toda>]<CR> text is entered<ctrl-Z/ESC> If PDU mode (+CMGF=0): +CMGS=<length><CR> PDU is entered<ctrl-Z/ESC>	+CMGS: <mr> +CMS ERROR: <err>

The following table shows the +CMGS parameters.

Table 74. +CMGS Parameters

<Parameter>	Description
<da>	Destination address in quoted string. This field contains a single MIN number.
<toda>	Type of DA.
<stat>	Status of new message In text mode: "STO UNSENT" (default) or "STO SENT" In PDU mode: 2 (default) or 3.
<length>	Size of message in PDU mode format, in octets, excluding SMSC data.
<mr>	Sent message reference number.

Example

AT+CMGS="064593042",129

>This is the message body <CTRL+Z>   //<CTRL+Z> ends the prompt text mode and returns to regular AT command mode

OK

AT+CMGF=0

OK

AT+CMGS=24

>079179521201009511FF0B917962543940F2000800140041004200430044 0045 <CTRL+Z>

+CMGS: 128

OK

4.5.1.18   +CSCB, Cell Broadcast Messages

This command handles the selection of cell broadcast message types and data coding schemes received by the g20.

Set Command

The Set command sets the cell broadcast message type and data coding scheme.

Command	Response/Action
+CSCB=[<mode>[,<mids>[,<dcss>]]]	The active channel list is updated with new Message IDs (MIDs) and Data Coding Schemes (DCSs).

	The Channel and DCS list is saved to the SIM card.
Note	The maximum number of active channels is SIM dependent.
	The AT+CSCB set command is not available when the phone is either in "Emergency Only" or "No Service" status.

Read Command

The Read command displays the current MID and DCS settings.

Command	Response/Action
+CSCB?	+CSCB: <mode>,<mids>,<dcss>

Test Command

The Test command displays the list of supported modes.

Command	Response/Action
+CSCB=?	+CSCB: (list of supported <mode>s)

The following table shows the AT+CSCB parameters.

Table 75. +CSCB Parameters

<Parameter>	Description
<mode>	The current broadcast message mode: 0 MIDs and DCSs accepted 1 MIDs and DCSs not accepted
<mids>	Cell broadcast message identifiers 0-65534
<dcss>	Cell broadcast message data coding schemes 0-255

	A combination of discrete values or intervals can be entered for <mids> and <dcss>, for example, "0,1,5,320-324,922".
Note	Parameter values must be entered in ascending order.

4.5.1.19 +MCSAT, Motorola Control SMS Alert Tone

This command enables/disables/exercises the SMS alert tone for an arriving SMS. It does not apply on Cell Broadcast SMS.

Set Command

The Set command is used to:

- Suppress (mute) the voice notification (alert tone) of a specific incoming SMS, identified by the received <dcs_mask>s property
- Enable voice notification (alert tone) of all incoming SMS events
- Activate the current alert tone for an incoming SMS event

Command	Response/Action
+MCSAT=<mode> [,<dcs_mask>[,....]]	OK or: +CME ERROR: <err>

Read Command

The Read command returns the current <mode> and current <dcs_mask>s.

Command	Response/Action
+MCSAT?	+MCSAT: <mode>[,<dcs_mask>[,....]] OK or: +CME ERROR: <err>

Test Command

The Test command returns the possible <mode> values.

Command	Response/Action
+MCSAT=?	+MCSAT: (list of supported <mode>s) OK or: +CME ERROR: <err>

The following table shows the +MCSAT parameters.

Table 76. +MCSAT Parameters

<Parameter>	Description
<mode>	0 Suppress alert tone 1 Enable alert tone 2 Play alert tone The default value at power-up is 1.
<dcs_mask>	SMS data coding-scheme mask. The format is an 8-bit information parameter. Each bit contains 0, 1, or X (ASCII character): 0 Condition is met if the arriving SMS includes dcs with 0 in this position 1 Condition is met if the arriving SMS includes dcs with 1 in this position X or x This bit is ignored from the dcs of the arriving SMS

Example

AT+MCSAT=?

+MCSAT:(0-2)

OK

AT+MCSAT?

+MCSAT: 1

OK

AT+MCSAT=2

OK

AT+MCSAT=1,00001000   // UCS2

OK

AT+MCSAT=1,00000100   // UTF8

OK

AT+MCSAT=1,00000000   // GSM

OK

AT+MCSAT=1

OK

AT+MCSAT=0

OK

4.5.1.20   +MEGA, Email Gateway Address

This Motorola-specific command updates the Email Gateway Address.

Set Command

The Set command sets the Email gateway address.

Command	Response/Action
+MEGA=<ega>	OK or: CME ERROR: <err>

Read Command

Command	Response/Action
+MEGA?	+MEGA: "<ega>"

The following table shows the +MEGA parameters.

Table 77. +MEGA Parameters

<Parameter>	Description
<ega>	Email Gateway Address, represented by a quoted string. Refer to "+CSCA, Service Centre Address", page 162, for a list of permitted characters.

Example

AT+MEGA="4252833433"

OK

AT+MEGA?

+MEGA: "4252833433"

OK

4.6   NETWORK

4.6.1   Network Commands

4.6.1.1   +CSQ, Signal Strength

This command displays the received signal strength indication <rssi> and channel bit error rate <ber> from the g20.

Execute and Read Command

Command	Response/Action
AT+CSQ AT+CSQ?	+CSQ: <rssi>,<ber> OK or: +CME ERROR: <err>

Test Command

Command	Response/Action
AT+CSQ=?	+CSQ: (list of supported <rssi>s),(list of supported <ber>s) OK or: +CME ERROR: <err>

The following table shows the +CSQ parameters.

Table 78. +CSQ Parameters

<Parameter>	Description
<rssi>	0 -113 dBm or less 1 -111 dBm 2 -109 dBm 10 -92.5 dBm 15 -84 dBm 20 -72 dBm 30 -53 dBm 31 -51 dBm or greater
<ber>	Channel bit error rate (in percent) 0–7 RXQUAL values in the GSM 05.08 table 99 Unknown or not detectable

Example

at+csq

+CSQ: 031,000

OK

at+csq=?

+CSQ: (000-031,099),(000-007,099)

OK

4.6.1.2   +CRLP, Radio Link Protocol

This command displays the Radio Link Protocol parameters that are used when non-transparent data calls are originated.

Set Command

The Set command enables you to change the RLP parameters.

Command	Response/Action
+CRLP= [<iws>[,<mws>[,<T1>[,<N2>]]]]	OK or: +CME ERROR: <err>

Read Command

Command	Response/Action
+CRLP?	+CRLP= <iws>,<mws>,<T1>,<N2> OK or: +CME ERROR: <err>

Test Command

Command	Response/Action
+CRLP=?	+CRLP= (list of supported <iws>s), (list of supported <mws>s), (list of supported <T1>s), (list of supported <N2>s) OK or: +CME ERROR: <err>

The following table shows the +CRLP parameters.

Table 79. +CRLP Parameters

<Parameter>	Description
<iws>	IWF to MS window size. The default value is 61.
<mws>	MS to IWF window size. The default value is 61.
<T1>	Acknowledgement timer T1. The default value is 48.
<N2>	Retransmission attempts N2 in integer format (refer to GSM 04.22 [18] subclause 5.4.3) The default value is 6.

Example

AT+CRLP=?

+CRLP: (010-061),(010-061),(048-255),(006-010)

OK

AT+CRLP?

+CRLP: 061,061,048,006

OK

4.6.1.3   +CREG, Network Registration Status

Set Command

The Set command controls the presentation of an unsolicited result code and the result of the Read operation.

Command	Response/Action
AT+CREG=<n>	OK or: +CME ERROR: <err

Read Command

The Read command returns the status of the result code presentation and shows whether the network has currently indicated the registration of the g20. Location information elements <lac> and <ci> are returned only when <n>=2 and the g20 is registered in the network.

Command	Response/Action
AT+CREG?	+CREG: <n>,<stat>[,<lac>,<ci>] OK or: +CME ERROR: <err>

Test Command

Command	Response/Action
AT+CREG=?	+CREG: (list of supported <n>s) OK

The following table shows the +CREG parameters.

Table 80. +CREG Parameters

<Parameter>	Description
<n>	0 Disables the network registration unsolicited result code. 1 Enables the network registration unsolicited result code +CREG: <stat>. 2 Enables the network registration and location information in unsolicited reports and Read command +CREG:<stat>[,<lac>,<ci>]. The default is 0.

Table 80. +CREG Parameters *(Continued)*

<Parameter>	Description
<stat>	0 Not registered, and the g20 is not searching for a new operator to which to register. 1 Registered, home network. 2 Not registered, but the g20 is searching for a network. 3 Registration denied. 4 Unknown. 5 Registered, roaming. 6 Registering 7 Emergency Call Only 8 Registered, but the g20 is searching for an available network.
<lac>	Two-byte location area code in hexadecimal format.
<ci>	Two-byte cell ID in hexadecimal format.

Example

at+creg=?

+CREG: (000 - 002)

OK

at+creg?

+CREG: 000,001

OK

at+creg=2

OK

at+creg?

+CREG: 002,001, a065,988b

OK

at+creg=1

OK

at+creg?

+CREG: 001,001

OK

at+creg=0

OK

4.6.1.4   +CGREG, GPRS Network Registration

Set Command

The Set command controls the presentation of an unsolicited result code "+CGREG:" and the result of the Read operation.

Command	Response/Action
AT+CGREG=[<n>]	OK or: +CME ERROR: <err>

Read Command

The Read command returns the status of the result code presentation and shows whether the network has currently indicated the GPRS registration of the g20. Location information elements <lac> and <ci> are returned only when <n>=2 and the g20 is registered in the network.

Command	Response/Action
AT+CGREG?	+CGREG: <n>,<stat>[,<lac>,<ci>] OK or: +CME ERROR: <err>

Test Command

Command	Response/Action
AT+CGREG=?	+CGREG: (list of supported <n>s) OK

The following table shows the +CGREG parameters.

Table 81. +CGREG Parameters

<Parameter>	Description
<n>	0 Disables the network registration unsolicited result code. 1 Enables the network registration unsolicited result code +CGREG: <stat>. 2 Enables the network registration and location information in unsolicited result code and Read command +CGREG:<stat>[,<lac>,<ci>]. The default is 0.

Table 81. +CGREG Parameters *(Continued)*

<Parameter>	Description
<stat>	0 GPRS is not attached and not available. 1 GPRS attached. 2 GPRS available, but not attached. 3 GPRS attaching.
<lac>	Two-byte location area code in hexadecimal format.
<ci>	Two-byte cell ID in hexadecimal format.

Example

at+cgreg=?

+CGREG: (000 - 002)

OK

at+cgreg=2

OK

at+cgreg?

+CGREG: 002,001,a065,76fd

OK

at+cgreg=1

OK

at+cgreg?

+CGREG: 001,001

OK

at+cgreg=0

OK

Example for unsolicited report:

at+cgreg=1

OK

at+cgatt=0

OK

+CGREG: 000

at+cgatt=1

OK

+CGREG: 001

                              //Remove GPRS SIM

+CGREG: 002

//Insert SIM

+CGREG: 003

+CGREG: 001

4.6.1.5 +COPS, Operator Selection

This command enables accessories to access the network registration information, and the selection and registration of the GSM network operator. The g20 is registered in the Home network.

Any attempt to register to a non-available or restricted network (AT+COPS=1,x,"zzzzzz") is reported as failed. If this occurs, the g20 returns to the Home network and does not remain unregistered.

The Enhanced Operator Name String (EONS) feature enables the g20 to return the operator name displayed on the handset. This feature allows the SIM card to store a mapping of MCC/MNC code pairs to the displayed operator name. As a result, several operators can share a single network while having their handsets display their own name as the network operator.

Testing the enhanced ONS feature requires a "SIM ONS" SIM card.

Set Command

The Set command can force an attempt to select and register a specific GSM network operator. The <mode> selects whether this is done automatically by the g20, or whether the selection is forced to an operator <oper> (given in format <format>). If the selected operator is not available, no other operator is selected (except when the <mode> is set to 4).

<mode>=2 forces an attempt to deregister from the network.

<mode>=3 sets the operator format to all further Read commands (+COPS?) as well.

The selected mode applies to future network registrations, for example, once you deregister from the network, the g20 remains unregistered until you select <mode>=0, <mode>=1, or <mode>=4.

Command	Response/Action
AT+COPS=[<mode>[,<format> [,<oper>]]]	OK or: +CME ERROR: <err>

Read Command

The Read command returns the current mode and the currently selected operator.

Command	Response/Action
AT+COPS?	+COPS: <mode>[,<format>,<oper>] OK or: +CME ERROR: <err>

Test Command

The Test command returns a list of quadruplets, each representing an operator present in the network. A quadruplet consists of an integer indicating the availability of the operator <stat>, long and short alphanumeric format of the name of the operator, and numeric format representation of the operator. If any of the formats are unavailable, there is an empty field.

After the operator list, the g20 returns lists of the supported <mode>s and <format>s. These lists are separated from the operator list by two commas.

Command	Response/Action
AT+COPS=?	+COPS: [list of supported (<stat>, long alpha numeric <oper>, short alphanumeric <oper>, numeric <oper>)] [,list of supported <mode>s, (list of supported <format>s)] OK or: +CME ERROR: <err>

The following table shows the +COPS parameters.

Table 82. +COPS Parameters

<Parameter>	Description
<format>	The operator format type: 0 Long alphanumeric 1 Short alphanumeric 2 Numeric The default value is 0.
<mode>	Determines whether what is displayed is defined by <oper>, or is done automatically by the g20. 0 Automatic (<oper> field is ignored) 1 Manual (<oper> field is present) 2 De-register from network 3 Set only <format> (<oper> field is ignored); used for Read command only, do not attempt registration/ deregistration 4 Manual/automatic (<oper> field is present; if manual selection fails, use automatic mode) The default value is 0.
<stat>	0 Unknown 1 Available 2 Current 3 Forbidden
<oper>	Operator name displayed on the handset. The long alphanumeric format can be up to 16 characters long. The short alphanumeric format can be up to 8 characters long. The numeric format is the GSM Location Area Identification number (refer to GSM 04.08 [8] subclause 10.5.1.3), consisting of a three BCD digit country code (as per ITU-T E.212 Annex A [10]), plus a two BCD digit network code, which is administration specific. The returned <oper> is not in BCD format, but in IRA characters converted from BCD, and therefore the number has the following structure: (country code digit 3)(country code digit 2)(country code digit 1)(network code digit 2)(network code digit 1)

Example

AT+COPS=?

+COPS:(002,"IL ORANGE","ORANGE","42501"),(003,"IL Cellcom","Cellcom","42502"),(001,"IL-77","I-77","42577"),,
(000,001,002,003,004),(000,001,002)

OK

AT+COPS?

+COPS: 000,000,"IL ORANGE"

OK

AT+CPS=3,2

AT+COPS ?

+COPS: 000,002,"42501"   //Specific provider number

AT+COPS=0

OK

AT+COPS=1,2,"31038"

OK

AT+COPS=1,1,"ORANGE"

OK

4.6.1.6   +CPOL, Preferred Operators

This command is used to edit the list of preferred network operators located in the SIM card.

Set Command

The Set command writes an entry in the list of preferred operators.

Command	Response/Action
AT+CPOL=[<index>][,<format>[, <oper>]]	OK or: +CME ERROR: <err>

Note

The g20 may also update this list automatically when new networks are selected.

Read Command

The Read command displays all the preferred operators that have been entered into the list.

Command	Response/Action
AT+CPOL?	+CPOL: <index1>,<format>,<oper1> [<CR><LF>+CPOL: <index2>,<format>,<oper2> [...]] OK or: +CME ERROR: <err>

Test Command

The Test command displays the entire index range supported by the SIM.

Command	Response/Action
AT+CPOL=?	+CPOL: (list of supported <index>s),(list of supported <format>s) OK or: +CME ERROR: <err> * Index range is SIM dependent

The following table shows the +CPOL parameters.

Table 83. +CPOL Parameters

<Parameter>	Description
<indexn>	Order number of network operator in the SIM preferred operator list
<format>	Defines the <oper> format: 0 Long alphanumeric format (up to 16 characters) 1 Short alphanumeric format (up to 8 characters) 2 Numeric (default)
<oper>	Name of the network operator

Note

To delete an entry from the list, enter an <index> without an <oper>.
If an <oper> is entered without an <index>, the <oper> is placed in the next free location in the list.
To change the format of <oper> displayed with the Read command, enter a <format>.
User is prevented to edit index No. 1.
When entering a new item to a full list, a "Memory Full" message will be prompted.

Examples

at+cpol=?

+CPOL: (001-032),(000-002)

OK

at+cpol?

+CPOL: 001,001,"Cellcom"

+CPOL: 002,001,"Orange"

OK

at+cpol=2,0,"MobileNetwork"   //MobileNetwork is the name of a valid cellular provider.

OK

at+cpol= ,0   //Changes the format of read command to long alpha.

OK

at+cpol=2   //Delete index 2.

OK

4.7   HARDWARE INFORMATION

4.7.1   Hardware Information

4.7.1.1   +CBC, Battery Charger Connection

This command enables a user to query the battery charger connection.

Read Command

Command	Response/Action
+CBC	+CBC:<bcs>,<bcl>

The following table shows the +CBC parameters.

Table 84. +CBC Parameters

<Parameter>	Description
<bcs>	Battery status values 0 Battery powered 1 Externally powered, battery connected 2 Externally powered, no battery connected 3 Invalid power supply Note: The g20 input power source is connected via the battery pins.
<bcl>	Battery charge level 0 Indicates no battery 1-100 Indicates percentage of charge remaining

Note

The g20 does not allow the detection of battery use. The power supply of the g20 is connected via the battery pins. However, users can use this command to verify the level of the g20 input power source.

Example

at+cbc

+CBC: 0,60   //This example shows 0 (battery powered) with 60% power.

OK

4.7.1.2   +CBAUD, Baud Rate Regulation

This command sets the baud rate. The baud rate of the g20 is changed/set to the request value <rate> written in the command.

Specifying a value of 9 or 0 disables the function and allows operation only at rates automatically detectable by the g20. The specified rate takes effect following the issuing of any result code(s) associated with the current command line.

The UART is configured according to the request, or to the specific constant baud rate or auto baud rate after output "OK" response to the terminal. For example, AT+CBAUD=8 is equivalent to AT+CBAUD=57600. Using AT+CBAUD with the <rate> value other than 9 or 0 disables the auto baud rate detection feature. The g20 supports up to 115200 auto baud.

Set Command

Command	Response/Action
AT+CBAUD=<n> AT+CBAUD=<rate>	OK or: ERROR

Read Command

Command	Response/Action
AT+CBAUD?	+CBAUD: <rate>

Test Command

Command	Response/Action
AT+CBAUD=?	+CBAUD: (list of supported <n>s, list of supported <rate>s)

The following table shows the +CBAUD parameters.

Table 85. +CBAUD Parameters

<Parameter>	Description
<n> <rate>	0 Auto baud rate 1 600 2 1200 3 2400 4 4800 5 9600 6 19200 7 38400 8 57600 9 Auto baud rate 10 115200 11 300 The default value is 9.

Example

AT+CBAUD=8

or AT+CBAUD=57600   //These commands have the same effect

OK

AT +CBAUD =?

+CBAUD: (0-11,300,600,1200,2400,4800,9600,19200,38400,57600,115200)

4.7.1.3   +IPR, Local Terminal/g20 Serial Port Rate

This command is responsible for setting and saving the request baud rate. This numeric extended-format parameter specifies the data rate at which the g20 accepts commands. Specifying a value of 9 disables the function and allows operation only at rates automatically detectable by the g20. The specified rate takes effect following the issuing of any result code(s) associated with the current command line.

The <rate> value specified is the rate in bits per second at which the terminal-g20 interface operates, for example, 19200 or 115200. The rates supported by the g20 are manufacturer-specific. However, the +IPR parameter permits setting any rate supported by the g20 during online operation.

The UART is configured to rates of 300, 600, 1200, 4800, 9600, 19200, 38400, 57600 or 115200 bits per second according to the parameters of the +IPR command.

Using AT+IPR=<rate> with a <rate> value other than 9 and 0 disables the auto baud rate detection feature. The entered baud rate is stored in the g20 and is restored after power up.

Note +IPR is similar to +CBAUD, but with the ability to save.

Set Command

Command	Response/Action
AT+IPR=<n> AT+IPR=<rate>	OK or: ERROR

Read Command

Command	Response/Action
AT+IPR?	+IPR: <rate>

Test Command

Command	Response/Action
AT+IPR=?	+IPR: (list of supported <rate>s)

The following table shows the +IPR parameters.

Table 86. +IPR Parameters

<Parameter>	Description
<n> <rate>	0 Auto baud rate 1 600 2 1200 3 2400 4 4800 5 9600 6 19200 7 38400 8 57600 9 Auto baud rate 10 115200 11 300

Example

AT+IPR=?

+IPR: (0-10,300,600,1200,2400,4800,9600,19200,38400,57600,115200)

OK

AT+IPR=6

OK

AT+IPR?

+IPR: (0-11,300,600,1200,2400,4800,9600,19200,38400,57600,115200)

4.7.1.4   +GCAP, Request Overall Capabilities

This command indicates the major capability areas of the g20. The support of different areas is presented in the response of the +GCAP command. Each area may be presented by the selection command name of a specific capability area. The g20 supports only FCLASS - fax support.

Execute Command

Command	Response/Action
AT+GCAP	GCAP: <list of supported features><CR><LF> OK // at the end of the list.

Example

AT+GCAP

+GCAP: +FCLASS

OK

4.7.1.5   +MTDTR, DTR Line Test Command

This command checks and outputs the physical current status of the DTR pin of the RS232.

Execute Command

Command	Response/Action
AT+MTDTR	MTDTR:<n> OK

Read Command

Command	Response/Action
AT+MTDTR?	MTDTR:<n> OK

Test Command

Command	Response/Action
AT+MTDTR=?	OK

The following table shows the +MTDTR parameters.

Table 87. +MTDTR Parameters

<Parameter>	Description
<n>	0 DTR OFF 1 DTR ON

Example

AT+MTDTR?

+MTDTR:1

OK

AT+MTDTR

+MTDTR:1

OK

AT+MTDTR=?

OK

4.7.1.6   +MTCTS, CTS Line Test Command

This command sets the CTS pin of the RS232 to active high, waits one second and then returns the CTS to active low.

Execute Command

Command	Response/Action
AT+MTCTS	OK

Example

AT+MTCTS

OK

4.7.1.7   &K, RTS/CTS Flow Control

This command configures the flow control. The RTS (Request To Send) is an input line. The RTS signal is received from the terminal and a low condition indicates that the g20 can send more data. The CTS (Clear To Send) is an output line. The CTS signal is sent to the terminal and a low state indicates that more data can be sent to the g20.

The RTS and CTS together make up what is called RTS/CTS or "hardware" flow control. Both lines are used when "hardware flow control" is enabled in both the terminal and the g20 devices. When the terminal is ready and able to receive data, it puts the CTS line in an active (low) condition to indicate this to the g20. If the terminal is not able to receive data (typically because its receive buffer is almost full), it puts the CTS line in an inactive (high) condition as a signal to the g20 to stop sending data. When the terminal is ready to receive more data (for example, after data has been removed from its receive buffer), it places this line back in the active condition. The RTS line complements the CTS line. The g20 puts the RTS line in an active condition to tell the terminal that it is ready to receive the data. Likewise, if the g20 is unable to receive data, it places the RTS line in an inactive condition.

Set Command

Command	Response/Action
AT&K<param>	OK

Read Command

Command	Response/Action
AT&K?	&K: <param>

Test Command

Command	Response/Action
AT&K=?	&K: (list of supported <param>s)

The following table shows the &K parameters.

Table 88. &K Parameters

<Parameter>	Description
<param>	0 Disable all terminal/g20 flow control 3 Enable CTS/RTS terminal/g20 flow control 4 Enable Xon/Xoff terminal/g20 flow control 5 Enable Xon/Xoff terminal/g20 flow control 6 Enable CTS/RTS terminal/g20 flow control The default value is 3.

Example

AT&K?

003

OK

AT&K4

OK

4.7.1.8   &C, Circuit 109 Behavior

This parameter determines how the state of the DCD line relates to the detection of the received line signal from the distant end. Changing the parameters will take effect immediately in both the command and online command states.

The DCD line is an output line that indicates the following:

• In Circuit Switch Data mode an active (low) indicates that a valid carrier (data signal) was detected by the g20 (CONNECT message is received), and inactive (high) indicates idle. The AT&C command always puts the DCD command ON, when set to 0. If the AT&C command is set to 1 then the "+++" escape command sets the DCD signal to an inactive state and the ATO command is set to active. The AT&C set to 2 sets the DCD signal OFF.

• In GPRS mode, the DCD line indicates the PDP context status. PDP context active sets the DCD to active (low); PDP context inactive sets the DCD to inactive (high). The DCD is activated only when the PDP context is achieved. The DCD is de-activated when the PDP context is off.

When AT&C is set to 0, the DCD signal is always ON. When AT&C is set to 1, the DCD is activated in online mode. When AT&C is set to 2, the DCD is activated only when the PDP context is achieved (temporary IP address is received).

Set Command

Command	Response/Action
AT&C<param>	OK

Read Command

Command	Response/Action
AT&C?	&C:<param>

Test Command

Command	Response/Action
AT&C=?	&C:(list of supported <param>s)

The following table shows the &C parameters.

Table 89. &C Parameters

<Parameter>	Description
<param>	DCD signal ON 0　DCD is forced ON at all times. 1　DCD is set to ON when: 　　a　A CSD carrier is detected. 　　b　A GPRS external session is being established: 　　　　•　g20 enters PPP mode 　　　　•　TE is about to send an LCP configure-request to the g20 (GPRS connection is not yet established). 　　DCD is set to OFF when: 　　a　No CSD carrier is detected. This can happen when a CSD call has been disconnected or when g20 enters CSD online command mode (switch operation). 　　b　The g20 has lost its GPRS connection with the network (PDP context was deactivated and the IP address is cancelled). 2　DCD is set to ON when g20 establishes a GPRS connection with the network (PDP context is activated and the IP address is received from the network). 　　DCD is set to OFF when g20 has lost its GPRS connection with the network (PDP context was deactivated and the IP address is cancelled). The default value is 1.

Note

If &C is set to 2 when a CSD call is set, DCD will always remain OFF.

Example

AT&C?

&C: 001

OK

AT&C0

OK

4.7.1.9 &D, Circuit 108 Behavior

This command determines how the g20 responds when the DTR (Data Terminal Ready) status is changed from ON to OFF during the online data state. The DTR is an input line that indicates that the terminal is ready.

The DTR line must be active (low) in order for the g20 to recognize the terminal. This signal is raised by the terminal when a process activates the serial port. If the DTR is not used by the application, it should connect this line to ground (DTR active). The default value is active (low).

Set Command

Command	Response/Action
AT&D<param>	OK

Read Command

Command	Response/Action
AT&D?	&D:<param>

Test Command

Command	Response/Action
AT&D=?	&D:(list of supported <param>s)

The following table shows the &D parameters.

Table 90. &D Parameters

<Parameter>	Description
<param>	The g20's reaction when the DTR status is changed from ON to OFF. In CSD calls: 0,4 Ignores DTR changes 1 Switches the CSD call to asynchronous command mode (the call remains connected) 2,3 Disconnects the call and returns to the command mode In GPRS calls: 0,4 Ignores DTR changes 1-3 Deactivates the GPRS and returns to command mode In MUX and MUX_INIT state: 0-3 Ignores DTE changes 4 Drops the MUX application and returns to PRE_MUX state The default value is 2.

Example

AT&D?

002

OK

AT&D1

OK

4.7.1.10   +MCWAKE, GPRS Coverage

This command tells the g20 whether to report on the status of the GPRS coverage. There are three possibilities:

- Do not report the status of the GPRS coverage
- Report only when the GPRS coverage goes off.
- Report only when the GPRS coverage goes on.

Set Command

Command	Response/Action
AT+MCWAKE=<param>	OK

Read Command

Command	Response/Action
AT+MCWAKE?	+MCWAKE: <param> OK

Test Command

Command	Response/Action
AT+MCWAKE =?	+MCWAKE: (list of supported <param>s) OK

The following table shows the +MCWAKE parameters.

Table 91. +MCWAKE Parameters

<Parameter>	Description
<param>	0 Sends no indication. 1 Sends an indication when GPRS coverage goes off. 2 Sends an indication when GPRS coverage goes on. The default value is 2.

Example

at+mcwake=0

OK

at+mcwake?

+MCWAKE: 0

OK

at+mcwake=1

OK

at+mcwake=2

OK

at+mcwake=?

+MCWAKE: (0,1,2)

OK

4.7.1.11   +CFUN, Shut Down Phone Functionality

This command shuts down the phone functionality of smart phones and PDAs with phone capabilities in order to prevent interference from a nearby environment. This enables other functionality to continue to be used in environments where phone use is either impractical or not permitted. For example, on airplanes the use of cellular phones is forbidden during the entire flight, but the use of computers is allowed during much of the flight. This command enables other functionality to continue while preventing use of phone functionality.

Set Command

The Set command selects the level of functionality <fun> in the smart phone or PDA incorporating the g20.

Command	Response/Action
AT+CFUN=[<fun>[,<rst>]]	OK +CME ERROR: <err>

Read Command

The Read command displays the current level of functionality.

Command	Response/Action
AT+CFUN?	+CFUN: <fun> OK

Test Command

The Test command displays the list of supported functionality settings.

Command	Response/Action
AT+CFUN=?	+CFUN: (list of supported <fun>s), (list of supported <rst>s) OK

The following table shows the AT+CFUN parameters.

Table 92. +CFUN Parameters

<Parameter>	Description
<fun>	Functionality levels: 0 Minimum functionality (default) 1 Full funtionality 2 Disables phone transmit RF circuits only 3 Disables phone receive RF circuits only 4 Disables phone transmit & receive RF circuits 5-127 Reserved for future use
<rst>	0 Sets functionality to <fun> without resetting the device (default) 1 Resets the device before setting functionality to <fun>

Examples

at+cfun=?

+CFUN:(0-4),(0-1)

OK

at+cfun?

+CFUN: 0

OK

at+cfun=4   //Disable phone transmit and receive RF circuits

OK

4.7.1.12   +ICF, DTE-DCE Character Framing

This command determines the local serial port start/stop (asynchronous) character framing used by the DCE when accepting DTE commands and transmitting information text and result codes, whenever these are not done automatically. Auto detect framing is not supported.

Set Command

The Set command determines the local serial port start/stop character framing.

Command	Response/Action
+ICF=[<format>[,<parity>]]	OK +CME ERROR: <err>

Read Command

The Read command displays the currently selected character framing.

Command	Response/Action
+ICF?	+ICF: <format>,<parity> +CME ERROR: <err>

Test Command

The Test command displays a list of supported <format> and <parity> values.

Command	Response/Action
+ICF=?	:+ICF:(list of supported <format> values),(list of supported <parity> values) +CME ERROR: <err>

The following table shows the +ICF parameters.

Table 93. +ICF Parameters

<Parameter>	Description
<format>	Determines the number of bits in the data bits, the presence (or absence) of a parity bit, and the number of stop bits in the start/stop frame. 1 8 Data, 2 Stop 2 8 Data, 1 Parity, 1 Stop 3 8 Data, 1 Stop (default) 4 7 Data, 2 Stop 5 7 Data, 1 Parity, 1 Stop 6 7 Data, 1 Stop 7 8 Data, 1 Parity, 2 Stop 8 7 Data, 1 Parity, 2 Stop
<parity>	Determines how the parity bit is generated and checked (if present). 0 Odd 1 Even 4 No parity (default)

Example

at+icf?

+ICF: 3,4

OK

at+icf=?

+ICF: (1-8),(0,1,4)

OK

at+icf=5,1

OK

4.7.1.13   +MPCMC, Continuous PCM Clock

This command defines whether the PCM clock runs continuously or not. The change takes effect after the next audio operation.

Note It is recommended to power cycle the g20 after PCM clock configuration.

Set Command

The Set command is used for setting the PCM clock configuration.

Command	Response/Action
+MPCMC=<flag>	OK or: +CME ERROR: <err>

Read Command

The Read command returns the current settings for the PCM clock <flag>.

Command	Response/Action
+MPCMC?	+MPCMC: <flag> OK or: +CME ERROR: <err>

Test Command

The Test command returns the possible <flag> values.

Command	Response/Action
+MPCMC=?	+MPCMC: (list of supported <flag>s) OK or: +CME ERROR: <err>

The following table shows the +MPCMC parameters.

Table 94. +MPCMC Parameters

<Parameter>	Description
<flag>	0 Non-continuous PCM clock 1 Continuous PCM clock Before the AT+MPCMC command is set for the first time, this value is 0. Power-up is according to the flex.

Example

AT+MPCMC=?

+MPCMC:(0-1)

OK

AT+MPCMC?

+MPCMC: 1

OK

AT+MPCMC=0

OK

AT+MPCMC?

+MPCMC: 0

OK

4.7.1.14   ATS97, Antenna Diagnostic

This command indicates whether the antenna is connected and whether the hardware supports this feature. In order to receive the required information, an external hardware short circuit should be implemented on the customer side, between PIN 39 and PIN 41 of the 70-pin connector.
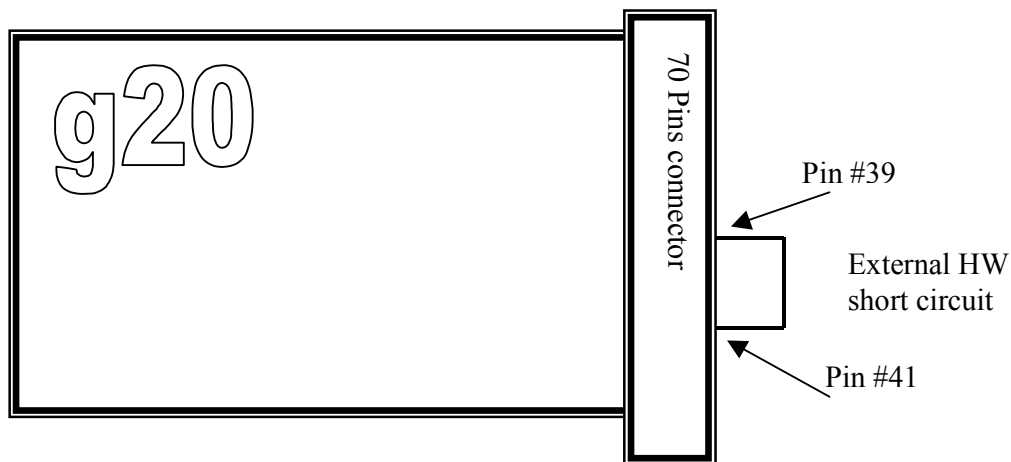
Figure 9. Antenna Diagnostics Pins Location

Execute Command

Command	Response/Action
ATS97	OK or: +CME ERROR: \<err>

Read Command

The Read command indicates whether the antenna is connected.

Command	Response/Action
ATS97?	\<info> OK or: +CME ERROR: \<err>

The following table shows the ATS97 parameters.

Table 95. ATS97 Parameters

\<Parameter>	Description
\<info>	000 Either the antenna is not connected or the hardware does not support this feature 001 The antenna is connected

Example

// Connect the antenna and the external short circuit

ATS97?

001

ATS97

OK

ATS97=?

ERROR

// Disconnect the antenna

ATS97?

000

4.7.1.15   +MRST, Perform Hard Reset

The +MRST command enables customer software to perform a hard reset to the g20 unit. This command provides a software simulation for pressing the power-off button. The command can be sent to the g20 unit from each of the MUX channels.

Set Command

The Set command performs a graceful hard reset to the g20 module.

Command	Response/Action
+MRST	OK

	The Read and Test commands are not permitted for the +MRST command.
Note	

Example

at+mrst

OK

// Result - g20 module performs a power down

4.8   AUDIO

The Audio feature in the g20 is made up of three main parts: Path, Gain and Algorithm. The Path features control the navigation of the audio in the product. The Gain features control the volume of the different accessories, sounds and tones. The Algorithm features control the audio quality, echo canceling and so on. All these features are accessible to the user via the Audio AT commands described in the following sections.

- Path AT Commands:

  The Audio may run in different paths that are related to the different Input or Output accessories. The AT+MAPATH and AT+MADIGITAL commands support path changes, as described in "+MAPATH, Audio Path" on page 231.

- Gain AT Commands:

  - Volume: The volume is set differently for each output path and audio feature (voice, keypad, and so on). For example, one volume level for rings through the speaker and a different volume level for rings through the transducer. Therefore, there will be 16 different volume levels, which is the product of the number of output accessories (speaker, headset speaker, transducer and digital output) and the number of audio tones (voice, keypad, ring and alert).

  - Input Accessories Mute: The user can mute any combination of the input accessories (mic, headset mic and digital input).

  Gain related commands include:

  - +MAVOL, Volume Setting, described on page 235.

  - +MAMUT, Input Devices Mute, described on page 239.

- Algorithm AT Commands:

  - Sidetone: Reduces the microphone audio input routed to the selected speaker so that the people speaking will be able to hear themselves talking. Use the AT+MAFEAT command, described on page 238. If g18 compatibility is required, refer to "S94, Sidetone Effect" on page 221.

  - Echo Cancel: Suppresses a large amount of the output sound picked up by the input device (cancels all echo). Use the +MAFEAT command, described on page 238. If g18 compatibility is required, refer to "S96, Echo Canceling" on page 222.

  - Noise Suppression: Improves audio quality in all modes and suppresses environment noise from the input device. Use the +MAFEAT command, described on page 238. If g18 compatibility is required, refer to "S96, Echo Canceling" on page 222.

On power up, the algorithms used are selected according to the device attached, for example, handset, headset or handsfree. Any use of the +MADIGITAL, +MAPATH, +MAVOL, +MAMUT or +MAFEAT AT commands will reset audio algorithms (EC, NS and ST) to their defaults, and from now on they will be selected using +MAFEAT.

The AT+MAFEAT command controls all the algorithm features, and can be used to enable/disable any combination of the algorithms. The ATS94/ATS96 set exists only for backup compatibility reasons. Clients using this set of commands do not use the AT+MAFEAT command.

Note While using ATS94 and ATS96, echo cancellation causes sidetone muting, and disabling echo cancellation causes sidetone unmuting.

The following table explains the use of the ATS94/ATS96 set.

Table 96. ATS96 and ATS94 Behavior

ATS96	ATS94	Echo Cancel	Noise Suppress	ST
0	0	Disabled	Disabled	Disabled
0	1	Disabled	Disabled	Enabled
1	0	Enabled	Enabled	Disabled
1	1	Enabled	Enabled	Disabled

Note
Motorola recommends using the AT+MAFEAT command when working with the audio algorithm features.

On power down, the state is not saved. In the next power up and upon entering advanced audio setup (refer to section 4.8.1) the default state is restored (sidetone enabled, echo canceling disabled and noise suppression disabled).

4.8.1   Audio Setup

The g20 has two audio setups: basic and advanced. The basic setup is divided to Fixed Mobile setup and g18 Compatible setup, which are selected by flex. Each setup has a different behavior and a set of relevant AT commands. Advanced mode is selected by using any of the advanced AT commands.

Figure 10 below describes the existing audio setups, the workflow of the steps and the AT commands related to each setup.
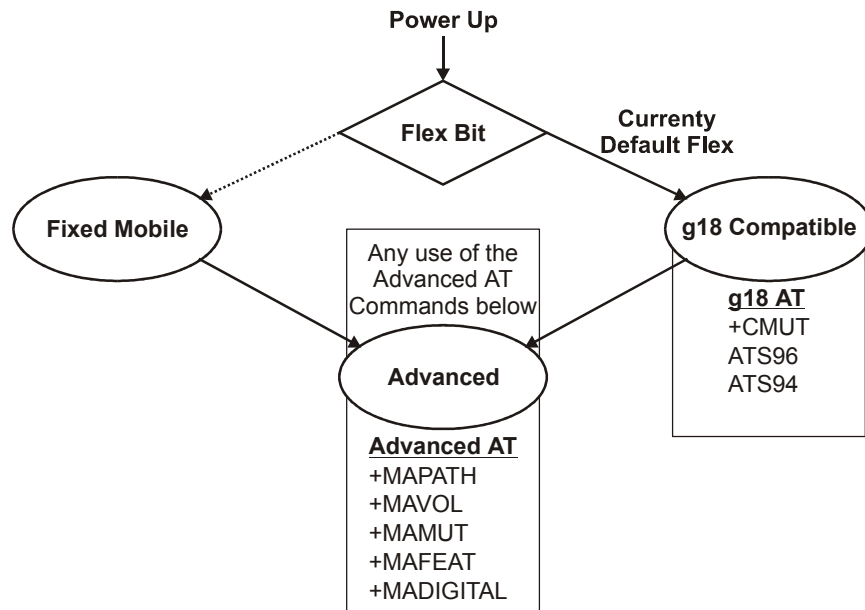
Figure 10. Audio Setup Workflow

4.8.1.1   Basic Audio Setup

In the basic audio setup, the g20 is responsible for audio path and algorithm selection, according to the device attached. While in g18 compatible mode, algorithms are set by the ATS94 and ATS96 commands.

Figure 11 shows the basic audio setup.

<u>Idle mode</u>

There is no signal on the HDST_INT line.

<u>HeadSet mode</u>

The user has attached a device to the HDST_INT line , and caused a change in the audio input and output path.

Mic			Speaker
Headset Mic	**g20**		Headset Speaker
Digital RX			Digital TX
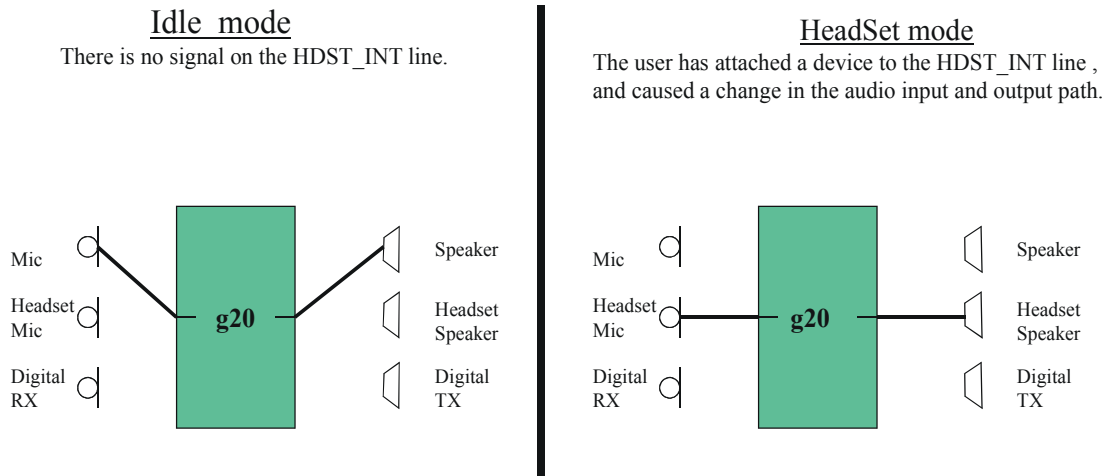
Figure 11. Basic Audio Setup

4.8.1.2   Advanced Audio Setup

The user is responsible for audio path and algorithm setting. The HDST_INT line does not affect the audio routing and the algorithm's selection. The user will not use ATS94 and ATS96 for algorithm selection.

Figure 12 shows the advanced setup.

The mic and speaker active are set using AT+MAPATH or AT+MADIGITAL .

The audio algorithms active are set using AT+MAFEAT .

Mic			Speaker
Headset Mic	**g20**		Headset Speaker
Digital RX			Digital TX
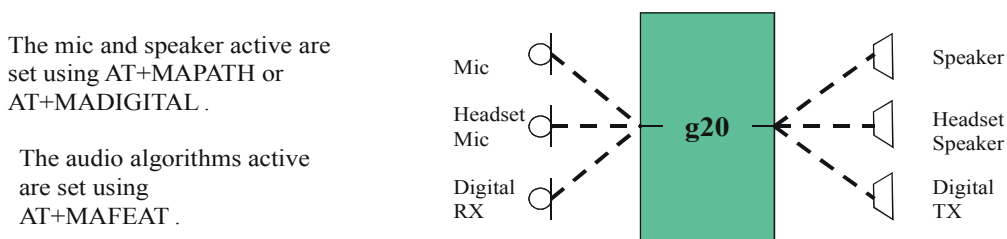
Figure 12. Advanced Audio Setup

The Advanced Audio Setup supports both analog and digital audio. Switching between analog and digital audio modes is done by AT+MADIGITAL command. The default state is analog.
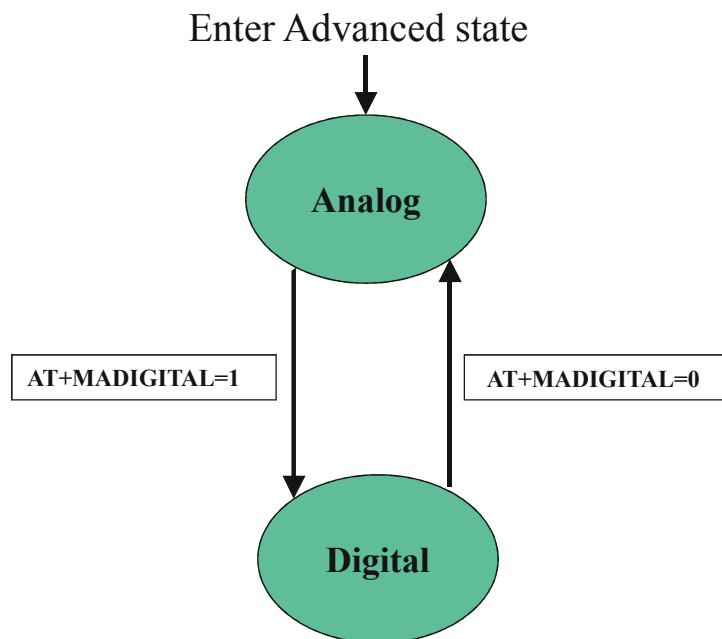
Figure 13. Analog/Digital Switching

4.8.2   Basic Audio Setup Commands

4.8.2.1   +CRTT, Ring Type Selection

This command plays one cycle of a tone ring, stops the cycle in the middle and sets the tone ring to be used.

Set Command

The Set command sets the ring type and operation.

Command	Response/Action
AT+CRTT=<RingTypeNumber>, <operation>	OK or: +CME ERROR: <err>

Read Command

The Read command returns the ring type number.

Command	Response/Action
AT+CRTT?	+CRTT: <RingTypeNumber> OK or: +CME ERROR: <err>

Test Command

The Test command returns the list of supported tone type numbers and operations.

Command	Response/Action
AT+CRTT=?	+CRTT: (list of supported <RingTypeNumber>s), (list of supported <operation>s) OK or: +CME ERROR: <err>

The following table shows the +CRTT parameters.

Table 97. +CRTT Parameters

<Parameter>	Description
<RingType Number>	Ring tone styles
<operation>	Play or set a tone 0 Play (play one cycle) 1 Set 2 Stop

Example

AT+CRTT=4,0	//Ring type number 4, operation 0 (play)
OK	//When 4 is in the supported <RingTypeNumber> range

AT+CRTT=4,2   //Ring type number=4, operation 2 (stop)

OK

AT+CRTT=?

+CRTT: (6-47),(0-2)

OK

AT+CRTT?

+CRTT: 4   //Ring type number 4

AT+CRTT=5,4   //Invalid operation

+CME ERROR: <err>

4.8.2.2   S94, Sidetone Effect

This command is used for g18 compatibility. This command reduces the microphone audio input that is routed to the selected speaker, so that people speaking will hear themselves talking. Refer to "+MAFEAT, Features Selection" on page 238. (The default value of S94 is "1").

Set Command

The Set command sets the sidetone status.

Command	Response/Action
ATS94=<n>	OK or: +CME ERROR: <err>

Read Command

The Read command returns the sidetone status.

Command	Response/Action
ATS94?	<000-disabled, 001-enabled> OK or: +CME ERROR: <err>

Test Command

Command	Response/Action
ATS94=?	+CME ERROR: <err>

The following table shows the S94 parameters.

Table 98. S94 Parameters

<Parameter>	Description
<n>	0 Disable sidetone 1 Enable sidetone * On power up the sidetone is enabled.

Example

ATS94=0   //Disable sidetone

OK

ATS94=2

+CME ERROR: <err>

ATS94?

000   //Sidetone disabled

OK

4.8.2.3   S96, Echo Canceling

This command is used for g18 compatibility. This command suppresses a large amount of the output sound picked up by the input device (cancels all echo). Refer to "+MAFEAT, Features Selection" on page 238. (S96 value is saved in the Flex).

Set Command

The Set command sets the echo canceling status.

Command	Response/Action
ATS96=<n>	OK or: +CME ERROR: <err>

Read Command

The Read command returns the echo canceling status.

Command	Response/Action
ATS96?	<000-disabled, 001-enabled> OK or: +CME ERROR: <err>

Test Command

Command	Response/Action
ATS96=?	+CME ERROR: <err>

The following table shows the S96 parameters.

Table 99. S96 Parameters

<Parameter>	Description
<n>	0 Disable echo canceling Disable noise suppression 1 Enable echo canceling Enable noise suppression

Example

ATS96=1   //Enable echo canceling

OK

ATS96=4

+CME ERROR: <err>

ATS96?

001   //Echo canceling enabled

OK

4.8.2.4   +CRSL, Call Ringer Level

This command handles the selection of the incoming call ringer and alert tone (SMS) sound level on the alert speaker of the g20. The new value remains after power cycle.

Set Command

The Set command sets the call ringer and alert (SMS) level.

Command	Response/Action
+CRSL=<level>	OK +CME ERROR: <err>

Read Command

The Read command displays the current ringer alert (SMS) sound level setting.

Command	Response/Action
+CRSL?	+CRSL: <level> +CME ERROR: <err>

Test Command

The Test command displays the list of supported sound level settings.

Command	Response/Action
+CRSL=?	+CRSL: (list of supported <level>s) +CME ERROR: <err>

The following table shows the +CRSL parameters.

Table 100. +CRSL Parameters

<Parameter>	Description
<level>	0 Mute 1-7 Ringer sound level (1 is lowest; 7 is default)

Example

at+crsl?

+CRSL: 7

OK

at+crsl=?

+CRSL: (0-7)

OK

at+crsl=5

OK

4.8.2.5   +CVIB, Vibrator Mode

This command handles the enabling and disabling of the vibrator alert feature of the g20 during a mobile-terminated incoming call. This command changes the +CALM command setting and vice-versa. (Refer to "+CALM, Alert Sound Mode", page 241.) The value of the command is saved after a power cycle.

Set Command

The Set command enables/disables the vibrator alert feature of the g20.

Command	Response/Action
+CVIB=<mode>	OK +CME ERROR: <err>

Read Command

The Read command displays the current vibrator alert setting.

Command	Response/Action
+CVIB?	+CVIB:<mode> +CME ERROR: <err>

Test Command

The Test command displays the list of supported CVIB modes.

Command	Response/Action
+CVIB=?	+CVIB: (list of supported <mode>s) +CME ERROR: <err>

The following table shows the +CVIB parameters.

Table 101. +CVIB Parameters

<Parameter>	Description
<mode>	Enables/disables the vibrator alert feature of the g20. 0 Disable (default) 1 Enable 16 Ring and vibrate

Example

at+cvib=?

+CVIB: (0,1,16)

OK

at+cvib?

+CVIB: 0

OK

at+cvib=1

OK

4.8.2.5.1   Interaction Between +CVIB and +CALM

Table 102. Interaction Between +CVIB and +CALM

Change +CVIB Mode	Change +CALM Mode
0 -> 1 Change to enable	Change to 2 (vibrate mode)
1 -> 0 Change to disable	Change to 0 (default ring mode)
-> 16 Change to ring/vibrate	Change to 3 (ring/vibrate)

Note

Changing the +CALM <mode> to 1 (silent) changes the +CVIB mode to 0 (disabled). This is a one-way change that does not occur in the other direction.

4.8.2.6   +VTD, Tone Duration

This command handles the selection of tone duration. An integer <n> defines the length of tones emitted as a result of the +VTS command. This command does not affect the D (dial) command. (Refer to "D, Dial Command", page 60.)

Any value other than zero causes a tone of duration <n> in multiples of 100 msec.

In this command, the new value is erased after power down.

Note In GSM, the tone duration value can be modified depending on the specific network.

Set Command

The Set command sets the tone duration.

Command	Response/Action
+VTD=<n>	OK. +CME ERROR: <err>

Read Command

The Read command displays the current tone duration.

Command	Response/Action
+VTD?	<n> +CME ERROR: <err>

Test Command

The Test command displays the list of supported tone durations.

Command	Response/Action
+VTD=?	+VTD: (list of supported <n>s) +CME ERROR: <err>

The following table shows the +VTD parameters.

Table 103. +VTD Parameters

<Parameter>	Description
<n>	Defines the length of tones emitted by the +VTS command. 0-600 Multiples of 100 msec (0 is equivalent to 1, that is, 100 msec) The default is 5 multiples of 100 msec.

Example

AT+VTD=?

+VTD: (0-600)

OK

AT+VTD?

+VTD: 5

OK

AT+VTD=10

OK

4.8.2.7   +VTS, Command-Specific Tone Duration

This command transmits a string of DTMF tones when a voice call is active. DTMF tones may be used, for example, when announcing the start of a recording period.

The duration does not erase the VTD duration (Refer to "+VTD, Tone Duration" on page 227.)

Note

In GSM, the tone duration value can be modified depending on the specific network.

If the active call is dropped in the middle of playing a DTMF tone, the following unsolicited message transfers to TE: +V+S: "Call termination stopped DTMF tones transmission".

Set Command

The Set command sets the tone and duration (if entered).

Command	Response/Action
+VTS= <DTMF>,[<duration>]	OK +CME ERROR: <err>

Read Command

The Read command displays the currently transmitted DTMF tone. An error is displayed if no tone is active.

Command	Response/Action
+VTS?	+VTS: <DTMF>
	+CME ERROR: <err>

Test Command

The Test command displays the list of supported DTMF tones and tone lengths.

Command	Response/Action
+VTS=?	+VTS: (list of supported <DTMF>, (list of supported <durations>s)
	+CME ERROR: <err>

The following table shows the +VTS parameters.

Table 104. +VTS Parameters

<Parameter>	Description
<DTMF>	String of ASCII characters (0-9, a-d) (maximum 32 characters)
<duration>	A DTMF tone of different duration from that set by the +VTD command. 0-600 Multiples of 100 msec (0 is equivalent to 1, that is, 100 msec) <duration> does not erase the +VTD duration.

Note

The duration defined by +VTS is specific to the DTMF string in this command only. It does not erase the duration defined by the +VTD command, and is erased when the g20 is powered down.

If <duration> is not defined, the +VTD value is used.

Example

AT+VTS ?

+VTS: "5"

OK

AT+VTS="2",10

OK

4.8.2.8   +CMUT, Mute/Unmute Currently Active Microphone Path

This command is used to mute/unmute the currently active microphone path by overriding the current mute state.

Set Command

The Set command enables/disables uplink voice muting during a voice call.

Command	Response/Action
+CMUT=<state>	OK or: +CME ERROR: <err>

Read Command

The Read command returns the current uplink voice mute/unmute state.

Command	Response/Action
+CMUT?	+CMUT: <state> OK

Test Command

The Test command returns the possible <state> values.

Command	Response/Action
+CMUT=?	+CMUT: (list of supported <state>s) OK

The following table shows the +CMUT parameters.

Table 105. +CMUT Parameters

<Parameter>	Description
<n>	0 Unmute microphone path 1 Mute microphone path

Example

AT+CMUT=?

+CMUT:(0-1)

OK

AT+CMUT?

+CMUT: 0 uplink voice is unmuted

OK

AT+CMUT=1 uplink voice is muted

OK

AT+CMUT?

+CMUT: 1

OK

AT+CMUT =2

+CME ERROR: <err>

4.8.3 Advanced Audio Setup Commands

This group of commands enables accessory devices to control certain audio aspects within the system.

4.8.3.1 +MAPATH, Audio Path

This command sets/requests the active input accessory, and the output accessory for each feature. For example, you can choose the headset mic to be active, the voice and keypad feedbacks to go to the speaker, and the alerts and rings to go to the alert speaker. On power up, the default path, mic, speaker and alert speaker are restored.

> **Note**
> +MAPATH cannot be used to set digital audio, but only to read it. In order to set the digital audio path, use +MADIGITAL. For more information, refer to section 4.8.3.2.

The following diagram shows the audio paths:

.
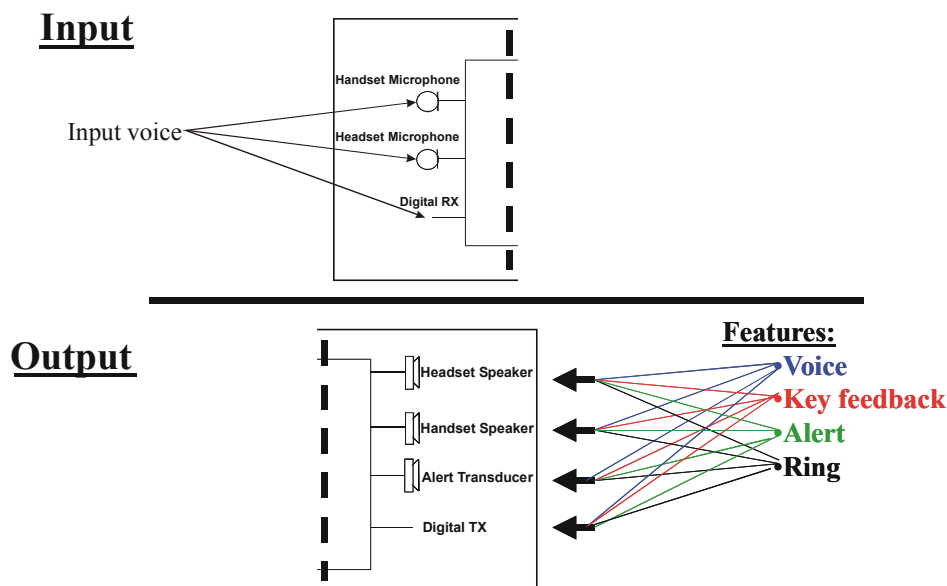
Figure 14. Audio Paths

Set Command

The Set command sets the audio path mode. The mode indicates which I/O accessories are now active for the different audio features. The <features> field is only used for outputs (direct=1).

Command	Response/Action
+MAPATH= <direct>,<accy> [,<features>]	OK or: +CME ERROR: <err>

Read Command

The Read command returns the active input audio accessory and the output accessory for each feature.

Command	Response/Action
+MAPATH?	+MAPATH:1(mode in),<accy> +MAPATH:2(mode out), <accy>,<feature> [<CR><LF>+MAPATH:2(mode out), <accy>,<feature> [...]] OK

Test Command

The Test command returns the supported audio directions (input/output), accessories and features.

Command	Response/Action
+MAPATH=?	+MAPATH: (list of supported directions),(list of supported accessories),(list of supported features combinations) OK

The following table shows the +MAPATH parameters.

Table 106. +MAPATH Parameters

<Parameter>	Description
<direct>	1 Mode in, field <features> is ignored. 2 Mode out, field <features> is present.
<accy>	Mode in: 1 Mic 2 Headset mic 3 Digital RX (for read command only) Mode out: 1 Speaker 2 Headset speaker 3 Alert speaker, for example, battery low, incoming SMS, power up, and so on 4 Digital TX (for read command only)
<features> (1-15)	1 Voice 2 Key feedback 4 Alert 8 Ring

Example

AT+MAPATH=1,2   //Direct=1 (input), accy=2 (headset mic)

OK

AT+MAPATH=2,1,3   //Direct=2 (output), accy=1 (speaker), feature=1 (voice and keypad)

OK

AT+MAPATH?   //Set the headset mic as the input accessory

MAPATH: 1,2   //Direct=1 (input), accy=2 (headset mic)

MAPATH: 2,1,1   //Direct=2 (output), accy=1 (speaker), feature=1 (voice)

MAPATH: 2,1,2	//Direct=2 (output), accy=1 (speaker), feature=2 (keypad)
MAPATH: 2,3,4	//Direct=2 (output), accy=3 (alert speaker), feature=4 (alert)
MAPATH: 2,3,8	//Direct=2 (output), accy=3 (alert speaker), feature=8 (ring)

OK

AT+MAPATH=?

+MAPATH: (1,2),(1-4),(1-15)

OK

4.8.3.2   +MADIGITAL, Analog/Digital Audio Switching

This command switches between analog and digital audio modes. The g20 enters the advanced audio setup (see "Advanced Audio Setup" on page 218) in analog audio mode, AT+MADIGITAL=1 switches it to digital audio mode and AT+MADIGITAL=0 switches it back to analog mode, see Figure 13

> **Note** Do not use +MAPATH set command while in digital audio mode.

Set Command

The Set command toggles between analog and digital audio modes.

Command	Response/Action
+MADIGITAL= <state>	OK or: +CME ERROR: <err>

Read Command

The Read command returns the current audio mode (analog or digital).

Command	Response/Action
+MADIGITAL= <state>	OK or: +CME ERROR: <err>

Test Command

The test command returns the available digital audio modes.

Command	Response/Action
+MADIGITAL= <state>	+MADIGITAL: <available audio modes> OK

Example

AT+MADIGITAL=1   //digital audio mode request

OK

AT+MADIGITAL?   //digital audio mode is on

+MADIGITAL:1

OK

AT+MADIGITAL=?

+MADIGITAL: (0,1)

OK

4.8.3.3   +MAVOL, Volume Setting

This command enables you to determine a volume level for a particular feature via a particular accessory. The gain levels are saved in flex. Therefore, upon power up, the path active (mic, speaker and alert speaker) will have these saved gain levels.

> **Note**
>
> The SMS MT volume is adjusted using the +MAVOL command with type "ring". The "RING value is related to the SMS alert, the MT call, and so on.

Output
+ MAVOL

Features:
- **Voice**
- **Key feedback**
- **Alert**
- **Ring**

Input
+MAMUT

- Input voice

Example of current g20 volume levels Matrix

	Voice	Key feedback	Alert	Ring
Headset Speaker	1	2	4	7
Handset Speaker	3	5	4	2
Alert Transducer	6	4	6	1
Digital TX	6	3	3	1

Example: g20 Mute state

	Handset Mic	Headset Mic	Digital RX
Mute state	0	1	0
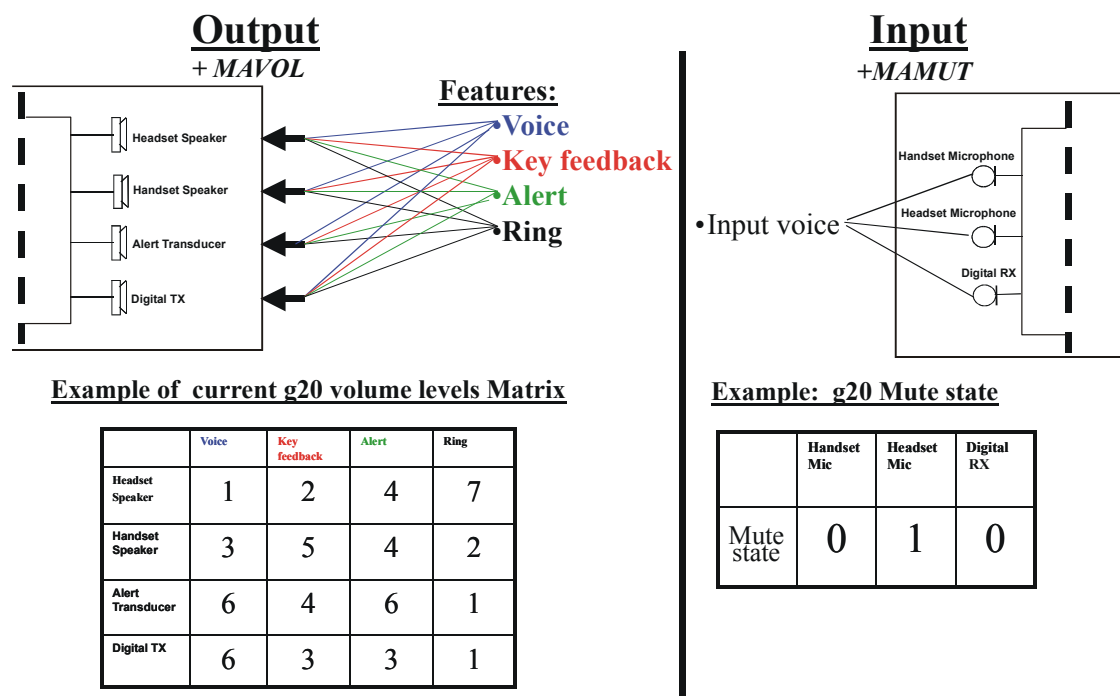
Figure 15. g20 Audio Gain

Set Command

The Set command sets the volume level <n> to a certain <feature> through a certain <accy>.

Command	Response/Action
+MAVOL=<accy>,<feature>,<vol>	OK or: +CME ERROR: <err>

Read Command

The Read command returns the volume level of all the features in the current active accessories.

Command	Response/Action
+MAVOL?	(Current path volume) +MAVOL: <accy>,<feature1>,<vol> +MAVOL: <accy>,<feature2>,<vol> +MAVOL: <accy>,<feature4>,<vol> +MAVOL: <accy>,<feature8>,<vol> OK

Test Command

Test command returns the supported range of volume levels, accessories and features.

Command	Response/Action
+MAVOL=?	+MAVOL:(supported accessories),(supported features combinations),(supported volume levels)

The following table shows the +MAVOL parameters.

Table 107. +MAVOL Parameters

<Parameter>	Description
<accy> (1-15)	1 Speaker 2 Headset speaker 4 Alert speaker 8 Digital TX
<feature> (1-15)	1 Voice 2 Keypad feedback 3 Voice and keypad feedback 4 Alert 8 Ring
<vol>	Volume level 0-7

Example

//Set volume level 3 for voice through speaker

AT+MAVOL=1,3,3   //Accy=1 (speaker), feature=1 (voice), vol=3 (volume level)

OK

 //Set volume level 5 for voice and keypad through speaker

AT+MAVOL=1,3,5   //Accy=1 (speaker), feature=3 (voice and keypad), vol=5 (volume level)

OK

AT+MAVOL?   //Requests the volume level of the current path's features

//Currently the voice outputs through speaker and its volume level is 5

+MAVOL: 1,1,5   //Accy=1 (speaker), feature=1 (voice), vol=5

//Currently the keypad outputs through speaker and its volume level is 5

+MAVOL: 1,2,5   //Accy=1 (speaker), feature=2 (keypad), vol=5

//Currently the alert outputs through alert speaker and its volume level is 2

+MAVOL: 4,4,2   //Accy=4 (alert speaker), feature=4 (alert), vol=2

//Currently the ring outputs through alert speaker and its volume level is 2

+MAVOL: 4,8,2   //Accy=4 (alert speaker), feature=8 (ring), vol=2

OK

4.8.3.4   +MAFEAT, Features Selection

This command controls the algorithm features: sidetone, echo cancel and noise suppression. Upon power up, the sidetone is enabled, and echo canceling and noise suppression are disabled.

Set Command

The Set command enables/disables feature combinations.

Command	Response/Action
AT+MAFEAT=<feature>,<state>	OK or: +CME ERROR: <err>

Read Command

The Read command returns the features state (enabled/disabled).

Command	Response/Action
AT+MAFEAT?	+MAFEAT: <feature><state>, [<CR><LF>+MAFEAT: <feature><state> [...]] OK or: +CME ERROR: <err>

Test Command

The Test command returns the list of supported features' numbers and supported states (enable/disable).

Command	Response/Action
AT+MAFEAT=?	+MAFEAT: (<list of supported <feature>s), (<list of supported <state>s) OK or: +CME ERROR: <err>

The following table shows the +MAFEAT parameters.

Table 108. MAFEAT Parameters

<Parameter>	Description
<feature>(1-7)	1 Sidetone 2 Echo cancel 4 Noise suppress
<state>	0 Disable 1 Enable

Example

AT+MAFEAT=5,1   //Enables sidetone and noise suppress

OK

AT+MAFEAT?

+MAFEAT: 1,1   //Feature=1 (sidetone), state=1 (enabled)

+MAFEAT: 2,0   //Feature=2 (echo cancel), state=0 (disabled)

+MAFEAT: 4,1   //Feature=4 (noise suppress), state=1 (enabled)

OK

4.8.3.5   +MAMUT, Input Devices Mute

This command controls the muting/unmuting of all input paths (mic, headset mic or digital RX). Upon power up, all the devices are unmuted.

Set Command

The Set command mutes/unmutes any input accessory or any combination of them.

Command	Response/Action
+MAMUT=<accy>,<state>	OK or: +CME ERROR: <err>

Read Command

The Read command returns the current mute/unmute state of all the input accessories.

Command	Response/Action
+MAMUT?	+MAMUT:<accy1>,<state>
	+MAMUT:<accy2>,<state>
	+MAMUT:<accy4>,<state>
	OK

Test Command

The Test command returns the mute states available and the output accessories supported.

Command	Response/Action
+MAMUT=?	+MAMUT:(<accy> range),(<state> range)

The following table shows the +MAMUT parameters.

Table 109. MAMUT Parameters

<Parameter>	Description
<accy> (1-7)	1 Mic
	2 Headset mic
	4 Digital RX
<state>	0 Unmute
	1 Mute

Example

AT+MAMUT=2,0   //Accy=2 (headset mic), state=0 (unmute)

OK

AT+MAMUT=5,1   //Accy=5 (mic + Digital RX), state=1 (mute)

OK

AT+MAMUT?

+MAMUT: 1,1   //Accy=1 (mic), state=1 (mute)

+MAMUT: 2,0   //Accy=2 (headset mic), state=0 (unmute)

+MAMUT: 4,1   //Accy=4 (Digital RX), state=1 (mute)

AT+MAMUT=?

+MAMUT: (1-7),(0,1)

OK

4.8.3.6 +CALM, Alert Sound Mode

This command handles the selection of the g20's alert sound mode. This command changes the +CVIB command setting and vice-versa. (Refer to "+CVIB, Vibrator Mode", page 225.) The value of the command is saved after a power cycle.

Set Command

The Set command sets the alert sound mode.

Command	Response/Action
+CALM=<mode>	OK +CME ERROR: <err>

Read Command

The Read command displays the current alert sound mode setting.

Command	Response/Action
+CALM?	+CALM: <mode> +CME ERROR: <err>

Test Command

The Test command displays the list of supported modes.

Command	Response/Action
+CALM=?	+CALM: (list of supported <mode>s) +CME ERROR: <err>

The following table shows the +CALM parameters.

Table 110. +CALM Parameters

<Parameter>	Description
<mode>	Alert sound mode of the g20. 0 Ring (default) 1 Silent mode (all g20 sounds prevented) 2 Vibrate (not in use for OEM models) 3 Ring/vibrate

Note Selecting the ring mode with this command retrieves the current alert volume level setting.

Example

at+calm=?

+CALM: (0,1,2,3)

OK

at+calm?

+CALM: 0

OK

at+calm=1

OK

4.8.3.7   +CLVL, Loudspeaker Volume

This command sets the volume of the internal loudspeaker (which also affects the key feedback tone) of the g20.

Note The +CLVL command does not control the alert speaker.

In this command, the new value remains after power cycle.

The +CLVL command can be used even when the SIM is not inserted.

Set Command

The Set command sets the internal loudspeaker volume level.

Command	Response/Action
+CLVL=<level>	OK +CME ERROR: <err>

Read Command

The Read command displays the current internal loudspeaker volume setting.

Command	Response/Action
+CLVL?	+CLVL: <level> +CME ERROR: <err>

Test Command

The Test command displays the possible loudspeaker volume settings.

Command	Response/Action
+CLVL=?	+CLVL: (list of supported <level>s) +CME ERROR: <err>

The following table shows the +CLVL parameters.

Table 111. +CLVL Parameters

<Parameter>	Description
<level>	0-7 Manufacturer-specific volume range. 0 is lowest volume (not mute). The default value is 7.

Example

at+clvl?

+CLVL: 7

OK

at+clvl=?

+CLVL: (0-7)

OK

at+clvl=3

OK

4.8.3.8 + MMICG, Microphone Gain Value

This command handles the selection of microphone gain values of MIC-handsets (not MIC-headsets). The new value remains after power cycle.

Set Command

The Set command sets the microphone gain value.

Command	Response/Action
+MMICG=<gain>	OK
	+CME ERROR: <err>

Read Command

The Read command displays the current microphone gain.

Command	Response/Action
+MMICG?	+MMICG: <gain>
	+CME ERROR: <err>

Test Command

The Test command displays the list of supported gain values.

Command	Response/Action
+MMICG=?	+MMICG （list of supported <gain>s)
	+CME ERROR: <err>

The following table shows the +MMICG parameters.

Table 112. +MMICG Parameters

<Parameter>	Description
<gain>	Microphone gain values in db:
	0-31 0 is lowest gain value (not mute); default is 16 db

Example

at+mmicg=?
+MMICG: (0-31)

OK
at+mmicg?

+MMICG: 16

OK
at+mmicg=30

OK

4.9   ACCESS

4.9.1   Access Control Commands

When the phone or SIM card is locked or blocked, the only accessory operations allowed are those found in the list of Core AT commands (allowed while phone/SIM card is locked), shown in "Core AT Commands" on page 41. All other AT commands are not executed, for example, accessing phone book entries. However, the phone is still capable of sending asynchronous message events via AT responses, for example, incoming call notification.

4.9.1.1   A/, Repeat Last Command

This command repeats the last command. It is not necessary to press <Enter> after this command.

Execute Command

Command	Response/Action
A/	Repeats last command

Example

AT&D?

&D: 2

OK

A/

&D: 2

OK

4.9.1.2   AT, Check AT Communication

This command only returns OK.

Execute Command

Command	Response/Action
AT	OK

Example

AT

OK

4.9.1.3   +CPIN, Enter PIN for Unlocking SIM Card or Enter PUK for Unblocking SIM Card

This command locks the SIM card, and therefore is only relevant for phones that use SIM cards. It unlocks the SIM card when the proper SIM PIN is provided and unblocks the SIM card when the proper SIM PUK is provided.

The SIM card is unlocked only once the provided pin is verified as the SIM PIN. If the required PIN (determined by the error code returned from the requested operation or the Read command) is SIM PUK or SIM PUK2, the second pin is required. This second pin, <newpin>, is used to replace the old pin in the SIM card. When entering the pin, a <new pin> is not required.

> **Note**
> The following commands are accepted when the g20 is awaiting the SIM PIN or SIM PUK: +CGMI, +CGMM, +CGMR, +CGSN, D112; (emergency call), +CPAS, +CFUN, +CPIN, all basic AT commands, +CBAUD, +CEER, +CIP, +CIPE, +CKPD, +CLAC, +CLCC, +CLVL, +CMEE, +CMER, +CMUX, +CR, +CRC, +CSCB, +CSCR, +CSQ, +GCAP, +GMI, +GMM, +GMR, +GSN, +IFC, +IPR, +MCWAKE, +MDES, +MECC, +MSCTS, +MTCTS and +MTDTR.

> **Note**
> The SIM card lock is another level of security independent of the phone lock (See "Access Control Commands" on page 246 for more information.)

Figure 16 presents a diagram of what occurs when using the SIM card. Note that if an incorrect password is entered three times, the g20 requires that a master password be entered, If this also fails three times, the SIM will be blocked, and you will have to go to your provider to unblock it.
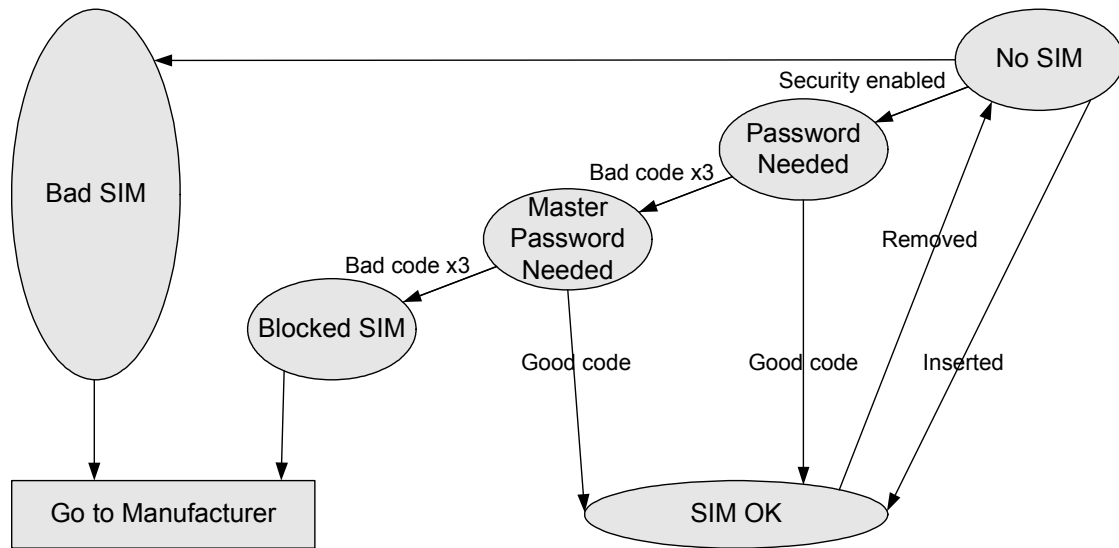
Figure 16. SIM States

A SIM card related error is returned if an AT command operation is unsuccessful due to a SIM card problem. The following table shows the SIM card errors:

Table 113. SIM Card Errors

Error	Description
10 SIM not inserted	SIM Card is not inserted
11 SIM PIN required	SIM Card waiting for SIM PIN to be entered
12 SIM PUK required	SIM PIN is blocked
13 SIM failure	SIM Card is permanently blocked
17 SIM PIN2 required	SIM Card is waiting for SIM PIN2 to be entered
18 SIM PUK2 required	SIM PIN2 is blocked

Set Command

The Set command sends the password to the g20 that is necessary before it can be operated (SIM PIN or SIM PUK). If there is no PIN request pending, no action is taken towards the g20, and an error message, +CME ERROR, is returned to the terminal.

The Set command issued gives the code (SIM PIN or SIM PUK) corresponding to the error code required or returned as the result of the Read command. For example, if the SIM PIN is blocked, the error code 11 or "SIM PIN required" is returned. The user must then issue the Set command with the SIM PIN.

Command	Response/Action
AT+CPIN=[<puk> or <pin>], [<newpin>]	OK or: +CME ERROR: <err>

Read Command

The Read command returns an alphanumeric string indicating the status of the SIM card, and whether a password is required or not. This is an independent SIM card lock status check only, and does not check the phone lock status.

Command	Response/Action
AT+CPIN?	+CPIN: <code> OK or: +CME ERROR: <err>

Test Command

Command	Response/Action
AT+CPIN=?	OK or: +CME ERROR: \<err>

The following table shows the +CPIN parameters.

Table 114. +CPIN Parameters

\<Parameter>	Description
\<puk>	PUK code for unblocking a blocked phone
\<pin>	Current PIN for unlocking a locked phone
\<newpin>	New PIN (after changing or after entering PUK) 4 - 8 digits
\<code>	READY Not waiting for a password SIM PIN Waiting for SIM PIN SIM PUK Waiting for SIM PUK SIM PIN2 Waiting for SIM PIN2 SIM PUK2 Waiting for SIM PUK2
SIM PIN SIM PUK SIM PUK2 SIM PIN 2	AT+CPIN=\<pin> AT+CPIN=\<puk>,\<newpin> AT+CPIN=\<puk2>,\<newpin2> AT+CPIN=\<pin2>

Example

AT+CPIN=?

OK

At+clck="SC",1,"\<correct PIN>"   //Not case-sensitive

OK

The facility is enabled by the +CLCK command (Refer to "+CLCK, Facility Lock" on page 253)

AT+CPIN?

+CPIN: SIM PIN

OK

AT+CPIN="\<correct PIN>"

OK

AT+CPIN?

+CPIN: READY

OK

The status of the SIM is still enabled, but the PIN is READY for this session.

The SIM is enabled per session. After power-up SIM must be unlocked again by using the +CLCK command.

The following case shows an example of three unsuccessful attempts at entering the PIN:

AT+CPIN?

+CPIN: SIM PIN

OK

AT+CPIN="<wrong pin>"

+CME ERROR: "incorrect password"

AT+CPIN="<wrong pin>"

+CME ERROR: "incorrect password"

AT+CPIN="<wrong pin>"

+CME ERROR: "SIM PUK required"

AT+CPIN?

+CPIN: SIM PUK   //PIN is blocked. The PUK is needed for unblocking.

OK

AT+CPIN="<PUK>","<NEW PIN>"   //Enter PUK and new PIN

OK

AT+CLCK="FD",1,"<wrong PIN2>"

+CME ERROR: "incorrect password"

AT+CLCK="FD",1,"<wrong PIN2>"

+CME ERROR: "incorrect password"

AT+CLCK="FD",1,"<wrong PIN2>"

+CME ERROR: "SIM PUK2 required

AT+CPIN?

+CPIN: SIM PUK2   //PIN2 is blocked. The PUK2 is needed for unlocking.

OK

AT+CPIN="<PUK2>","<NEW PIN2>" //Enter PUK2 and new PIN2

OK

4.9.1.4   +CPWD, Change Password

This command sets a new password for the facility lock. The password can only be changed once the required facility is enabled by the +CLCK command. (Refer to "+CLCK, Facility Lock" on page 253).

A password can be changed only if the provided password <oldpwd> has been verified. The entered password <newpwd> must also comply to the password rules. The facility value <fac> is not case-sensitive. In the password value, letters are not allowed.

Set Command

The Set command sets a new password for the facility lock function, defined by the +CLCK command. (Refer to "+CLCK, Facility Lock" on page 253).

Command	Response/Action
AT+CPWD=<fac>,<oldpwd>, <newpwd>	OK or: +CME ERROR: <err>

Read Command

Command	Response/Action
AT+CPWD?	+CME ERROR: <err>

Test Command

The Test command returns a list of pairs which represent the available facilities, and the maximum length of their passwords.

Command	Response/Action
AT+CPWD=?	+CPWD:list of supported (<fac>,<pwdlength>)s OK or: +CME ERROR: <err>

The following table shows the +CPWD parameters.

Table 115. +CPWD Parameters

<Parameter>	Description
<fac>	List of supported facilities. All the facility messages, except for SC and P2, are sent to the network. (The facilities are not case-sensitive.)
	SC SIM (lock SIM card) The SIM requests the password during g20 power-up and when this command is issued.
	AO BAOC (Bar All Outgoing Calls)
	OI BOIC (Bar Outgoing International Calls)
	OX BOIC-exHC (Bar Outgoing International Calls except to Home Country)
	AI BAIC (Bar All Incoming Calls)
	IR BIC-Roam (Bar Incoming Calls when Roaming outside the home country)
	AB All Barring services (applicable only for <mode>=0)
	AG All outGoing barring services (applicable only for <mode>=0)
	AC All inComing barring services (applicable only for <mode>=0)
	P2 SIM PIN2 (Refer to "+CLCK, Facility Lock", page 253)
<oldpwd>	String type, 4-8 character password specified for the facility from the g20 user interface.
<newpwd>	String type, 4-8 character new password specified by the user.
<pwdlength>	Maximum length of the facility password. Integer type.

Example

at+cpwd =?

+CPWD: ("SC",8),("AO",8),("OI",8),("OX",8),("AI",8),("IR",8),("AB",8),("AG",8), ("AC",8),("P2",8)

OK

at+cpwd?

+CME ERROR: "operation not supported"

at+clck: "sc",1,"current pin password"

at+cpwd="sc","incorrect old password","new password"

+CME ERROR: "incorrect password"

at+clck="sc",2

+CLCK: 0

OK

at+cpwd="sc","old password","new password"

+CME ERROR: "operation not allowed"

at+clck="fd",1,"current pin2 password"

at+cpwd="p2","old password","new password"

OK

at+clck="ai",2

+CLCK: 0,1

+CLCK: 0,2

+CLCK: 0,4

OK

at+clck="ai",1,"correct password"

OK

at+clck="ai",2

+CLCK: 1,1

+CLCK: 1,2

+CLCK: 1,4

OK

at+cpwd="ai","old password","new password"

OK

4.9.1.5   +CLCK, Facility Lock

This command locks, unlocks or interrogates a g20 or a network facility <fac> (any kind of call barring program). A password is mandatory for performing locking and unlocking actions, but not for querying. The features of the g20 that are affected by this are the keypad power-up operation and fixed dialing list. When querying the status of a single call barring program <mode>=2, the <status> for each call type will be returned.

For <fac>="SC", SIM Card PIN setting and for <fac>="FD", SIM Fixed Dialing memory setting, the <class> is irrelevant (For more information about <class>, refer to +CLCK Parameters). The <passwd> for "sc" is SIM PIN, and for "fd" it is SIM PIN2.

Set Command

The Set command performs the specified <mode> action on the specified <fac>.

Command	Response/Action
+CLCK=<fac>,<mode>[,<passwd>[,<classx>]]	For <fac> where <class> is irrelevant (SC, FD): +CLCK=<fac>,2 +CLCK: <status> For <fac> with several supported <class>es: +CLCK=<fac>,2 +CLCK: <status>,<class1> [<CR><LF>+CLCK: <status>,<class2> […]] OK

Read Command

Command	Response/Action
+CLCK?	+CLCK: ERROR

Test Command

The Test command returns the list of supported facilities.

Command	Response/Action
+CLCK=?	+CLCK: (list of supported <fac>s)

The following table shows the +CLCK parameters.

Table 116. +CLCK Parameters

<Parameter>	Description

<fac>	SC SIM Card PIN setting
	      <mode> 0 Disable PIN
	             1 Enable PIN)
	FD SIM Fixed Dialing memory setting
	      <mode> 0 Disable fixed dialing feature
	             1 Enable fixed dialing feature)
	AO BAOC (Bar All Outgoing Calls)
	OI BOIC (Bar Outgoing International Calls)
	OX BOIC-exHC (Bar Outgoing International Calls except to Home Country)
	AI BAIC (Bar All Incoming Calls)
	IR BIC-Roam (Bar Incoming Calls when Roaming outside the home country)
	AB All Barring services (applicable only for <mode>=0)
	AG All outgoing barring services (applicable only for <mode>=0)
	AC All incoming barring services (applicable only for <mode>=0)

<passwd>	String type, 4-8 character password
<mode>	0 Unlock 1 Lock 2 Query status (<passwd> does not apply)
<class>	Sum of integers, each representing a class of information <class>. Only applies to call barring related facilities. 1 Voice (telephony) 2 Data (refers to all bearer services) 4 Fax (facsimile services) The default value is 7.
<status>	0 Inactive 1 Active

Example

AT+CLCK=?

+CLCK: ("SC","AO","OI","OX","AI","IR","AB","AG","AC","FD")

OK

AT+CLCK="SC",2

+CLCK: 0

OK

AT+CLCK="SC",1

+CME ERROR: "operation not allowed"

AT+CLCK="SC",1,"incorrect password

+CME ERROR: incorrect password

AT+CLCK="SC",1,"correct password"

OK

(From now SIM Card is locked and PIN is requested on power up)

AT+CLCK="AB",0,"incorrect password"

+CME ERROR: incorrect password

AT+CLCK="IR",2

+CLCK: 0,1

+CLCK: 0,2

+CLCK: 0,4

OK

AT+CLCK="IR",1,"correct password"   //<classx> is defaulted to 7 when not specified

OK

AT+CLCK="IR",2

+CLCK: 1,1

+CLCK: 1,2

+CLCK: 1,4

OK

AT+CLCK="OI",2

+CLCK: 0,1

+CLCK: 0,2

+CLCK: 0,4

OK

AT+CLCK="OI",1,"correct password"

OK

(All international calls are barred.)

AT+CLCK="OI",1,"correct password",3

OK

(Voice and data international calls barred, fax not barred.)

AT+CLCK="OI",2

+CLCK: 1,1

+CLCK: 1,2

+CLCK: 0,4

OK

4.10   MODEM CONFIGURATION AND PROFILE

4.10.1   Modem Register Commands

The g20 holds certain data items in selected memory space, named Software Registers (S-registers) and Modem Registers. Some of these registers are used as bitmaps, where one register holds more than one data item.

All S-registers can be accessed using the S command, described in "S, Bit Map Registers" on page 262. Some registers can also be accessed using dedicated commands, detailed below.

4.10.1.1   V, g20 Response Format

This command determines the response format of the data adapter and the contents of the header and trailer transmitted with the result codes and information responses. This command also determines whether the result codes are transmitted in a numeric or an alphabetic ("verbose") form. The text portion of information responses is not affected by this setting.

The following table shows the effect that setting this parameter has on the format of information text and result codes.

Table 117. Effects of Parameter Settings

	V0	**V1**
Information Responses	\<text\>\<cr\>\<lf\>	\<cr\>\<lf\>\<text\>\<cr\>\<lf\>
Result Codes	\<numeric code\>\<cr\>	\<cr\>\<lf\>\<verbose code\>\<cr\>\<lf\>

Set Command

The Set command sets the format of information responses and result codes.

Command	**Response/Action**
ATV\<value\>	OK or: +CME ERROR: \<err\>

Read Command

The Read command reads the current setting of response format.

Command	Response/Action
ATV?	<current value>

Test Command

The Test command for V is not defined, and therefore is not supported by the g20. The g20 returns an error.

The following table shows the V parameters.

Table 118. V Parameters

<Parameter>	Description
<value>	0 Transmits limited headers and trailers, and numeric text. 1 Transmits full headers and trailers, and verbose response text. The default value is 1.

Example

ATV?

001

OK

ATV0

0

ATV7

4

ATV1

OK

ATV7

ERROR

4.10.1.2   Q, Result Code Suppression

This command determines whether to output the result codes. Information text transmitted in response to commands is not affected by the setting of this parameter.

Set Command

The set commands sets whether or not to output result codes.

Command	Response/Action
ATQ<value>	OK or: +CME ERROR: <err>

Read Command

The Read command reads the current setting for result code suppression.

Command	Response/Action
ATQ?	<current value>

Test Command

The Test command for Q is not defined, and therefore is not supported by the g20. The g20 returns an error.

The following table shows the Qn parameters.

Table 119. Qn Parameters

<Parameter>	Description
<value>	0 Transmit result codes. 1 Suppress result codes. The default value is 0.

Example

ATQ0

OK

ATQ?

000

OK

ATQ4

ERROR

ATQ1   //No response because result codes are suppressed.

ATQ4   //No response because result codes are suppressed.

4.10.1.3 E, Command Echo

This command defines whether input characters are echoed to output. If so, these characters are echoed at the same rate, parity and format at which they were received.

Set Command

The Set command sets whether or not to echo characters.

Command	Response/Action
ATE<value>	OK or: +CME ERROR: <err>

Read Command

The Read command reads the current setting for command echo.

Command	Response/Action
ATE?	<current value>

Test Command

The Test command for E is not defined by ITU, and therefore is not supported by the g20. The g20 returns an error.

The following table shows the E parameters.

Table 120. En Parameters

<Parameter>	Description
<value>	0 Does not echo characters 1 Echoes characters The default value is 0.

Example

ATE?

001

OK

4.10.1.4 X, Result Code Selection and Call Progress Monitoring Control

This command defines the CONNECT result code format. It determines whether or not the g20 transmits particular result codes to the user. It also controls whether the g20 verifies the presence of dial tone when it first goes off-hook to begin dialing, and whether the engaged tone (busy signal) detection is enabled.

Set Command

The Set command sets the result code and call progress monitoring control.

Command	Response/Action
ATX<value>	OK or: +CME ERROR: <err>

Read Command

Command	Response/Action
ATX?	<current value>

Test Command

The Test command for X is not defined by ITU, and therefore is not supported by the g20. The g20 returns an error.

The following table shows the X parameters.

Table 121. X Parameters

<Parameter>	Description
<value>	0 CONNECT result code given upon entering online data state: Dial tone detection Disabled Busy detection Disabled 1 CONNECT <text> result code given upon entering online data state: Dial tone detection Disabled Busy detection Disabled 2 CONNECT <text> result code given upon entering online data state: Dial tone detection Enabled Busy detection Disabled 3 CONNECT <text> result code given upon entering online data state: Dial tone detection Disabled Busy detection Enabled 4 CONNECT <text> result code given upon entering online data state: Dial tone detection Enabled Busy detection Enabled The default value is 0.

Example

ATX?

000

OK

4.10.1.5   S, Bit Map Registers

This command reads/writes values of the S-registers. The g20 supports this command for various S values, according to official specifications (ITU-I, ETSI, or manufacturer specific).

Set Command

The Set command is allowed for read/write S-registers, and not allowed for read-only S-registers.

Command	Response/Action
ATSn=<value>	OK or: +CME ERROR: <err>

Read Command

Command	Response/Action
ATSn?	<current value of S-register n> or: +CME ERROR: <err>

Test Command

The Test command for Sn is not defined by ITU, and therefore is not supported by the g20. The g20 returns an error.

The following table shows the different S-registers and their associated values.

Table 122. S-registers and Values

Sn	Description	Min Value	Max Value	Default Value
S0	Sets/gets number of rings before auto answer.	0	255	0
S2	Sets/gets escape code character.	0	255	43
S3	Sets/gets carriage return code character.	0	127	13
S4	Sets/gets line feed code character.	0	127	10

Table 122. S-registers and Values *(Continued)*

Sn	Description	Min Value	Max Value	Default Value
S5	Sets/gets command line editing character (backspace).	0	127	8
S7	Sets the number of seconds in which connection must be established before the call is disconnected.			
S12	Sets/gets guard time (in units of 50 msec) for the escape character during CSD connections	0	255	20
S14	Read-only. Holds values of En (in bit 1), Qn (in bit 2), Vn (in bit 3).	—	—	170
S21	Read-only. Holds values of &Dn (in bits 2, 3 and 4), &Cn (in bits 5 and 6).	—	—	40
S22	Read-only. Holds values of Mn (in bits 2 and 3), Xn (in bits 4, 5 and 6)	—	—	134
S31	Read-only. Holds value of Wn (in bits 2 and 3).	—	—	0
S36	Sets/gets value of \Nn.	0	7	5
S39	Read-only. Holds value of &Kn (in bits 0, 1 and 2).	—	—	3
S40	Read-only. Holds value of \An (in bits 6 and 7).	—	—	192
S41	Read-only. Holds value of %Cn (in bits 0 and 1).	—	—	3

Note S0 (Auto Answer) should work regardless of the DTR HW line state. This is a deviation from the ITU V. 25-ter standard.

Example

ATS36?

005

OK

ATS0=3

OK

ATS0?

003

OK

4.10.1.5.1   S2

This command handles the selection of the escape characters, which are stored in S-Register 2, and specifies the escape character used in CSD connections.

Set Command

The Set command sets the CSD escape character value if all parameters are valid.

Command	Response/Action
S2=<escape_character>	OK +CME ERROR: <err>

Read Command

The Read command displays the currently defined escape character for CSD connections.

Command	Response/Action
S2?	<escape_character> OK +CME ERROR: <err>

The following table shows the S2 parameters.

Table 123. S2 Parameters

<Parameter>	Description
<escape_character>	CSD escape character. Range is 0 to 255. The default value is 43 ("+").

4.10.1.5.2 S12

This command handles the selection of the guard time, which is stored in S-Register 12, and specifies the behavior of escape characters during CSD connection.

> **Note**
> For a guard time specified by S-Register 12, no character should be entered before or after "+++". The duration between escape codes must be smaller than the guard time.

Set Command

The Set command sets the CSD escape character guard time value if all parameters are valid.

Command	Response/Action
S12=<guard_time>	OK +CME ERROR: <err>

Read Command

The Read command displays the current CSD escape character guard time.

Command	Response/Action
S12?	<guard_time> OK +CME ERROR: <err>

The following table shows the S12 parameters.

Table 124. S12 Parameters

<Parameter>	Description
<guard_time>	CSD escape character guard time (units of 50 msec). Range is 0 to 255. The default value is 20.

4.10.1.6   \S, Show the Status of the Commands and S-registers in Effect

This command displays the status of selected commands and S-registers.

4.10.1.7   \G, Software Control

This command sets the use of the software control. It is used for backward compatibility.

4.10.1.8   \J, Terminal Auto Rate

This command adjusts the terminal auto rate. It is used for backward compatibility.

4.10.1.9   \N, Link Type

This command displays the link type. It is used for backward compatibility.

4.10.1.10   +CBAND, Change Radio Band

This command has no effect, and only returns OK. It is used for backward compatibility.

4.10.1.11   ?, Return the Value of the Last Updated S-register

This command displays the most recently updated value stored in an S-register.

Read Command

The Read command returns the value of the last updated S-register..

Command	Response/Action
AT?	000 OK

Example

AT?

000

OK

AT?

003

OK

ATS36=5

OK

AT?

005

OK

4.10.1.12   &F, Set to Factory Defined Configuration

This command restores the factory default configuration profile. The g20 only supports one factory default profile, 0.

Set Command

Command	Response/Action
AT&F<value>	OK or: +CMS ERROR: <err>

Read Command.

Command	Response/Action
AT&F?	<current profile number>

Test Command

The Test command for &F is not defined by ITU, and therefore is not supported by the g20. The g20 returns an error.

The following table shows the &F parameters.

Table 125. &F Parameters

<Parameter>	Description
<value>	0 Factory default configuration profile. This is the only value supported.

Example

AT&F?

000

OK

4.10.1.13 Z, Reset to Default Configuration

This command drops the current call, and resets the values to default configuration. The only acceptable value is 0.

Set Command

Command	Response/Action
ATZ<value>	OK or: +CMS ERROR: <err>

Read Command

The Read command for Z is not defined, and therefore is not supported by the g20. The g20 returns an error.

Test Command

The Test command for Z is not defined, and therefore is not supported by the g20. The g20 returns an error.

The following table shows the Z parameters.

Table 126. Z Parameters

<Parameter>	Description
<value>	0 Default configuration

Example

ATZ0

OK

4.10.2   Sleep Mode Commands

In order to improve the power consumption, the g20 supports a low-power consumption mode, called "Sleep mode". The g20 has internal decision conditions for entering and exiting sleep mode. As the terminal and the g20 operate in a combined system, and as the communication between the g20 and the terminal must be reliable, there should be a mechanism agreed upon by both the g20 and the terminal to co-ordinate their separate sleep mode entering and exiting sequences. The g20 will not enter sleep mode unless the terminal enables the g20 sleep mode and signals its readiness for sleep. For this purpose, a set of AT commands and dedicated HW lines are defined.

4.10.2.1   Sleep Mode AT Commands

The following are the Sleep mode AT commands:

• ATS24: Activates/deactivates Sleep mode.

   The g20 receives a request to activate or deactivate Sleep mode.

• ATS102: Sets the value of the delay before sending data to the terminal.

   The g20 receives the value that defines the period to wait between sending the wake-up signal, and sending data to the terminal.

• AT+MSCTS: The UART's CTS line control.

   The g20 receives a request to define the behavior of the CTS line when the g20 is in Sleep mode. It enables or disables activation of the CTS line after wakeup.

4.10.2.2   Sleep Mode HW Signals

Two HW lines are used:

• One for waking the g20 (Wakeup-In)

• One for waking the terminal (Wakeup-Out)

4.10.2.2.1 Terminal Does Not Wake the g20 (If the Terminal Uses Hardware Flow Control Only)

When the g20 is in Sleep mode, the CTS line is also inactive. The terminal does not send any characters to the g20 if the CTS is inactive, otherwise the character may be lost (Hardware Flow Control).

4.10.2.2.2 Terminal Wakes the g20 Using the Wakeup-In Line

The terminal uses the Wakeup-In line (pin #16) to wake up the g20 when it wants to send data. When the Wakeup-In line is low, the g20 will not enter the Sleep mode. If the terminal has data to send while the g20 is sleeping, it activates the line (brings it to active low), then waits 30 ms (the time required to wake the g20). Only then can the terminal start sending data.
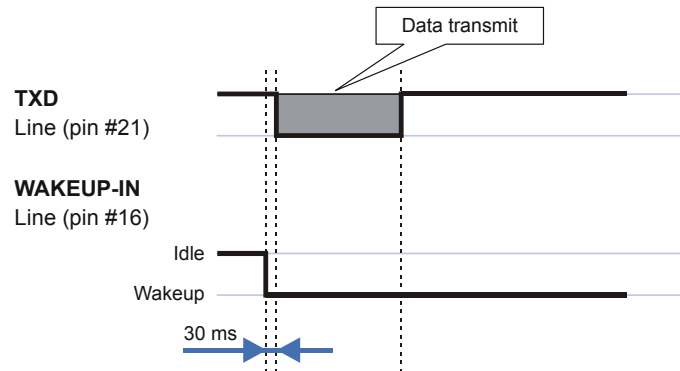
Figure 17. Wakeup-In Line

Two modes exist:

- Idle Mode: The terminal has no data to send. If the terminal enables sleep mode (using ats24), the g20 activates its Sleep mode module.
- Wakeup Mode: The g20 does not enter sleep mode, and the terminal can send data.

Once the terminal changes the line edge to Wakeup mode, it needs a 30 ms delay before sending any data to the g20 (using the RS232 protocol).

4.10.2.2.3 g20 Wakes the Terminal

The g20 follows these steps in order to wake up the terminal:

- The g20 indicates to the terminal that it has data and that it must wake up. The g20 uses the Wakeup-Out Line (pin #26) (brings it to active low).
- While the Wakeup Out line is low, the terminal should not enter Sleep mode.
- The terminal should set a value of the delay (in ms) needed for waking it (using the ATS102 command) before receiving data (default value is 30 ms).

When the data transmission is complete, the g20 gets the output wakeup line to high.
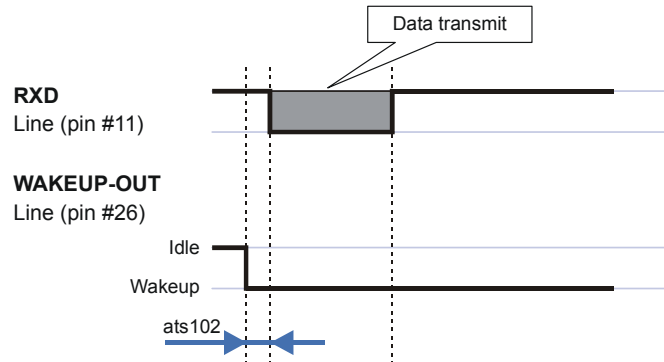
Figure 18. Wakeup-Out Line

Two modes exist:

• Idle mode: The g20 has no data to send.

• Wakeup mode: The g20 has data to send to the terminal.

After the g20 changes the line edge to Wakeup mode, there will be a delay (the default is 30 ms) sent by the ats102 command before sending any data to the terminal (using RS232 protocol).
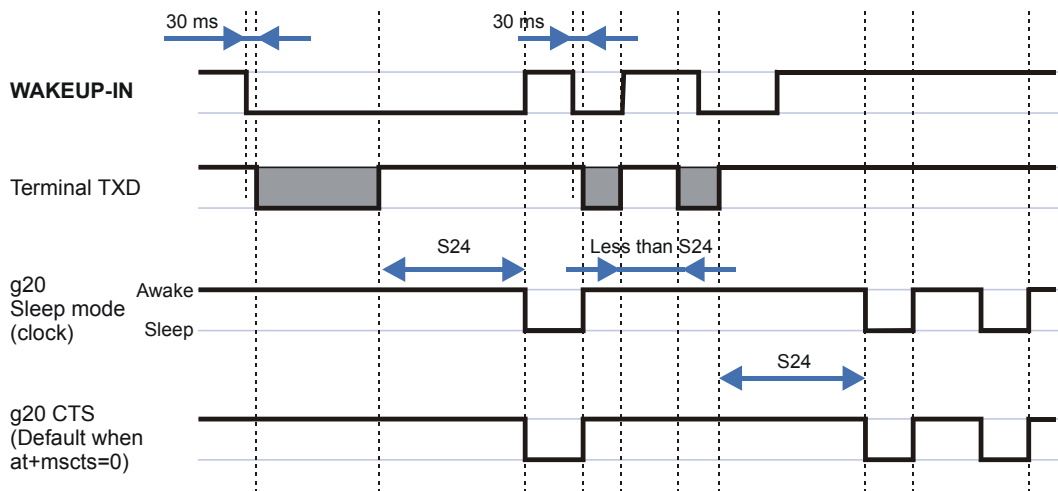
Figure 19. Sleep Mode when S24 > 0
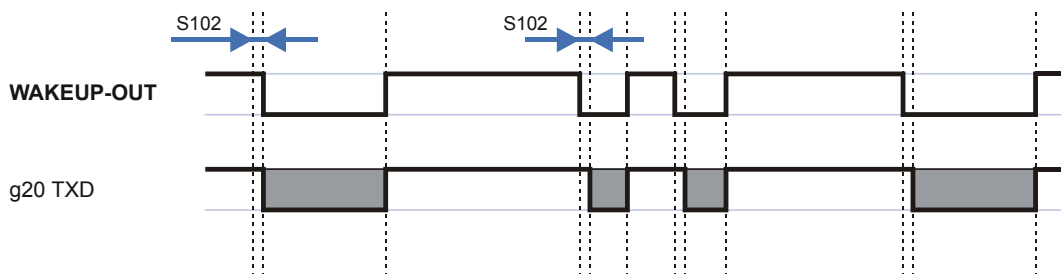
Figure 20. g20 Lines when S24 > 0

4.10.2.3   S24, Set Number of Seconds Delay Before g20 Enters Sleep Mode

This command activates/disables the Sleep mode. The terminal sends ATS24=5, and if there are no radio and UART activities, the g20 enters sleep mode in 5 seconds.

If terminal has some indication of the CTS pin activity, it can see:

• If +MSCTS=0 (default), the line changes its state periodically. (For more information refer to "+MSCTS, Enable/Disable CTS During Wakeup Period" on page 273.)

• If +MSCTS=1, the line is switched off at the moment of entering Sleep mode and stays off even if g20 is awakened.

Set Command

The Set command sets the amount of time, in seconds, the g20 should wait before entering Sleep mode.

Command	Response/Action
ATS24=[<value>]	OK

Read Command

The Read command returns the current value.

Command	Response/Action
ATS24?	<value> OK

The following table shows the S24 parameters.

Table 127. S24 Parameters

<Parameter>	Description
<value>	Number of seconds (0 <= n <= 255) 0 Disable Sleep mode >0 Enable Sleep mode The default value is 0.

Example

ATS24? <enter>

000

OK

ATS24=5 <enter>

OK

ATS24? <enter>

005

OK

(If there are no radio and UART activities, the g20 will enter sleep mode in 5 seconds)

4.10.2.4   S102, Set Delay Before Sending Data to the Terminal

This command sets the value of the delay before sending data to the terminal. Before receiving data, the terminal connected to the g20 will receive:

• Terminal Wakeup signal (the Wakeup Out Line (pin #26) state will be active low).
• A delay that is equal ATS102 value.
• Data (GPRS, CSD, AT commands' echo and results, unsolicited reports).

Set Command

The Set command sets the delay before sending data to the terminal, and defines a period between sending the wakeup signal and sending data to the terminal.

Command	Response/Action
ATS102 = <value>	OK

Read Command

The Read command returns the current value.

Command	Response/Action
ATS102?	<value> OK

The following table shows the S102 parameters.

Table 128. S102 Parameters

<Parameter>	Description
<value>	0 <= value <= 255 The default value is 30 ms.

Example

ATS102? <enter>

030

OK

ATS102=100 <enter>

OK

ATS102? <enter>

100

OK

(This means if there is data for transmission to the terminal, the g20 drops the Wakeup Out line, waits 100 ms. and then sends data to the terminal.)

4.10.2.5   +MSCTS, Enable/Disable CTS During Wakeup Period

This command defines the behavior of the CTS line when the g20 is in normal mode (not Sleep mode).

The command configures the g20 CTS line behavior always to follow the flow control requirements, or to follow it only if the terminal initiated a serial transmission session. This saves the terminal from following the CTS interrupt every time the g20 exits Sleep mode for internal g20 reasons (non-terminal communication related reasons).

Set Command

The Set command tells the g20 whether to activate the CTS when the unit is awakening.

Command	Response/Action
AT+MSCTS=<control>	OK

Read Command

The Read command returns the current control value.

Command	Response/Action
AT+MSCTS?	+MSCTS: <current control> OK

Test Command

The Test command returns the possible control values.

Command	Response/Action
AT+MSCTS=?	+MSCTS: (list of supported <control>) OK

The following table shows the +MSCTS parameters.

Table 129. +MSCTS Parameters

<Parameter>	Description

<control>	0 In Normal Mode: The CTS is used for Flow Control
	       In Sleep mode: The CTS is inactive.
	1 Wakeup In line is Active: The CTS is used for Flow Control.
	       Wakeup In line is Inactive: The CTS is inactive.
	The default value is 0.

Example

AT+MSCTS = ?

+MSCTS: (0-1)

OK

AT+MSCTS?

+MSCTS: 0

OK

AT+MSCTS = 1

OK

ATS102?

1

OK

(This means that by waking up, the CTS line will stay OFF and it can be activated by the Wakeup IN Line interrupt only.)

4.10.3   Error Handling Commands

4.10.3.1   +CMEE, Report Mobile Equipment Error

The Set command disables or enables the use of result code +CME ERROR: <err> as an indication of an error relating to the functionality of the g20. When enabled, g20-related errors cause a +CME ERROR: <err> final result code instead of the regular ERROR final result code. Usually, ERROR is returned when the error is related to syntax, invalid parameters or terminal functionality.

For all Accessory AT commands besides SMS commands, the +CMEE set command disables or enables the use of result code +CME ERROR: <err> as an indication of an error relating to the functionality of the g20. When enabled, g20 related errors cause a +CME ERROR: <err> final result code instead of the regular ERROR result code.

For all SMS AT commands that are derived from GSM 07.05, the +CMEE Set command disables or enables the use of result code +CMS ERROR: <err> as an indication of an error relating to the functionality of the g20. When enabled, g20-related errors cause a +CMS ERROR: <err> final result code instead of the regular ERROR final result.

Set Command

The Set command enables or disables the use of result code +CME ERROR: <err> as an indication of an error relating to the functionality of the g20.

Command	Response/Action
AT+CMEE=[<n>]	OK or: +CME ERROR: <err>

Read Command

The Read command returns the current setting format of the result code.

Command	Response/Action
AT+CMEE?	+CMEE: <n> OK

Test Command

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

Command	Response/Action
AT+CMEE=?	+CMEE: (list of supported <n>s) OK

The following table shows the +CMEE parameters.

Table 130. +CMEE Parameters

<Parameter>	Description
<n>	0 Disable the +CME ERROR: <err> result code and use ERROR. 1 Enable the +CME ERROR: <err> result code and use numeric <err> values. 2 Enable +CME ERROR: <err> result code and use verbose <err> values. The default value is 0.

Table 130. +CMEE Parameters *(Continued)*

<Parameter>	Description
<err>	Numeric format followed by verbose format: 0 Phone failure 1 No connection to phone 2 Phone-adaptor link reserved 3 Operation not allowed 4 Operation not supported 5 PH-SIM PIN required 6 PH-FSIM PIN required 7 PH-FSIM PUK required 10 SIM not inserted 11 SIM PIN required 12 SIM PUK required 13 SIM failure 14 SIM busy 15 SIM wrong 16 Incorrect password 17 SIM PIN2 required 18 SIM PUK2 required 20 Memory full 21 Invalid index 22 Not found 23 Memory failure 24 Text string too long 25 Invalid characters in text string 26 Dial string too long 27 Invalid characters in dial string 30 No network service 31 Network timeout 32 Network not allowed - emergency calls only 33 Command aborted 34 Numeric parameter instead of text parameter 35 Text parameter instead of numeric parameter 36 Numeric parameter is out of bounds 40 Network personalization PIN required 41 Network personalization PUK required 42 Network subset personalization PIN required 43 Network subnet personalization PUK required 44 Service provider personalization PIN required 45 Service provider personalization PUK required 46 Corporate personalization PIN required 47 Corporate personalization PUK required 60 SIM service option is not supported 100 Unknown

Table 130. +CMEE Parameters *(Continued)*

<Parameter>	Description
<err> *continued*	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) 132 Service option not supported (#32) 133 Requested service option not subscribed (#33) 134 Service option temporarily out of order (#34) 147 Long context activation 148 Unspecified GPRS error 149 PDP authentication failure 150 Invalid mobile class 151 GPRS disconnection timer is active 256 Too many active calls 257 Call rejected 258 Unanswered call pending 259 Unknown calling error 260 No phone number recognized 261 Call state not idle 262 Call in progress 263 Dial state error 264 Unlock code required 265 Network busy 266 Invalid phone number 267 Number entry already started 268 Cancelled by user 269 Number entry could not be started 280 Data lost 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 SIM not inserted 311 SIM PIN required 312 PH-SIM PIN required 313 SIM failure 314 SIM busy 315 SIM wrong 316 SIM PUK required 317 SIM PIN2 required 318 SIM PUK2 required 320 Memory failure 321 Invalid memory index 322 Memory full

Table 130. +CMEE Parameters *(Continued)*

<Parameter>	Description
<err> *continued*	330 SMSC address unknown 331 No network service 332 Network timeout 340 No +CMNA acknowledgement expected 500 Unknown error 512 Network busy 513 Invalid destination address 514 Invalid message body length 515 Phone is not in service 516 Invalid preferred memory storage 517 User terminated 518 Inactive socket 519 Socket already open 700 SIM ToolKit not available 701 Cannot sustain both call and SIM application

Note

+CME ERROR:280, Data lost, is sent to the terminal in extreme cases when the g20 has to transmit data to the terminal and the buffers are full (Flow control Xoff status).

This error occurs when:

•An unsolicited indication (such as RING, +CLCC and so on) encounters the Xoff status.
  When the flow control status returns to Xon, Error 280, Data lost, is sent to the terminal instead of the unsolicited indication.

•An initiated AT command is waiting for a response, and the response encounters the Xoff status.
  When the flow control status returns to Xon, the AT command is aborted (if not yet aborted) and Error 280, Data lost is sent to the terminal instead of OK (and the missing data).

Example

AT+CMEE=0   //+CME ERROR is not used

OK

AT+VTD

ERROR

AT+CMEE=1   //Use numeric <err>

OK

AT+VTD

+CME ERROR: 1

AT+CMEE=2   //Use verbose <err>

OK

AT+VTD

+CME ERROR: "operation not supported"

4.10.3.2   +CEER, Extended Error Report

This execution command returns an extended error report containing one or more lines of information text <report>, determined by the manufacturer, providing reasons for the following errors:

• Failure in the last unsuccessful call setup (originating or answering) or the in-call modification.

• Last call release.

Typically, the text consists of a single line containing the reason for the error according to information given by GSM network, in textual format.

Set Command

Command	Response/Action
AT+CEER=[<n>]	OK

Execute Command

Command	Response/Action
AT+CEER	+CEER: <report> OK

Read Command

Command	Response/Action
AT+CEER?	+CEER: <n> OK

Test Command

Command	Response/Action
AT+CEER=?	+CEER: (List of supported <n>s) OK

The following table shows the +CEER parameters.

Table 131. +CEER Parameters

<Parameter>	Description
<n>	1 Returns numeric response. 2 Returns verbose response. The default value is 2.

Table 131. +CEER Parameters *(Continued)*

<Parameter>	Description
<report>	The total number of characters and line terminators (up to 2041) in the information text. The text must not contain the sequence 0<CR> or OK<CR>. Numeric format followed by verbose format: 1 Unassigned or unallocated number 3 No route to destination 6 Channel unacceptable 8 Operator determined barring 16 Normal call clearing 17 User busy 18 No user responding 19 User alerting, no answer 21 Call rejected 22 Number changed 26 Non selected user clearing 27 Destination out of order 28 Invalid number format (incomplete number) 29 Facility rejected 30 Response to STATUS ENQUIRY 31 Normal, unspecified 34 No circuit/channel available 38 Network out of order 41 Temporary failure 42 Switching equipment congestion 43 Access information discarded 44 Requested circuit/channel not available 47 Resources unavailable, unspecified 49 Quality of service unavailable 50 Requested facility not subscribed 55 Incoming calls barred within the CUG 57 Bearer capability not authorized 58 Bearer capability not presently available 63 Service or option not available, unspecified 65 Bearer service not implemented 69 Requested facility not implemented 70 Only restricted digital information bearer capability is available 79 Service or option not implemented, unspecified 81 Invalid transaction identifier value 87 User not member of CUG 88 Incompatible destination 91 Invalid transit network selection 95 Semantically incorrect message 96 Invalid mandatory information 97 Message type non-existent or not implemented

Table 131. +CEER Parameters *(Continued)*

<Parameter>	Description	
<report> *(continued)*	98	Message type not compatible with protocol state
	99	Information element non-existent or not implemented
	100	Conditional IE error
	101	Message not compatible with protocol state
	102	Recovery on timer expiry
	111	Protocol error, unspecified
	127	Interworking, unspecified

Example

At+CEER

+CEER: "No information available"

OK

AT+CEER?

+CEER:2

OK

AT+CEER=?

+CEER: (001-002)

OK

4.11   UI (USER INTERFACE)

4.11.1   +MH, Handset Status/Control

This group of commands is used mostly by car-kit type applications. They indicate information about the state of the handset to the g20, and control some aspects of the system.

4.11.2   +MHIG, Set Ignition State

This command enables an intelligent car kit to indicate the ignition state of the vehicle to the terminal, which enables the terminal to turn on and off with the ignition, or to enter a power saving state when the ignition is turned off. The actual operation is dependent on the terminal.

> **Note** The action of the +MHIG command is subject to change.

Set Command

The Set command sets the ignition state.

Command	Response/Action
+MHIG=<state>	OK

The following table shows the +MHIG parameters.

Table 132. +MHIG Parameters

<Parameter>	Description
<state>	0 Ignition Off 1 Ignition On

Example

AT+MHIG=1

OK

4.11.3   +CKPD, Keypad Control

This command emulates key presses, or virtual keycodes, as if entered from the g20 keypad or from a remote handset. If a key is not supported by the g20, the g20 returns +CME ERROR: indicating that error 25 (Invalid character) has occurred.

When using this command, numeric keys (0-9) must be placed within double quotes, for example, at+ckpd="4". Multiple numeric key presses can be strung together into one command, for example, at+ckpd+"18478622544".

The characters ^ (up) and v (down) can be used with this command to scroll through menu items. The number of characters indicates the number of times to scroll in that direction. For example, at+ckpd=vvvv scrolls four menu items down.

This command is provided primarily to support test efforts, and to allow the emulation of a handset device by a peripheral. This command is not intended to be used by accessory devices to access items within the g20 menus.

It is not recommended to dial using this command. Using CKPD for call control purposes can cause inconsistencies between call control indications and the true call control state. If CKPD is used for call control despite this recommendation, it should not be mixed with call control AT commands like ATH/AT+CHLD and so on.

> **Note** The +CKPD command does not support DTMF tones.

Set Command

Command	Response/Action
+CKPD=<keys>[,<time>[,<pause>]]	OK or: +CME ERROR: <err>

The following table shows the +CKPD parameters.

Table 133. +CKPD Parameters

<Parameter>	Description
<keys>	Virtual keycode (See Table 134, "Character Codes" on page 284)
<time>	Time for which to hold the key (in 0.1 seconds) 0...255　Seconds (default values are manufacturer specific, but should long enough that a normal g20 can handle keystrokes correctly).
<pause>	Time for which to pause between key presses (in 0.1 seconds) 0...255　 Seconds (default values are manufacturer specific, but should be long enough that a normal g20 can handle keystrokes correctly).

The following table shows the Character codes.

Table 134. Character Codes

Character	IRA (dec)	Comment (and Known Key Symbols)
#	35	Hash (Number sign)
%	37	Percent sign (P)
*	42	Star (*)
0... 9	48... 57	Number keys
:	58	Escape character for manufacturer specific keys
;	59	Escape character for string entering
<	60	Left arrow
>	62	Right arrow
@	64	Alpha key (α/ABC)

Table 134. Character Codes *(Continued)*

Character	IRA (dec)	Comment (and Known Key Symbols)
A/a	65/97	Channel A (A)
B/b	66/98	Channel B (B)
C/c	67/99	Clear display (C/CLR)
D/d	68/100	Volume down
E/e	69/101	Connection end (END)
F/f	70/102	Function (FCN)
L/l	76/108	Phone lock (LOCK)
M/m	77/109	Menu (MENU)
P/p	80/112	Power (PWR)
Q/q	81/113	Quiet/Mute (MUTE)
R/r	82/114	Recall last number (R/RCL/MR)
S/s	83/115	Connection start (SEND)
T/t	84/116	Store/Memory (STO/M/M+)
U/u	85/117	Volume up
V/v	86/118	Down arrow
W/w	87/119	Pause character
X/x	88/120	Auxiliary (AUX)
Y/y	89/121	Delete last character (C)
[	91	Soft Key Left
]	93	Soft Key Right
^	94	Up arrow

Example

AT+CMER=0,2,0,0,0

OK

AT+CKPD=m   //Emulate pressing the MENU button

OK

+CKEV: "M",1   //If +CMER is configured to echo and phone not locked

+CKEV: "M",0

AT+CKPD=[//Emulate pressing the EXIT button - the left soft-key button

OK

+CKEV: "[",1

+CKEV: "[",0

4.11.4   +MKPD, Auxiliary Keypad Control

This command enables accessories to control the press and release of key presses. If a key is not supported by a g20, the g20 returns a +CME ERROR: indicating that error 25 (Invalid character) has occurred.

Only a single key may be pressed at a given time. Sending in a new key press without releasing the previous key results in the previous key being automatically released.

Set Command

Command	Response/Action
+MKPD=<key>,<state>	OK or: +CME ERROR: <err>

The following table shows the +MKPD parameters.

Table 135. +MKPD Parameters

<Parameter>	Description
<state>	Key press state 0 Release 1 Press
<key>	Virtual keycodes, described in Table 134, "Character Codes" on page 284

Example

AT+CMER=0,2,0,0,0

AT+MKPD=m,1   //Emulate pressing the MENU button

OK

+CKEV: "M",1   //If +CMER is configured to echo and phone not locked

AT+MKPD=m,0   //Emulate releasing the MENU button

OK

+CKEV: "M",0

4.11.5   +CMER, Mobile Equipment Event Reporting

Set Command

The Set command enables/disables an external accessory to receive event reports from the g20. In some cases, this is used to track the user activity for redisplay on a vehicle system, or to perform accessory-specific menu operations.

Command	Response/Action
+CMER=[<mode>[,<keyp>[,<disp> [,<ind>[,<bfr>]]]]]	OK or: +CME ERROR: <err>

Read Command

The Read command queries the current settings for the AT+CMER command.

Command	Response/Action
+CMER?	+CMER: <mode>,<keyp>,<disp>,<ind>,<bfr> OK or: +CME ERROR: <err>

Test Command

The Test command returns the possible <mode>, <keyp>, <disp>, <ind>, and <bfr> values.

Command	Response/Action
+CMER=?	+CMER: (list of supported <mode>s),(list of supported <keyp>s),(list of supported <disp>s),(list of supported <ind>s),(list of supported <bfr>s)

The following table shows the +CMER parameters.

Table 136. +CMER Parameters

<Parameter>	Description
<mode>	Controls the processing of unsolicited result codes specified within this command. 0 Buffer unsolicited result codes in g20

Table 136. +CMER Parameters *(Continued)*

<Parameter>	Description
<keyp>	0 Do not report keypad events. 1 Display events reporting using result code +CKEV. Only keypad events that are not caused by the +CKPD command are reported. 2 Keypad events reporting using result code +CKEV. All keypad events, including those caused by the +CKPD command, are reported. The default value is 0.
<disp>	0 No display of event reporting. 1 Display event reporting using result code +CDEV: <elem>,<text>. <elem> indicates the element order number (Y coordinate of left upper corner of the text string) and <text> is the new value of the text element. The character set used in <text> is as specified by the Select TE Character Set (+CSCS) command. The default value is 0.
<ind>	0 No indicator events reporting. 1 Indicator event +CIEV: <ind>,<value>. <ind> shows the indicator order number and <value> is new value of indicator. The default value is 0.
<bfr>	Controls the effect on buffered codes. 0 Clear buffer.

4.11.6   Unsolicited UI Status Messages

Certain actions performed in the g20 UI by the user are transmitted to all attached accessories, primarily as a notification of a change in state. For example, notification of a phone-book storage, recall operation or setting a call restriction level. These messages are required by certain accessories to maintain local information, or to provide additional information on an auxiliary display.

4.11.6.1   +CKEV, Key Press Echo Output

This unsolicited message is sent when local key press echo is enabled (as described in "+CMER, Mobile Equipment Event Reporting" on page 287) and a key is pressed on the g20 keypad. The identity of the key is broadcast to all the accessories, as well as information about whether the key was pressed or released. This command can be configured to send key presses from the g20 keypad only, or from other accessories as well.

When the phone is locked and a digit or a softkey is pressed, the "@" character is used in the message event instead of the actual key being pressed. This prevents passwords or codes entered by the user being monitored or stolen by attached accessories (for example, Bluetooth devices).

Unsolicited Report

Response/Action
+CKEV: <key>,<press>

The following table shows the +CKEV parameters.

Table 137. +CKEV Parameters

<Parameter>	Description
<key>	Key that changed state
<press>	0 Key released 1 Key pressed

Example

AT+CMER=?

+CMER: (00),(00,01,02),(00),(00),(00)

AT+CMER?

+CMER: 00,00,00,00,00

AT+CMER=0,2,0,0,0

OK

AT+CMER?

+CMER: 00,02,00,00,00

AT+CKPD=M

OK

+CKEV: "M",1

+CKEV: "M",0

4.11.6.2   +CDEV, Change Display Indication

When text on the display changes and the <disp> parameter of the +CMER command is set to 1, the +CDEV indication is sent to the DTE.

Unsolicited Report

Response/Action
+CDEV: <elem>,<text>

	<elem> indicates the Y coordinate of the upper left corner of the text on the display.
Note	

4.11.6.3 +CIEV, Indicator Event Reporting

When a g20 indication is changed and the <ind> parameter of the +CMER command is set to 1, the +CIEV indication is sent to the DTE.

Unsolicited Report

Response/Action
+CIEV: <ind>,<value>

The following table shows the +CIEV parameters.

Table 138. +CIEV Parameters

<ind>	Description	<value> Range	Explanation	
0	Battery indicator	0-3	0 3	Low battery Full battery
1	Signal bars	1-5	1 5	Low signal strength High signal strength
2	Service availability	0/1	0 1	Service available Service not available
3	Unread message indication	0/1	0 1	No unread messages Unread messages exist
4	Call in progress	0/1	0 1	Call not in progress Call in progress
5	Roaming indicator	0/1	0 1	Not roaming Roaming
6	SIM Pin 1 requested	0/1	0 1	SIM pin ready SIM pin required
7	SIM SMS full	0/1	0 1	SIM SMS storage is not full SIM SMS storage is full
8	GPRS coverage	0/1	0 1	GPRS service not available GPRS service available

4.11.6.4   +MUPB, Phone Book Event

This output is sent by the g20 when a phone book entry is accessed or modified by the user.

Set Command

Command	Response/Action
+MUPB=<n>	OK

Unsolicited Report

Response/Action
+MUPB: <event>,<index>,<ph_list>

The following table shows the +MUPB parameters.

Table 139. +MUPB Parameters

<Parameter>	Description
<n>	0 Event reporting Off 1 Event reporting On
<event>	The type of operation performed on the location 1 Stored (new) 2 Modified 3 Cleared 4 Cleared all entries
<index>	Location number of the accessed entry
<ph_list>	Phone list affected by the change

Example

AT+MUPB=1

OK

+MUPB: 2,4."ME"   //User modifies location 4

4.11.7   &V, View Configuration

Execute Command

The Execute command displays the current active configuration and stored user profiles.

Command	Response/Action
&V	ACTIVE PROFILE: ... (profile data) STORED PROFILE 0: ... (profile data) STORED PROFILE1: ... (profile data) OK or +CME ERROR: \<err>

Example

at&v

ACTIVE PROFILE:

E1 Q0 V1 X4 &C1 &D2 &K3 &Y0

S00:000 S01:000 S02:043 S03:013 S04:010 S05:008 S06:004 S07:050

S08:004 S09:006 S10:014 S12:040 S14:AAH S16:80H S18:000 S21:30H

S22:F6H S23:1BH S25:005 S26:001 S27:09H

STORED PROFILE 0:

E1 Q0 V1 X4 &C1 &D2 &K3

S00:000 S02:043 S03:013 S04:010 S05:008 S07:050 S12:040

STORED PROFILE 1:

E1 Q0 V1 X4 &C1 &D2 &K3

S00:000 S02:043 S03:013 S04:010 S05:008 S07:050 S12:040

OK

4.11.8   &W, Store User Profile

Set Command

The Set command stores the current active configuration to user profile 0 or 1.

Command	Response/Action
&W[<n>]	OK or: +CME ERROR: <err>

The following table shows the &W parameters.

Table 140. &W Parameters

<Parameter>	Description
<n>	User's profile number: 0 Store to user's profile 0 1 Store to user's profile 1 The default value is 0.

The parameters that are set in a profile are described in the table below.

Table 141. Profile Parameters

Profile Parameter	Description	Parameter Range	Default Value	Length in Bits
ATE	Echo	0-1	1	1
ATQ	Result code return mode	0-1	0	1
ATV	Display result code	0-1	1	1
ATX	Select result code	0-4	0	3
AT&C	Set circuit 109 (DCD) behavior	0-2	1	2
AT&D	Set circuit 109 (DTR) behavior	0-4	2	3
AT&K	Flow control	0-6	3	3
AT&Y	Power-up profile	0-1	0	1
S0	Auto-answer	0-255	0	8
S2	Escape code character	0-255	43	8
S3	Carriage return character	0-127	13	7

Table 141. Profile Parameters

Profile Parameter	Description	Parameter Range	Default Value	Length in Bits
S4	Line feed character	0-127	10	7
S5	Backspace character	0-32	8	6
S7	Wait time for carrier. Register S7 tells the data adaptor how many seconds to wait for a remote data adaptor's carrier signal before hanging up. The register value can be increased if the data adaptor does not detect a carrier within the specified time. If the data adaptor detects a remote carrier signal within the specified time, it sends a CONNECT response and enters Data mode. If it does not detect a remote carrier signal within the specified time, it sends the NO ANSWER (or 8) response, hangs up, and returns to the Command Mode.	0-255	30	8
S 12	Time, in 50ths of a second, until OK is displayed after entering command mode by an escape sequence.	0-255	20	8

Example

at&w0

OK

at&w1

OK

4.11.9   &Y, Default User Profile

Set Command

Command	Response/Action
&Y[<n>]	OK or: +CME ERROR: <err>

The following table shows the &Y parameters.

Table 142. &Y Parameters

<Parameter>	Description
<n>	User's profile number: 0 Selects power-up configuration to user's profile 0 1 Selects power-up configuration to user's profile 1 The default value is 0.

Example

at&y0

OK

at&y1

OK

4.11.10 +CRSM, Restricted SIM Access

This command enables you to read the following data from the SIM card:

- IMSI
- GID1
- GID2
- ICC ID

Set Command

The Set command issues a request for information stored in the SIM card. In case of a successful read operation, the information is sent to the DTE. IMSI, GID1 and GID2 require an unlocked SIM. For ICC ID, the SIM may be locked.

Command	Response/Action
+CRSM=<command>,<field>	+CRSM: <sw1>,<sw2>[,<response>] OK or: +CME ERROR: <err>

Test Command

The Test command returns the possible <command> and <field> values.

Command	Response/Action
+CRSM=?	+CRSM: (list of supported <command>s),(list of supported <field>s) OK or: +CME ERROR: <err>

The following table shows the +CRSM parameters.

Table 143.

<Parameter>	Description
<command>	176　Read BINARY
<field>	Type of read field from SIM card: 197　IMSI 214　GID1 242　ICC ID 243　GID2
<sw1> <sw2>	Indicates the outcome of the operation: 0 0　Success 0 1　SIM card not inserted 0 2　Service is not available 0 3　Pin required 0 5　Unavailable. Data is temporarily unavailable (initializing)
<response>	Response of a successful completion of the issued command (hexidecimal character uppercase format). This is the requested data.

Example

AT+CRSM=176,214

+CRSM: 0,0,FFFFFFFFFFFFFFFFFFFF00000000000000000000

OK

AT+CRSM=176,242

+CRSM: 0,0,89972010102050863733

OK

4.12   GPRS

4.12.1   GPRS Functionality

GSM 07.07 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 online data state, unless the layer 2 protocol itself supports this feature (GSM 07.60-12). However, g20-specific escape mechanism (DTR) is provided to enable the TE to switch the g20 into limited online command state.

The use of a multiplexed interface, (GSM 07.10), is not considered here (See "RS232 multiplexer feature"). The g20-specific escape mechanism use DTR as an escape signal (following &D parameters) and designed for limited non network related commands. This specific mechanism purpose is to give the user a way to retrieve the signal strength. The time limit of consecutive DTR toggles is a minimum of 90 seconds. The g20-specific is not designed to support online command and data states both at the same time, therefore any wrong or extreme usage can cause unexpected behaviors. The basic GPRS concept is be "always connected" and there is no charge for being connected (only per real data transferred).

4.12.2   GPRS Commands

This section defines commands that a terminal may use to control a GPRS MT. GPRS MTs vary widely in functionality. A class A MT might support multiple PDP-types as well as circuit-switched data, and use multiple external networks 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 PDP context definition. A comprehensive set of GPRS-specific commands is defined below to provide the flexibility needed by the more complex MT. The commands are designed to be expandable to accommodate new PDP types and interface protocols, merely by defining new values for many of the parameters. Multiple contexts may be activated if the interface link-layer protocol is able to support them. The commands use the extended information and error message capabilities described in this specification. For MTs of intermediate complexity, most commands have simplified forms where certain parameters may be omitted. For the simplest MTs, and for backwards compatibility with existing communications software, it is possible to control access to the GPRS using existing modem-compatible commands. This "modem compatible" mode of operation is described below.

4.12.2.1   +CGCLASS, GPRS Mobile Station Class

This command is used to set the g20 to operate according to the specified GPRS mobile class. If the requested class is not supported, an ERROR or +CME ERROR response is returned. Extended error responses are enabled by the +CMEE command.

Read Command

The Read command returns the current GPRS mobile class.

Command	Response/Action
AT +CGCLASS?	+CGCLASS: <class> OK or: +CME ERROR: <err>

Test Command

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

Command	Response/Action
AT +CGCLASS=?	+CGCLASS: (list of supported <class>s) OK or; +CME ERROR: <err>

Note Issuing GPRS actions over a poor-quality connection may cause protocol errors and harm data validity. To prevent these problems, g20 is equipped with a protection mechanism that confirms GPRS signal strength before issuing GPRS network-related commands.

The following table shows the +CGCLASS parameters.

Table 144. +CGCLASS Parameters

<Parameter>	Description
<class>	String parameter that indicates the GPRS mobile class B Class B

Example

AT+CGCLASS=?

+CGCLASS: (B)

OK

Note If a SIM card without GPRS allowance is used:

at+cgclass=?

+CGCLASS: (CC)   //Note that CC is a not supported value.

4.12.2.2   +CGDCONT, Define PDP Context

This command specifies the PDP (Packet Data Protocol) context.

Set Command

The Set command specifies the context identification parameter values for a PDP context. A special form of the Set command, +CGDCONT= <cid> causes the values for context number <cid> to become undefined.

Command	Response/Action
AT+CGDCONT=[<cid> [,<PDP_type>[,<APN> [,<PDP_addr>[,<d_comp> [,<h_comp>]]]]]]	OK or: +CME ERROR: <err>

Read Command

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

Command	Response/Action
AT+CGDCONT?	+CGDCONT: <cid>, <PDP_type>, <APN>, <PDP_addr>, <data_comp>, <head_comp>[<CR><LF>+CGDCONT: <cid>, <PDP_type>, <APN>, <PDP_addr>, <data_comp>, <head_comp>

Test Command

The Test command returns the 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.

Command	Response/Action
AT+CGDCONT=?	+CGDCONT: (range of supported <cid>s), <PDP_type>, , , (list of supported <d_comp>s), (list of supported <h_comp>s)

The following table shows the +CGDCONT parameters.

Table 145. +CGDCONT Parameters

<Parameter>	Description
<cid>	Numeric parameter specifying a particular PDP context definition (PDP Context Identifier). The parameter is local to the Terminal-Mobile Terminal interface and is used in other PDP context-related commands. The Test command returns the range of permitted values (minimum value=1). The default value is 0.
<"PDP_type"> (Packet data protocol type)	String parameter (in quotation marks) specifying 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) If the MT supports several PDP types, the parameter value ranges for each <PDP_type> are returned on a separate line.
<"APN"> (Access Point Name)	String parameter (in quotation marks), 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, the subscription value is requested.
<"PDP_address">	String parameter (in quotation marks), which identifies the MT in the address space applicable to the PDP. If the value is null or omitted, a value may be provided by the terminal during the PDP startup procedure or, failing that, a dynamic address is requested. The Read form of the command continues 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. The default value is 0.
<d_comp>	Numeric parameter that controls PDP data compression. 0 OFF 1 ON Other values are reserved. The default value is 0.

Table 145. +CGDCONT Parameters *(Continued)*

<Parameter>	Description
<h_comp>	Numeric parameter that controls the PDP header compression. 0 OFF 1 ON Other values are reserved. Note: Currently, 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 data compression algorithms. The default value is 0.

Note The IP address may be entered without double quotes (" ").

For example:

AT+CGDCONT=1, IP,RTY,123.32.45.9

OK

Example

AT+CGDCONT=?

+CGDCONT: (1-3),("IP"),,,(0,1),(0,1)

OK

AT+CGDCONT?

+CGDCONT: 1,"IP","","0.0.0.0",0,0

+CGDCONT: 2,"IP","","0.0.0.0",0,0

+CGDCONT: 3,"IP","","0.0.0.0",0,0

OK

at+cgdcont= 1,"IP","internetg","0.0.0.0",0,0

OK

at+cgdcont?

+CGDCONT: 1,"IP","internetg","0.0.0.0",0,0

+CGDCONT: 2,"IP","","0.0.0.0",0,0

+CGDCONT: 3,"IP","","0.0.0.0",0,0

OK

at+cgdcont= 1,"IP","internetg","0.0.0.0",0,0

OK

at+cgdcont=2,"IP","internetg","0.0.0.0",1,1

OK

4.12.2.3 +CGQMIN, Quality of Service Profile (Min Acceptable)

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

Set Command

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

Command	Response/Action
AT+CGQMIN=[<cid> [,<precedence> [,<delay> [,<reliability.> [,<peak> [,<mean>]]]]]]	OK or: +CME ERROR: <err>

Read Command

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

Command	Response/Action
AT+CGQMIN?	+CGQMIN: <cid>, <precedence>, <delay>, <reliability>,<peak>, <mean>[<CR><LF>+CGQMIN: <cid>, <precedence>,<delay>, <reliability.>, <peak>, <mean>[...]] OK or: +CME ERROR: <err>

Test Command

The Test command returns the parameter value ranges for each <PDP_type>.

Command	Response/Action
AT+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) OK or: +CME ERROR: <err>

The following table shows the +CGQMIN parameters.

Table 146. +CGQMIN Parameters

<Parameter>	Description
<cid>	A numeric parameter that specifies a particular PDP context definition. The value is from 1 to 3.
<precedence>	A numeric parameter that specifies the precedence class.
<delay>	A numeric parameter that specifies the delay class.
<reliability>	A numeric parameter that specifies the reliability class.
<peak>	A numeric parameter that specifies the peak throughput class.
<mean>	A numeric parameter that specifies the mean throughput class.

Example

AT+CGQMIN=?

+CGQMIN: (1-3),(0-3),(0-4),(0-5),(0-9),(0-18,31)

OK

AT+CGQMIN?

+CGQMIN: 1,2,4,3,9,10

+CGQMIN: 2,2,4,3,9,10

+CGQMIN: 3,2,4,3,9,10

OK

4.12.2.4   +CGQREQ, Quality of Service Profile (Requested)

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

Set Command

The Set command specifies a profile for the context identified by the (local) context identification parameter, <cid>. As this is the same parameter that is used in the +CGDCONT command, the +CGQREQ command is effectively an extension of 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.

Command	Response/Action
AT+CGQREQ=[<cid> [,<precedence> [,<delay> [,<reliability.> [,<peak> [,<mean>]]]]]]	OK or: +CME ERROR: <err>

Read Command

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

Command	Response/Action
AT+CGQREQ?	+CGQREQ: <cid>, <precedence>, <delay>, <reliability>, <peak>, <mean> OK or: +CME ERROR: <err>

Test Command

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.

Command	Response/Action
AT+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) OK or: +CME ERROR: <err>

The following table shows the +CGQREQ parameters.

Table 147. +CGQREQ Parameters

<Parameter>	Description
<cid>	A numeric parameter that specifies a particular PDP context definition. The value is from 1 to 3.
<precedence>	A numeric parameter that specifies the precedence class.
<delay>	A numeric parameter that specifies the delay class.
<reliability>	A numeric parameter that specifies the reliability class.
<peak>	A numeric parameter that specifies the peak throughput class.
<mean>	A numeric parameter that specifies the mean throughput class.

Example

AT+CGQREQ=?

+ CGQREQ: (1-3),(0-3),(0-4),(0-5),(0-9),(0-18,31)

OK

AT+CGQREQ?

+CGQREQ: 1,2,4,3,9,10

+CGQREQ: 2,2,4,3,9,10

+CGQREQ: 3,2,4,3,9,10

OK

AT+CGQREQ=1,0,,0,0,0

OK

AT+CGQREQ?

+CGQREQ: 1,0,4,0,0,0

+CGQREQ: 2,2,4,3,9,10

+CGQREQ: 3,2,4,3,9,10

OK

4.12.2.5   +CGATT, GPRS Attach or Detach

This command attaches/detaches the MT to/from the GPRS service. When the command has completed, the MT remains in V.25ter command state. If the MT is already in the requested state, the command is ignored and the OK response is returned. If the requested state cannot be achieved, an ERROR or +CME ERROR response is returned. Extended error responses are enabled by the +CMEE command. Any active PDP contexts will be automatically deactivated when the attachment state changes to detached.

Set Command

The Set command attaches/detaches the MT to/from the GPRS service.

Command	Response/Action
AT+CGATT= [<state>]	OK or: +CME ERROR: <err>

Read Command

The Read command returns the current GPRS service state.

Command	Response/Action
AT+CGATT?	+CGATT: <state> OK or: +CME ERROR: <err>

Test Command

The Test command requests information on the supported GPRS service states.

Note
This command has the characteristics of both the V.25ter action and parameter commands. Therefore, it has the Read form in addition to the Execution/Set and Test forms.

Command	Response/Action
AT+CGATT=?	+CGATT: (list of supported <state>s) OK or: +CME ERROR: <err>

The following table shows the +CGATT parameters.

Table 148. +CGATT Parameters

<Parameter>	Description
<state>	Indicates the state of the GPRS attachment: 0 Detached. 1 Attached. If no <state> is given, the default state is the current state and nothing needs to be done.

Example

AT+CGATT=?

+CGATT: (0,1)

OK

AT+CGATT?

+CGATT: 0

OK

AT+CGATT=0

OK

4.12.2.6   D*99, Request GPRS Service "D"

This command enables the MT to perform the actions necessary for establishing communication between the terminal and the external Packet Data Network (PDN).

The ITU V.25ter 'D' (Dial) command causes the MT to enter the ITU V.25ter Online Data state and together with the terminal, to start the specified layer 2 protocol. The MT returns CONNECT to confirm acceptance of the command prior to entering the ITU V.25ter Online Data state. No further commands may follow on the AT command line.

The detailed behavior after the Online Data state has been entered is dependent on the PDP type, and is described briefly. 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 protocols have terminated, either as a result of an orderly shut down of the PDP or an error, the MT enters the ITU V.25ter command state and returns the NO CARRIER final result code.

If <called address> is supported and provided, the MT automatically sets up a virtual call to the specified address after the PDP context has been activated.

If <L2P> and <cid> are supported, their usage is the same as in the +CGDATA command. The +CGDCONT, +CGQREQ and other such commands may then be used in the modem initialization AT command string to set values for PDP type, APN, QoS and so on.

If <L2P> is not supported, or is supported but omitted, the MT uses a layer 2 protocol appropriate to the PDP type.

If <cid> is not supported, or is supported but omitted, the MT attempts to activate the context using one of the following:

- Any information provided by the terminal during the PDP startup procedure. For example, the terminal may provide a PDP type and/or PDP address to the MT.
- A prior knowledge, for example, the MT may implement only one PDP type.

Using the "Empty PDP type" No PDP address or APN is sent in this case and only one PDP context subscription record is present in the HLR for this subscriber.

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

Set Command

Command	Response/Action
ATD*<GPRS_SC>[* [<called_address>][*[<L2P>] [*[<cid>]]]]#	CONNECT or: ERROR

The following table shows the D*99 parameters.

Table 149. D*99 Parameters

<Parameter>	Description
<GPRS_SC> (GPRS Service Code)	Digit string (value 99) which identifies a request to use GPRS.
<called_address>	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 comma character "," may be used as a substitute for the period character ".". 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 "+CGDCONT, Define PDP Context" on page 299. For communications software that does not support arbitrary characters in the dial string, a numeric value equivalent to the hostname may be used. However, this should be avoided if at all possible.

Table 149. D*99 Parameters

<Parameter>	Description
<L2P>	String variable which indicates the layer 2 protocol to be used. For communications software that does not support arbitrary characters in the dial string, the following numeric equivalents are used: 0 NULL 1 PPP 2 PAD 3 X25 9 yyyy M-xxxx Other values are reserved and result in an ERROR response to the Set command. Note: V.250 (and certain communications software) do not permit arbitrary characters in the dial string. The <L2P> and <called_address> strings are therefore specified as containing digits (0-9) only.
<cid>:	Digit string which specifies a particular PDP context definition (See "+CGDCONT, Define PDP Context" on page 299.)

Example

ATD*99   //Try connecting to GPRS according to the first <cid>, defined in +CGDCONT

4.12.2.7   +CGPRS, GPRS Coverage

This command indicates whether there is GPRS coverage.

Execute Command

The Execute command returns the mode of the GPRS coverage.

Command	Response/Action
AT+CGPRS	+CGPRS: <mode> OK or: +CME ERROR: <err>

Read Command

The Read command returns the mode of the GPRS coverage.

Command	Response/Action
AT+CGPRS?	+CGPRS: <mode> OK or: +CME ERROR: <err>

The following table shows the +GPRS parameters.

Table 150. +GPRS Parameters

<Parameter>	Description
<mode>	0 No GPRS coverage 1 GPRS coverage There is no parameter default value.

Example

Without GPRS coverage

AT+CGPRS

+CGPRS: 0

OK

AT+CGPRS?

+CGPRS: 0

OK

With GPRS coverage

AT+CGPRS

+CGPRS: 1

OK

4.12.2.8 +CGACT, PDP Context Activate or Deactivate

This command activates/deactivates the specified PDP context(s).

Set Command

The Set command activates/deactivates the specified PDP context(s). When the command is completed, the MT remains in V.25 command state. If any PDP context is already in the requested state, the state for that context remains unchanged. If the requested state for any specified context cannot be achieved, an ERROR or +CME ERROR response is returned. Extended error responses are enabled by the +CMEE command. If the MT is not 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, the MT responds with an ERROR or, if extended error responses are enabled, with the appropriate failure-to-attach error message.

Command	Response/Action
AT+CGACT=[<state> [,<cid> [,<cid>[,]]]]	OK or: +CME ERROR: <err>

Read Command

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

Command	Response/Action
AT+CGACT?	+CGACT: <cid>, <state> [<CR><LF>+CGACT: <cid>, <state> OK or: +CME ERROR: <err>

Test Command

The Test command requests informaton on the supported PDP context activation states.

Command	Response/Action
AT+CGACT=?	+CGACT: (list of supported <state>s) OK or: +CME ERROR: <err>

The following table shows the +CGACT parameters.

Table 151. +CGACT Parameters

<Parameter>	Description
<state>	Indicates the activation state of the context: 0 Non-active 1 Active
<cid>	A numeric parameter that specifies a particular PDP context definition

Example

AT+CGACT=?

+CGACT: (0,1)

OK

AT+CGACT?

+CGACT: 1,0

+CGACT: 2,0

+CGACT: 3,0

OK

AT+CGACT=1

ERROR   //GPRS network not present.

In some GPRS networks, +CGACT is not supported. the ATD*99 # command can be used to establish a connection.

Note

4.13   NOP - COMPATIBLE

4.13.1   IGNORED (Compatible Only) Commands

The following commands return OK, but do not execute any operation. They are only used to provide backward compatibility.

Table 152. Ignored (Compatible Only) Commands

Command	Description
F	Selects the line modulation standard
L	Monitors the speaker loudness
M	Monitors the speaker mode
N	Enables auto mode

Table 152. Ignored (Compatible Only) Commands *(Continued)*

Command	Description
P	Selects pulse dialing
T	Selects tone dialing
W	Wait for dial tone
Y	Disconnects on long space
&G	Selects the guard tone
&J	Jack type selection
&L	Leased line operation
&M	Asynch/synch mode connection
&P	Selects pulse dialing
&Q	Communications mode options
&R	Selects the CTC controls
&S	Defines the DSR behavior
&T	Selects tone dialing
\A	Sets the maximum MNP block size
\G	Sets the use of the Xon/Xoff flow control
\J	Adjusts the terminal auto rate
\K	This command is supported for backward compatibility only, and has no effect.
\N	Displays the link type
%C	Enables/disables data compression
B	Selects the communications standard used by the data adaptor
\B	Transmits break to remote
\K	Breaks control
+CBAND	Changes band frequencies
+CSDH	Shows text mode parameters.

4.14   FAX CLASS 1

Facsimile machines were developed for sending digitized documents over the General Switched Telephone Network (GSTN) These facsimile terminals are in widespread use around the world. The operation of facsimile terminals has been standardized in Recommendations T.4, T.6 and T.30. The cellular network also supports the facsimile service within the cellular network and also with the GSTN network. The g20 is configured as an external "facsimile DCE", connected to the terminal by a standard serial port (for example, Recommendation V.24), using serial data interchange. The g20 supports Fax Class 1, with a few exceptions, marked as "Not supported" in the table below. The SW flow control is mandatory (using the DC1/ DC3 characters). (ITU - T.31section 5.3)

The following table shows the Fax Class 1 command summary.

Table 153. Fax Class 1 Command Summary

Command	Description	g20 Support
+FCLASS	Selects, reads or tests the Service Class (Note 1)	Supported
+FTS = <Time>	Stops/Pauses the transmission	Supported
+FRS = <Time>	Waits for silence	Supported
+FTM = <MOD>	Transmits data with <MOD> carrier	Supported
+FRM = <MOD>	Receives data with <MOD> carrier	Supported
+FTH = <MOD>	Transmits HDLC data with <MOD> carrier	Supported
+FRH = <MOD>	Receives HDLC data with <MOD> carrier	Supported
+FAR = <off/on>	Adaptive reception control	Not supported
+FCL = <time>	Carrier loss timeout	Not supported
+FDD = <value>	Double escape character replacement control	Not supported
+FIT = <time>, <action>	Terminal inactivity timeout	Not supported
+GMI?	Reports manufacturer ID	Supported (refer to "+CGMI, +GMI, +FMI, Request Manufacturer ID" on page 45)
+GMM?	Reports model ID	Supported (refer to "+CGMM, +GMM, +FMM, Request Model ID" on page 46)
+GMR?	Reports revision ID	Supported (refer to "+CGMR, +GMR, +FMR, Request Revision" on page 47)
+IFC	Local terminal-g20 flow control	Supported (refer to "+IFC, Terminal-g20 Local Flow Control" on page 323)

Table 153. Fax Class 1 Command Summary *(Continued)*

Command	Description	g20 Support
+IPR	Local terminal-g20 serial port rate	Supported (refer to "+IPR, Local Terminal/g20 Serial Port Rate" on page 199)
A	Answers	Supported (refer to "A, Answer Incoming Call" on page 66)
D <string>	Dials	Supported (refer to "D, Dial Command" on page 60)
H	Hangs up	Supported (refer to "H, Hang-up Call" on page 65)

4.14.1 Fax Commands

4.14.1.1 +FCLASS, Select Mode

The g20 facsimile service maintains a parameter for identification and control of facsimile services, "+FCLASS". When the terminal wants to establish a FAX connection, it must set the g20 to Service Class 1 operation prior to answering or originating a call. This is done by setting +FCLASS = 1.

Set Command

The Set command sets the g20 facsimile service class from the available choices.

Command	Response/Action
AT+FCLASS=<n>	OK (Puts the g20 into a particular mode of operation.) +CME ERROR: <err>

Read Command

The Read command reads the current service class setting of the g20.

Command	Response/Action
AT+FCLASS?	+FCLASS: <n> OK +CME ERROR: <err>

Test Command

The Test command returns a list of service classes available from the g20.

Command	Response/Action
AT+FCLASS=?	(list of supported <n>s) OK +CME ERROR: <err>

The following table shows the +FCLASS parameters.

Table 154. +FCLASS Parameters

<Parameter>	Description
<n>	0 Data modem (for example, Recommendation V.25 ter) 1 Service Class 1 fax

Example

AT+FCLASS=?

+FCLASS: 0,1

OK

AT+FCLASS?

+FCLASS: 0

OK

AT+FCLASS=1

OK

4.14.1.2   +FTS, Transmit Silence

This command causes the g20 to stop any transmission. The g20 then waits for the specified amount of time, and sends the OK result code to the terminal.

Set Command

The Set command causes the terminal to stop any transmission.

Command	Response/Action
AT+FTS = <Time>	OK or: +CME ERROR: <err>

The following table shows the +FTS parameters.

Table 155. +FTS Parameters

<Parameter>	Description
<Time>	The time the terminal waits, in 10 millisecond intervals 0-255 Number of milliseconds

Example

At+fclass=1

OK

Atd035658584

CONNECT 9600

OK

AT+FTS=20

OK

4.14.1.3   +FRS, Receive Silence

This command causes the g20 to wait for silence and to report back an OK result code when silence has been present on the line for the specified amount of time. The command terminates when the required amount of silence on the line is detected or when the terminal sends the g20 a character other than <DC1> (11h) or <DC3> (13h), which is discarded. In either event, the OK result code is returned to the terminal.

Set Command

The Set command specifies the amount of time the line must be silent.

Command	Response/Action
+FRS = <Time>	OK or: +CME ERROR: <err>

The following table shows the +FRS parameters.

Table 156. +FRS Parameters

<Parameter>	Description
<Time>	The duration of the silence, in 10 millisecond intervals. 0-255 Number of milliseconds.

Example

At+fclass=1

OK

Atd035658584

CONNECT 9600

OK

At+frs=50

OK   //The g20 sends the OK after silence for 10*50 milliseconds

4.14.1.4   +FTM, Transmit Data

This command causes the g20 to transmit data to the remote party using the modulation selected in <MOD>. The g20 sends the data stream received from the terminal without any framing.

Transmission Using the Transparent Data Command

The DLE character, (0x10), is used as a special character to precede command characters. The character pairs <DLE><command> are used to convey commands or status information between the terminal and the g20.

- Terminal to g20 streams (Encoding)
  - When the terminal needs to send a <DLE> character in the data stream, it sends two sequential <DLE> characters to the g20.
  - When the terminal needs to send two sequential <DLE> characters in the data stream, it sends the <DLE><SUB> characters instead.
  - When the terminal sends the terminator sequence <DLE> <ETX>, the data stream is terminated.
- g20 to terminal streams (Decoding):
  - The terminal decodes the input stream and removes all character pairs beginning with <DLE>.
  - The terminal recognizes <DLE><ETX> as the data stream terminator.
  - The terminal recognizes and replaces <DLE><DLE> by a single <DLE> in the data stream.
  - The terminal recognizes and replaces <DLE><SUB> by a single <DLE><DLE> in the data stream.

When the g20 receives the +FTM command, it immediately returns an OK result code. When the terminal receives the OK from the g20, it can start sending the data stream using the transparent data command encoding. When the g20 decodes the terminating sequence, it returns a CONNECT.

Set Command

The Set command causes the g20 to transmit data using the modulation selected in <MOD>.

Command	Response/Action
+FTM = <MOD>	OK or: +CME ERROR: <err>

Test Command

Command	Response/Action
+FTM=?	(list of supported <MOD>s) OK or: +CME ERROR: <err>

The following table shows the command modulation select codes.

Table 157. Command Modulation Select Codes

Modulation Parameters				
<MOD> Value	**Modulation**	**TrainTime**	**Rate (bit/s)**	**Required**
24	Rec. V.27 ter		2 400	
48	Rec. V.27 ter		4 800	
72	Rec. V.29		7 200	
96	Rec. V.29		9 600	

Example

AT+FCLASS=1

OK

ATD035658584

CONNECT 19200

AT+FRH=3

OK

CONNECT 19200

AT+FTH=3

OK

(The terminal sends DATA. The g20 decodes and packs it into the HDLC frame and sends it to the remote party)

CONNECT 19200   //g20 detected termination sequence <DLE><DTX>.

AT+FTM=?

+FTM: 24,48,72,96

OK

AT+FTM=96   //Terminal selected mode 96

CONNECT 19200

(Terminal sends data stream encoded of the fax document)

OK   //g20 detected termination sequence <DLE><DTX>.

4.14.1.5 +FRM, Receive Data

This command causes the g20 to receive data from the remote party using the modulation specified in <MOD>.

When the g20 receives the +FRM command it immediately returns a CONNECT result code. When the terminal receives the CONNECT from g20, it can start receiving the data stream using the transparent data command decoding. (Refer to Table 157, "Command Modulation Select Codes" on page 319.)

When the g20 receives the +FRM command, it checks the line for a carrier. If the g20 detects a carrier, it sends a CONNECT to the terminal, and starts receiving the fax page.

Upon data stream termination, the g20 sends the termination sequence to the terminal. Afterwards, if the g20 detects a loss of carrier, it sends a "NO CARRIER", otherwise it sends OK.

Set Command

The Set command causes the g20 to enter the receive mode using the modulation specified in <MOD>.

Command	Response/Action
+FRM = <MOD>	CONNECT Data stream <DLE><ETX> OK

Test Command

Command	Response/Action
+FRM=?	(list of supported <MOD>s) OK or: +CME ERROR: <err>

The following table shows the command modulation select codes.

Table 158. Command Modulation Select Codes

Modulation Parameters				
<MOD> Value	Modulation	TrainTime	Rate (bit/s)	Required
24	Rec. V.27 ter		2 400	
48	Rec. V.27 ter		4 800	
72	Rec. V.29		7 200	
96	Rec. V.29		9 600	

4.14.1.6   +FTH, Transmit DATA with HDLC Frame

This command causes the g20 to transmit data framed in the HDLC protocol, using the modulation mode selected, to the remote party.

For encoding and decoding information refer to "Transmission Using the Transparent Data Command" on page 318.

After the entering active session mode (g20 sent CONNECT to the terminal), the terminal can perform one of the following:

• If the terminal sends additional data, the g20 transmits another frame

• If the terminal sends only <DLE><ETX> (a null frame), the g20 turns off the transmit carrier and sends the CONNECT result code to the terminal

• If five seconds elapses from the time the g20 reports the OK result code without any additional data transmitted from the terminal, the g20 turns off the transmit carrier, returns to command mode, and sends the ERROR result code to the terminal.

Set Command

The Set command causes the g20 to transmit data framed in HDLC protocol using the modulation mode selected.

Command	Response/Action
FTH = <MOD> (Send data stream <DLE><ETX>)	CONNECT OK or: NO CARRIER

Note

MOD = 3 (Clause 2/V.21) rate 300 bps, is mandatory.

If the g20 detects a carrier after the FTH command, it sends a CONNECT to the terminal. If not, it sends "NO CARRIER".

The following table shows the command modulation select codes.

Table 159. Command Modulation Select Codes

Modulation Parameters				
<MOD> Value	**Modulation**	**TrainTime**	**Rate (bit/s)**	**Required**
24	Rec. V.27 ter		2 400	
48	Rec. V.27 ter		4 800	
72	Rec. V.29		7 200	
96	Rec. V.29		9 600	

Example

AT+FCLASS=1

OK

ATD035658584

CONNECT 19200

AT+FRH=3

CONNECT 19200

(Terminal sends TSI frame data, as described in ITU-T30 with terminating sequence)

CONNECT 19200   //The g20 detected the terminating sequence

(Terminal sends DCS frame data, as described in ITU-T30 with terminating sequence and drops the carrier)

OK

4.14.1.7   +FRH, Receive DATA with HDLC Frame

This command causes the g20 to receive HDLC framed data using the modulation mode selected in <MOD>, and deliver the next received frame to the terminal.

If the g20 detects the selected carrier with an HDLC flag, the g20 send the CONNECT result code to the terminal, otherwise it sends "NO CARRIER".

The g20 sends the FCS octant to the terminal. The terminal may ignore the FCS.

Upon receipt of the CONNECT from g20, the terminal can start receiving the data stream using the transparent data command decoding. (Refer to "Command Modulation Select Codes" on page 319.)

After the FCS octets are transferred, the g20 marks the end of the frame with the characters <DLE> <ETX>, and reports the status of the frame reception to the terminal, as follows:

- If the frame was received correctly (FCS is OK), the g20 returns the OK result code.
- If the frame was received in error (FCS is not OK, or carrier lost, or data lost due to data overflow), the g20 returns the ERROR result code, and the terminal should discard the frame.

After the status result code, the g20 accepts new commands from the terminal.

Set Command

The Set command causes the g20 to receive HDLC framed data using the modulation mode selected in <MOD>, and deliver the next received frame to the terminal.

Command	Response/Action
+FRH = <MOD>	CONNECT or: NO CARRIER

Note

MOD = 3 (Clause 2/V.21) rate 300 bps, is mandatory.

4.14.1.8   +IFC, Terminal-g20 Local Flow Control

This parameter controls the operation of the local flow control between the terminal and the g20 during the data state when V.42 error control is used, or when fallback to non-error control mode is specified to include buffering and flow control. It accepts two numeric subparameters:

- <DCE_by_DTE>: Specifies the method to be used by the terminal to control the flow of received data from the g20.
- <DTE_by_DCE>: Specifies the method to be used by the g20 to control the flow of transmitted data from the terminal.

The implementation of this parameter is mandatory if V.42 error control or Buffered mode is provided in the g20. If not, it is optional. g20s which do not implement circuit 106 and/or circuit 133 do not need to support the value 2 for the corresponding subparameter.

Set Command

Command	Response/Action
AT+IFC=[[<DCE_by_DTE>,[DTE_by_DCE>]]]	OK +CME ERROR: <err>

Read Command

Command	Response/Action
AT+IFC?	+IFC: <DCE_by_DTE>,<DTE_by_DCE>

Test Command

Command	Response/Action
AT+IFC=?	+IFC: (list of supported <DCE_by_DTE>s, list of supported <DTE_by_DCE>s)

The following table shows the <DCE_by_DTE> and <DTE_by_DCE> parameters.

Table 160.   <DCE_by_DTE> and <DTE_by_DCE> Parameters

<Parameter>	Description
<DCE_by_DTE>	0 None 1 DC1/DC3 on circuit 103. Do not pass DC1/DC3 characters to the remote DCE. 2 Circuit 133 (ready for receiving). 3 DC1/DC3 on circuit 103 with DC1/DC3 characters being passed through to the remote g20 in addition to being acted upon for local flow control. 4-127 Reserved for future standardization. Other Reserved for manufacture-specific use. The default is 2. Note: DC1 is IA5 1/1. DC3 is IA5 1/3.
<DTE_by_DCE>	0 None 1 DC1/DC3 on circuit 104. 2 Circuit 106 (clear to Send/Ready for Sending). 3-127 Reserved for future standardization. Other Reserved for manufacture-specific use. The default is 2. Note: DC1 is IA5 1/1. DC3 is IA5 1/3.

Example

AT+IFC=?

+IFC: (0-3),(0-2)

OK

AT+IFC?

+IFC: 2,2

OK

AT+IFC=2,2

OK

4.15   FEATURES

4.15.1   STK

The SIM Application Toolkit (STK) is a set of applications and related procedures, which may be used in conjunction with SIM or Smart Cards during a GSM session. The STK provides mechanisms that enable applications existing in the SIM to interact and operate with any ME (such as the g20) that support these mechanisms.

The following scheme shows the SIM Toolkit functionality commands and unsolicited results that are implemented. All these commands are non-basic commands.
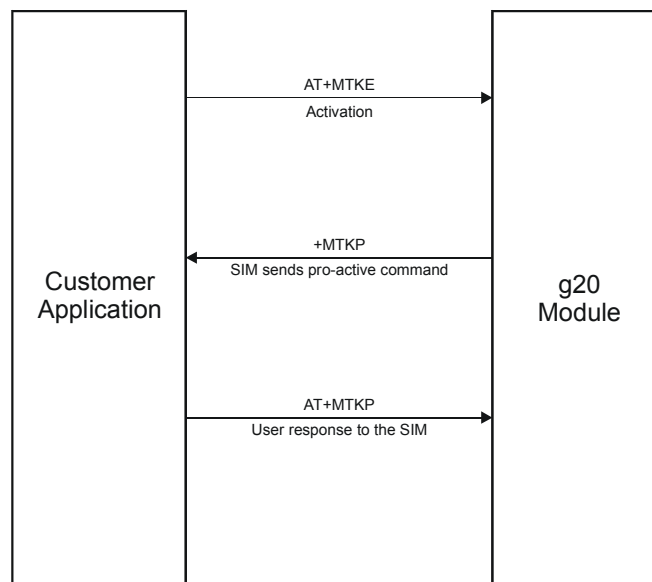
Figure 21. SIM Toolkit

- In the first step, the customer application informs the g20 module that it wants all features to be supported. This operation is performed using the AT+MTKE (Motorola ToolKit Enable) command, which allows activating or deactivating the SIM Toolkit functionality.
- In the second step, an unsolicited result +MTKP (Motorola ToolKit Proactive) is sent by the g20 in order to indicate the customer application, command type the SIM Application Toolkit is running on the SIM card, and the relevant information.
- In the third step, the customer application uses the AT+MTKP command to respond to the SIM ToolKit command, given by +MTKP.

4.15.1.1 STK Mechanisms

The mechanisms defined for the STK are dependent upon the relevant commands and protocols found in GSM 11.11.

Table 161. STK Mechanisms

Mechanism	Description
Profile Download	Enables the g20 to tell the SIM what its capabilities are. (The g20 is aware of the SIM's capabilities via the SIM Service Table and EFPHASE.) Refer to "+MTKR, Profile Download", page 326.
Provide Local Information	Defined as part of the proactive SIM service, this command requests the g20 to pass local information to the SIM, for example, the mobile country and network codes (MCC + MNC) of the network on which the user is registered.
Send DTMF	Defined as part of the proactive SIM service, this command requests the g20 to send DTMF tone(s) during an established call. Refer to "Send DTMF", page 344.
Set Up Idle Mode Text	Defined as part of the proactive SIM g20, this command supplies a text string to be used by the ME as stand-by mode text.
Launch Browser	Defined as part of the proactive SIM service, this command requests a browser inside a browser-enabled user terminal to interpret the content corresponding to a URL. Refer to "Launch Browser", page 346.
Set Up Event List	Defined as part of the proactive SIM service, this command supplies a list of events, which the SIM wants the g20 to provide details of when these events happen. Refer to "Set Up Event List", page 347.

4.15.1.2 +MTKR, Profile Download

This command displays the profile that is downloaded from the g20 to the SIM during the SIM initialization process. This profile includes the facilities relevant to the STK that are supported by the g20, enabling the SIM to limit its instruction range to those STK features the g20 supports. (Refer to "Profile Structure", page 327**.**) Without a profile, the SIM assumes that the g20 does not support the STK.

Profile download is performed automatically during device initialization, with no user intervention required.

Set Command

The Set command for +MTKR is not supported by the g20. (The g20 will return an error.)

Read Command

The Read command displays the current STK profile.

Command	Response/Action
+MTKR?	+MTKR: <profile>

Test Command

The Test command for +MTKR is not supported by the g20. (The g20 will return an error.)

The following table shows the +MTKR parameters.

Table 162. +MTKR Parameters

<Parameter>	Description
<profile>	Displayed in hexadecimal characters, each byte of the profile is represented by two characters: First character — Higher nibble (bits 4-7) Second character — Lower nibble (bits 0-3) The bits are displayed in the following order: <byte 1 higher nibble><byte 1 lower nibble><byte 2 higher nibble><byte 2 lower nibble> (and so on)

Example

AT+MTKR?

+MTKR: 2F6FFFFFFF0E1F1F4300001F2300000003

OK

4.15.1.2.1   Profile Structure

The profile lists those STK facilities supported by the g20. One bit is used to code each facility:

• If bit = 1, facility is supported
• If bit = 0, facility is not supported

The following table describes the contents of each bit in the profile.

Table 163. Profile Structure – Byte 1 (Download)

Bit	Description
b1	Profile download
b2	SMS-PP data download

Table 163. Profile Structure – Byte 1 (Download) *(Continued)*

Bit	Description
b3	Cell Broadcast data download
b4	Menu selection
b5	9EXX' response code for SIM data download error
b6	Timer expiration
b7	USSD string data object supported in Call Control
b8	Envelope Call Control always sent to the SIM during automatic redial mode

.

Table 164. Profile Structure – Byte 2 (Other)

Bit	Description
b1	Command result
b2	Call Control by SIM
b3	Cell identity included in Call Control by SIM
b4	MO short message control by SIM
b5	Handling of the alpha identifier according to reference 1 subclause 9.1.3
b6	UCS2 Entry supported
b7	UCS2 Display supported
b8	Display of the extension text

Table 165. Profile Structure – Byte 3 (Proactive SIM)

Bit	Description
b1	Proactive SIM: DISPLAY TEXT
b2	Proactive SIM: GET INKEY
b3	Proactive SIM: GET INPUT

Table 165. Profile Structure – Byte 3 (Proactive SIM) *(Continued)*

Bit	Description
b4	Proactive SIM: MORE TIME
b5	Proactive SIM: PLAY TONE
b6	Proactive SIM: POLL INTERVAL
b7	Proactive SIM: POLLING OFF
b8	Proactive SIM: REFRESH

Table 166. Profile Structure – Byte 4 (Proactive SIM)

Bit	Description
b1	Proactive SIM: SELECT ITEM
b2	Proactive SIM: SEND SHORT MESSAGE
b3	Proactive SIM: SEND SS
b4	Proactive SIM: SEND USSD
b5	Proactive SIM: SET UP CALL
b6	Proactive SIM: SET UP MENU
b7	Proactive SIM: PROVIDE LOCAL INFORMATION (MCC, MNC,LAC, Cell ID & IMEI)
b8	Proactive SIM: PROVIDE LOCAL INFORMATION (NMR)

Table 167. Profile Structure – Byte 5 (Event driven information)

Bit	Description
b1	Proactive SIM: SET UP EVENT LIST
b2	Event: MT call
b3	Event: Call connected
b4	Event: Call disconnected
b5	Event: Location status
b6	Event: User activity
b7	Event: Idle screen available
b8	Event: Card reader status

Table 168. Profile Structure – Byte 6 (Event driven information extensions)

Bit	Description
b1	Event: Language selection
b2	Event: Browser Termination
b3	Event: Data available
b4	Event: Channel status
b5	RFU, bit = 0
b6	
b7	
b8	

Table 169. Profile Structure – Byte 7 (Multiple card proactive commands)

Bit	Description
b1	Proactive SIM: POWER ON CARD
b2	Proactive SIM: POWER OFF CARD
b3	Proactive SIM: PERFORM CARD APDU
b4	Proactive SIM: GET READER STATUS (Card reader status)
b5	Proactive SIM: GET READER STATUS (Card reader identifier)
b6	RFU, bit = 0
b7	
b8	

Table 170. Profile Structure – Byte 8 (Proactive SIM)

Bit	Description
b1	Proactive SIM: TIMER MANAGEMENT (start, stop)
b2	Proactive SIM: TIMER MANAGEMENT (get current value)
b3	Proactive SIM: PROVIDE LOCAL INFORMATION (date, time and time zone)
b4	Binary choice in GET INKEY
b5	SET UP IDLE MODE TEXT
b6	RUN AT COMMAND (that is, class "b" is supported)
b7	2nd alpha identifier in SET UP CALL
b8	2nd capability configuration parameter (see 3GPP TS 11.14 version 8.9.0 Release 1999, subclause 9.1.6)

Table 171. Profile Structure – Byte 9 (Proactive SIM)

Bit	Description
b1	Sustained DISPLAY TEXT (see 3GPP TS 11.14 version 8.9.0 Release 1999, subclause 6.4.1)
b2	SEND DTMF command (see 3GPP TS 11.14 version 8.9.0 Release 1999, subclause 6.4.24)
b3	Proactive SIM: PROVIDE LOCAL INFORMATION - BCCHChannel List coding, as per 3GPP TS 11.14 version 8.9.0 Release 1999, subclause 12.29)
b4	Proactive SIM: PROVIDE LOCAL INFORMATION (language)
b5	Proactive SIM: PROVIDE LOCAL INFORMATION (TimingAdvance)
b6	Proactive SIM: LANGUAGE NOTIFICATION
b7	Proactive SIM: LAUNCH BROWSER
b8	RFU, bit = 0

Table 172. Profile Structure – Byte 10 (Soft keys support)

Bit	Description
b1	Soft keys support for SELECT ITEM (see 3GPP TS 11.14 version 8.9.0 Release 1999, subclause 6.4.9)
b2	Soft Keys support for SET UP MENU (see 3GPP TS 11.14 version 8.9.0 Release 1999, subclause 6.4.8)
b3	RFU, bit = 0
b4	
b5	
b6	
b7	
b8	

Table 173. Profile Structure – Byte 11 (Soft keys information)

Bit	Description
b1	Maximum number of soft keys available.
b2	
b3	
b4	
b5	'FF' value is reserved for future use
b6	
b7	
b8	

Table 174. Profile Structure – Byte 12 (Bearer independent protocol proactive commands – class "e")

Bit	Description
b1	Proactive SIM: OPEN CHANNEL
b2	Proactive SIM: CLOSE CHANNEL
b3	Proactive SIM: RECEIVE DATA
b4	Proactive SIM: SEND DATA
b5	Proactive SIM: GET CHANNEL STATUS
b6	RFU, bit = 0
b7	
b8	

Table 175. Profile Structure – Byte 13 (Bearer independent protocol supported bearers – class "e")

Bit	Description
b1	CSD supported by ME
b2	GPRS supported by ME
b3	RFU, bit = 0
b4	
b5	
b6	Number of channels supported by ME
b7	
b8	

Table 176. Profile Structure – Byte 14 (Screen height)

Bit	Description
b1	Number of characters supported down the ME display, as defined in 3GPP TS 11.14 version 8.9.0 Release 1999, subclause 5.3.1
b2	
b3	
b4	
b5	
b6	RFU, bit = 0
b7	
b8	Screen Sizing Parameters supported as defined in 3GPP TS 11.14 version 8.9.0 Release 1999, section 5.3

Table 177. Profile Structure – Byte 15 (Screen width)

Bit	Description
b1	Number of characters supported across the ME display, as defined in 3GPP TS 11.14 version 8.9.0 Release 1999, subclause 5.3.2
b2	
b3	
b4	
b5	
b6	
b7	
b8	Variable size fonts supported

Table 178. Profile Structure – Byte 16 (Screen effects)

Bit	Description
b1	Display can be resized as defined in 3GPP TS 11.14 version 8.9.0 Release 1999, subclause 5.3.3
b2	Text Wrapping supported as defined in 3GPP TS 11.14 version 8.9.0 Release 1999, subclause 5.3.4
b3	Text Scrolling supported as defined in 3GPP TS 11.14 version 8.9.0 Release 1999, subclause 5.3.5
b4	RFU
b5	
b6	Width reduction when in a menu as defined in 3GPP TS 11.14 version 8.9.0 Release 1999, subclause 5.3.6
b7	
b8	

Table 179. Profile Structure – Byte 17 (Bearer independent protocol supported transport interface – class "e")

Bit	Description
b1	TCP
b2	UDP
b3	RFU, bit = 0
b4	
b5	
b6	
b7	
b8	

Table 180. Profile Structure – Byte 18 (Reserved)

Bit	Description
b1	RFU, bit = 0
b2	
b3	
b4	
b5	
b6	
b7	
b8	

Table 181. Profile Structure – Byte 19 (Reserved for TIA/EIA-136 facilities)

Bit	Description
b1	Protocol Version, coded as indicated in TIA/EIA-136-123
b2	
b3	
b4	
b5	RFU, bit = 0
b6	
b7	
b8	

> **Note**
>
> The bits comprising each subsequent byte are all: RFU, bit = 0.

4.15.1.3   +MTKE, Motorola ToolKit Enable

This command enables/disables the SIM ToolKit functionality.

Set Command

The Set command tells the g20 in which mode to work.

Command	Response/Action
+MTKE=<Enable>	OK or: +CME ERROR: <err>

Read Command

The Read command returns the current values.

Command	Response/Action
+MTKE?	+MTKE: <State>

Test Command

The Test command returns supported values as a compound value.

Command	Response/Action
+MTKE=?	+MTKE: (list of supported \<state\>s) OK

The following table shows the +MTKE parameters.

Table 182. +MTKE Parameters

\<Parameter\>	Description
\<State\>	Indicates the state of the SIM ToolKit 0 Deactivate the SIM ToolKit functionality 1 Activate the SIM ToolKit functionality The default is 0.

Example

AT+MTKE=?   //Test command SIM ToolKit set facilities

+MTKE: (0-1)

OK

AT+MTKE?

+MTKE: 0   //No activation of SIM ToolKit functionality

OK

AT+MTKE=1   //Set all facilities SIM ToolKit (class 2).

OK

AT+MTKE=3   //Syntax error

+CME ERROR:

AT+MTKE=1   //Activation of SIM ToolKit functionality

OK

4.15.1.4   +MTKP, Motorola ToolKit Proactive (Unsolicited Indication)

In order to allow the customer to identify the pro-active command sent by the SIM ToolKit, an unsolicited SIM ToolKit indication (with the appropriate information, such as text to display, priorities and so on) is implemented.

The following table shows the+MTKP Field Descriptions.

Table 183. +MTKP Field Descriptions

Cmd Type	Description	Responses
1	Provides data about the "Display text" pro-active command.	+MTKP: <ProactiveCmdType>,<Priority>,<Text>
2	Provides data about the "Get Inkey" pro-active command.	+MTKP: <ProactiveCmdType>,<ResponseType>,<HelpInfo>[, <Text>]
3	Provides data about the "Get Input' pro-active command.	+MTKP: <ProactiveCmdType>,<ResponseType> ,<SecurityMode>,<MinLen>,<MaxLen>, <HelpInfo>[,<Text>]
5	Provides data about 'Play Tone' pro-active command.	+MTKP: <ProactiveCmdType>, <ToneType>[,<TimeUnit>,<TimeInterval>],[<Text>]
9	Provides data about the 'Send SMS' pro-active command.	+MTKP: <ProactiveCmdType>[,<Text>]
10	Provides data about the 'Send SS' pro-active command.	+MTKP: <ProactiveCmdType>[,<Text>]
12	Provides data about the 'Setup call' pro-active command.	+MTKP: <ProactiveCmdType>, <Type>,<CalledNb>,<Redials>,<Text>
13	Provides data about the 'Refresh' pro-active command.	+MTKP: <ProactiveCmdType>,<RefreshType>
20	Provides data indicating the timeout (get inkey, get input and select item).	+MTKP: <ProactiveCmdType>
22	Provides a text string to display when the g20 is in idle text mode.	+MTKP=22,"<idle mode text string>"
24	Sends a DTMF string after a call has been successfully established.	+MTKP: 24,<status>
26	Displays a browser for URLs inside browser-enabled g20s.	+MTKP: <ProactiveCmdType>, <URL>,<bearers>,<proxy_Id>[,<alpha_id>]

Note

The Cmd Type numbers refer to the proactive command which was sent from the SIM (This is the ProactiveCmdType field).

For "get inkey" and "get input", a one-minute timer is set, and any response for these unsolicited commands after one minute is not accepted.

The following table shows the +MTKP parameters.

Table 184. +MTKP Parameters of MTKP Field Descriptions

<Parameter>	Description
ProactiveCmdType=1 (Display Text)	
<Priority>	0 Normal priority of display. 1 High priority of display.
<Text>	Text information in ASCII format.
ProactiveCmdType=2 (Get Inkey)	
<ResponseType>	0 Digit (0-9, *, #,and +) 1 SMS alphabet. 2 UCS2 characters 3 Yes/No
<HelpInfo>	0 No help information available. 1 Help information is available.
<Text>	Text information in ASCII format.
ProactiveCmdType=3 (Get Input)	
<ResponseType>	0 Digit (0-9, *, #,and +) 1 SMS alphabet. 2 UCS2 characters.
<SecurityMode>	0 Security off. 1 Security on.
<SizeMin>	Minimum length of input.
<SizeMax>	Maximum length of input.
<HelpInfo>	0 No help information available. 1 Help information is available.
<Text>	Text information in ASCII format.

Table 184. +MTKP Parameters of MTKP Field Descriptions *(Continued)*

<Parameter>	Description

Values when ProactiveCmdType=5 (Play tone)

<ToneType>	1 Dial tone. 3 Network Congestion. 4 Radio ack. 5 Tone Dropped. 6 Tone Error. 7 Tone Call waiting. 8 Alert classic. 10 Powerup. 11 Confirm. 12 Negative.
<TimeUnit>	0 Minutes. 1 Seconds. 2 Tenths of seconds.
<TimeInterval>	(1-255) Time required expressed in units.
<Text>	Text information in ASCII format.

Values when ProactiveCmdType=9 (Send SMS)

<Text>	Text information in ASCII format.

Values when ProactiveCmdType=10 (Send SS)

<Text>	Text information in ASCII format.

Values when ProactiveCmdType=12 (Setup Call)

<Parameter>	0 Set up call, but only if not currently busy on another call. 1 Set up call, putting all other calls (if any) on hold. 2 Set up call, disconnecting all other calls (if any).
<CalledNb>	Called number in ASCII format.
<Redials>	0 Redial allowed. 1 Redial not allowed.
<Text>	Text information in ASCII format

Table 184. +MTKP Parameters of MTKP Field Descriptions *(Continued)*

<Parameter>	Description
Values when ProactiveCmdType=13 (Refresh)	
<RefreshType>	0 SIM initialization and full file change notification 1 File change notification 2 SIM initialization and file change notification 3 SIM initialization 4 SIM reset
Values when ProactiveCmdType=22 (Set Up Idle Mode Text)	
<idle mode text string>	Text string to display when the g20 is in idle mode.
Values when ProactiveCmdType=24 (Send DTMF)	
<alpha id>	Alpha ID of the DTMF string.
Values when ProactiveCmdType=26 (Launch Browser)	
<URL>	URL (text string of up to 100 characters)
<bearers>	0 Bearer unspecified 1 Bearer SMS (for future use) 2 Bearer CSD 4 Bearer USSD (for future use) 8 Bearer GPRS and all possible intersections (Currently only 2 bearer types are supported: CSD and GPRS. Valid bearers are: 0,2,8,10)
<proxy_Id>	Text string containing name/identity of the gateway or proxy used for connecting to the URL (max. 20 characters)
<alpha_id>	Text string identifying the current connection (max. 20 characters)

Set Command

The Set command allows the user to answer the following proactive commands:

• GET_INKEY Key pressed from the user.

• GET_INPUT Message entered by the user.

• Enable/disable the DTMF service by the user.

• Launch browser

• Set up event list

Command	Response/Action
AT+MTKP=<CmdType>,<Result> [,<Data>]	OK +CME ERROR: <err>

The following table shows the MTKP Set command parameters.

Table 185. MTKP Set Command Parameters

<Parameter>	Description
<CmdType>	2 Response for a "Get Inkey" 3 Response for a "Get Input'

Values when CmdType=2 (Get Inkey)

<Result>	0 Session ended by user. 1 Response given by the user. 2 Help information required by user.
<Data>	Key pressed by the user.

Values when CmdType=3 (Get Input)

<Result>	0 Session ended by user. 1 Response given by the user. 2 Help information required by user.
<Data>	String of characters entered by the user.

Values when CmdType=16 (Set Up Event List)

<Result>	5 User activity event 6 Idle Screen Available event 8 Language Selection event 9 Browser Termination event
<Data>	None User activity event None Idle Screen Available event 0 Browser Termination event (user terminated) 1 Browser Termination event (error terminated) 4 String coded as follows: <table><tr><td>Byte(s)</td><td>Description</td><td>Length</td></tr><tr><td>1</td><td>Language tag</td><td>1</td></tr><tr><td>2</td><td>Length='02'</td><td>1</td></tr><tr><td>3-4</td><td>Language</td><td>2</td></tr></table>

Table 185. MTKP Set Command Parameters *(Continued)*

<Parameter>	Description
Values when CmdType=24 (DTMF service)	
<Result>	0 disable DTMF service 1 enable DTMF, short tones 2 enable DTMF, long tones
<Data>	None
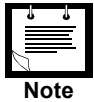
Note

If the SIM asks for yes/no answer then respond with 0 or 1.

Example

+ MTKP: 1,0,Hello   //Display text cmd was sent from SIM (number 1), with normal priority (number 0), and the text is "hello"

4.15.1.4.1   Send DTMF

This proactive SIM service command requests the g20 to send a DTMF string after successfully establishing a call. This command can be used at any time during a call. The g20 does not locally generate audible DTMF tones to play to the user.

This command can be activated/deactivated by the user using the command +MTKP=24. The setting defined by the user is retained during the currently active call and is restored after a power cycle. If a DTMF command is sent to the g20 while this command is disabled, the g20 sends an "Unable to process" terminal response to the SIM.

The terminal response indicating that the command has been performed successfully is sent after the complete DTMF string is sent to the network by the g20. If the command is sent in idle mode, or if a call is terminated or put on hold before the complete DTMF string is sent to the network, the g20 informs the SIM using terminal response 20, with the additional information "Not in speech call". If the user indicates the need to end the proactive SIM application session while the g20 is sending the DTMF string, the g20 stops sending the string and sends the following terminal response, "Proactive SIM application session terminated by the user".

If the SIM includes an alpha identifier in the command, the g20 displays this string for the user in the form of a +MTKP unsolicited response. In all other cases, no information is sent to the user.

Set Command

The Set command activates and deactivates the send DTMF command.

Command	Response/Action
+MTKP=24,<enable/disable>	OK +CME ERROR: <err>

Unsolicited Response
+MTKP=24,<alpha identifier string>

Read Command

The Read command displays the current status of the send DTMF command.

Command	Response/Action
+MTKP?	+MTKP: 24,<status>

The diagram below demonstrates the communication between the SIM, the g20 and the TE regarding a DTMF command during an active voice call.
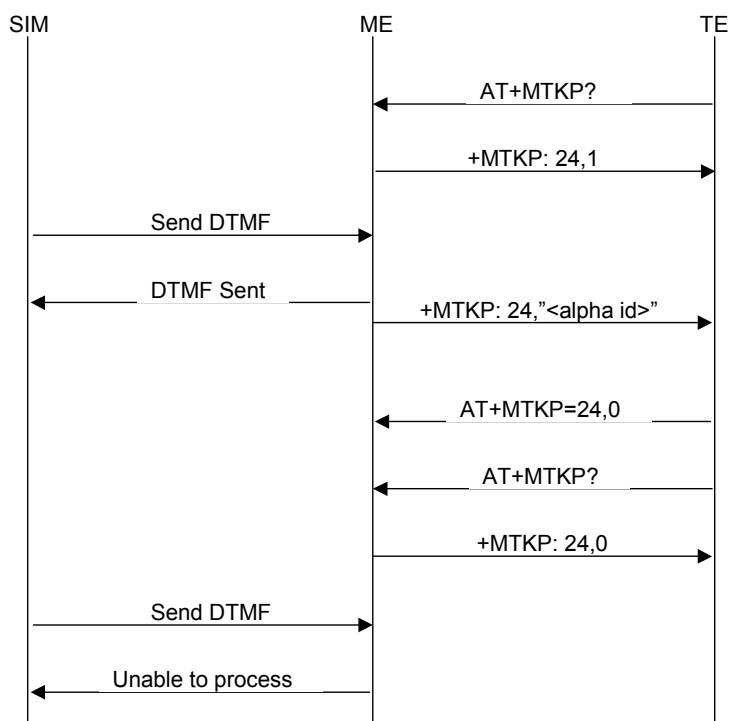
Figure 22. Communication During DTMF Command

4.15.1.4.2 Launch Browser

This is a proactive command that requests a browser inside a browser-enabled user terminal to interpret the content corresponding to a URL. It is forwarded to the TE using an unsolicited event mechanism.

Unsolicited Response
+MTKP=26,<URL>,<bearers>,<proxy_Id>[,<alpha_id>]

The TE answers this unsolicited response using the +MTKP command. For the general result, "launch browser generic error code", the g20 must provide additional information.

Command	Response/Action
AT+MTKP=26,<Result>[<additional info>]	OK +CME ERROR: <err>

The following table shows the +MTKP parameters for response code 26.

Table 186. +MTKP Parameters – Response Code 26

<Parameter>	Description
<result>	0 Success 1 Failure
<additional info>	0 No specific cause can be given 1 Bearer unavailable 2 Browser unavailable 3 g20 unable to read provisioning data Note: Additional info should be added only in case of failure.
<err>	1 Unknown result value

Note

When STK proactive commands are disabled by the TE, MTKP unsolicited events are not issued to it. In such a case, the Launch Browser command is rejected with the result value "Browser unavailable".
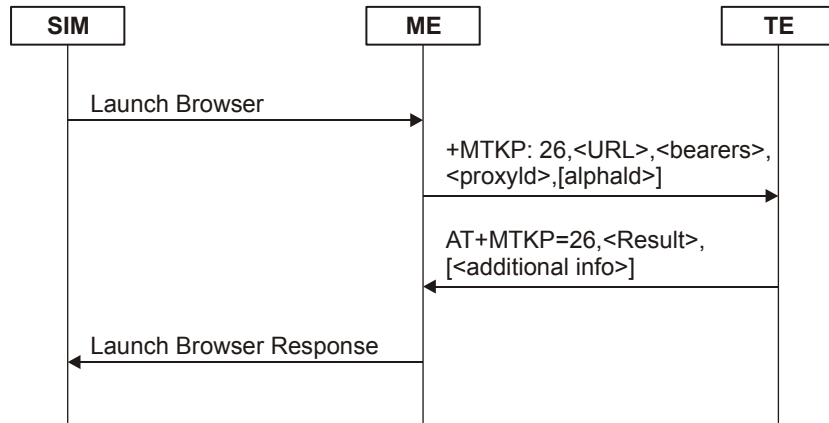
Figure 23. Communication During Launch Browser Command

4.15.1.4.3   Set Up Event List

The SIM card uses this command to supply a set of events, which becomes the current list of events for the g20 to monitor, replacing any existing list. This command can also be used to remove the list of events. The list of events provided by the SIM is erased if the g20 is powered down, or if the SIM is removed or electrically reset. When one of the events in the current list occurs, the g20 uses the Event Download mechanism to transfer event details to the SIM.

The following table describes the events types.

Table 187. Current Event Types

Event	Notes
MT Call Event	Performed by g20; no indication sent to the TE.
Call Connected Event	Performed by g20; no indication sent to the TE.
Call Disconnected Event	Performed by g20; no indication sent to the TE.
Location Status Event	Performed by g20; no indication sent to the TE.
User Activity Event	Initiated by TE and reported via +MTKP command. TE is responsible for deciding what triggers this event. Only the event occurrence is monitored by g20; no additional information is required.
Idle Screen Available Event	Initiated by TE and reported via +MTKP command. TE is responsible for deciding what triggers this event. Only the event occurrence is monitored by g20; no additional information is required.
Card Reader Status Event	Issued by message handler of SCIM_CARD_DETECT_IND_ID message. Performed by g20; no indication sent to the TE.

Table 187. Current Event Types

Event	Notes
Language Selection Event	TE is responsible for deciding what triggers this event. +MTKP command contains a data portion with language code – a pair of alphanumeric characters (defined in ISO 639 [29]), each of which is coded on one byte using the SMS default 7-bit coded alphabet, as defined in TS 23.038, with bit 8 set to 0.
Browser Termination Event	Initiated by TE and reported via +MTKP command. The command contains a data portion that includes the cause of termination: 0　　User terminated 1　　Error terminated TE is responsible for deciding what triggers this event.
Data Available Event	Performed by g20; no indication sent to the TE.
Channel Status Event	Performed by g20; no indication sent to the TE.

Set Command

The Set command defines the event type.

Command	Response/Action
+MTKP=16,<result>[,<Data>]	OK +CME ERROR: <err>

Test Command

Command	Response/Action
+MTKP=?	OK

The following table shows the Set Event List parameters.

Table 188. Set Event List Parameters

<Parameter>	Description	
<Result>	5	User Activity event
	6	Idle Screen Available event
	8	Language Selection event
	9	Browser Termination event

Table 188. Set Event List Parameters *(Continued)*

<Parameter>	Description
<Data>	None User Activity event None Idle Screen Available event 0 Browser Termination event (User terminated) 1 Browser Termination event (Error terminated) 4 Language Selection event, with string coded as follows: Byte(s) Description Length 1 Language tag 1 2 Length='02' 1 3-4 Language 2

Note Each language code consists of a pair of alphanumeric characters, defined in ISO 639 [4]. Each character is coded on one byte using the SMS default 7-bit coded alphabet, as defined in TS 23.038, with bit 8 set to 0. For a list of language codes, refer to the section that follows.

4.15.1.4.4 Language Codes

The following table lists an example of the codes for each language supported by the STK for Language Selection Events.

Table 189. Sample Language Codes

Code	Language
aa	Afar
ab	Abkhazian
af	Afrikaans
am	Amharic
ar	Arabic
as	Assamese
ay	Aymara
az	Azerbaijani
ba	Bashkir
be	Byelorussian
bg	Bulgarian
bh	Bihari
bi	Bislama
bn	Bengali;
bo	Tibetan
br	Breton
ca	Catalan
co	Corsican
cs	Czech
cy	Welsh
da	Danish
de	German
dz	Bhutani
el	Greek
en	English
eo	Esperanto
es	Spanish
et	Estonian
eu	Basque
fa	Persian
fi	Finnish
fj	Fiji
fo	Faroese
fr	French
fy	Frisian
ga	Irish
gd	Scots
gl	Galician
gn	Guarani

Table 189. Sample Language Codes *(Continued)*

Code	Language
gu	Gujarati
ha	Hausa
he	Hebrew
hi	Hindi
hr	Croatian
hu	Hungarian
hy	Armenian
ia	Interlingua
id	Indonesian
ie	Interlingua
ik	Inupiak
is	Icelandic
it	Italian
iu	Inuktitut
ja	Japanese
jw	Javanese
ka	Georgian
kk	Kazakh
kl	Greenlandic
km	Cambodian
kn	Kannada
ko	Korean
ks	Kashmiri
ku	Kurdish
ky	Kirghiz
la	Latin
ln	Lingala
lo	Laothian
lt	Lithuanian
lv	Latvian,
mg	Malagasy
mi	Maori
mk	Macedonian
ml	Malayalam
mn	Mongolian
mo	Moldavian
mr	Marathi
ms	Malay
mt	Maltese
my	Burmese
na	Nauru
ne	Nepali

Table 189. Sample Language Codes *(Continued)*

Code	Language
nl	Dutch
no	Norwegian
oc	Occitan
om	(Afan)
or	Oriya
pa	Punjabi
pl	Polish
ps	Pashto,
pt	Portuguese
qu	Quechua
rm	Rhaeto-Romance
rn	Kirundi
ro	Romanian
ru	Russian
rw	Kinyarwanda
sa	Sanskrit
sd	Sindhi
sg	Sangho
sh	Serbo-Croatian
si	Sinhalese
sk	Slovak
sl	Slovenian
sm	Samoan
sn	Shona
so	Somali
sq	Albanian
sr	Serbian
ss	Siswati
st	Sesotho
su	Sundanese
sv	Swedish
sw	Swahili
ta	Tamil
te	Telugu
tg	Tajik
th	Thai
ti	Tigrinya
tk	Turkmen
tl	Tagalog
tn	Setswana
to	Tonga
tr	Turkish

Table 189. Sample Language Codes *(Continued)*

Code	Language
ts	Tsonga
tt	Tatar
tw	Twi
ug	Uighur
uk	Ukrainian
ur	Urdu
uz	Uzbek
vi	Vietnamese
vo	Volapuk
wo	Wolof
xh	Xhosa
yi	Yiddish
yo	Yoruba
za	Zhuang
zh	Chinese
zu	Zulu

4.15.1.5   +MTKM, Motorola ToolKit Menu

Execute Command

This command is sent when the customer application wants to see the SIM Toolkit Main menu.

Command	Response/Action
AT+MTKM	+MTKM: <Alpha Identifier menu> +MTKM: <Idx1>, <NoOfItems>, <Alpha Idx1>, <Help Info> [<CR><LF>+MTKM: <Idx2>, <NoOfItems>, <Alpha Idx2>, <Help Info> […]] OK

Note This command invokes only the main send invocation of the Main menu. (Can be in any state or submenu.)

Set Command

The Set command is issued when the user wants to select an item from the menu.

Command	Response/Action
AT+MTKM=<CmdType>[,<ItemId>]	OK or: +CME ERROR: <err>

The following table shows the +MTKM parameters.

Table 190. +MTKM Parameters

<Parameter>	Description
<CmdType>	0 Session terminated 1 Item selected 2 Help information request
<ItemId>	Item identifier of the selected item

4.15.1.6   +MTKM, Motorola ToolKit Menu (Response)

This result appears after the SIM has sent the proactive command Select Item (as a result of the item selection by the user).

Command	Response/Action
AT+MTKM	+MTKM: [<DefaultItem>]<Alpha Identifier menu> +MTKM: <Idx1>, <NoOfItems>, <Alpha Idx1>, <Help Info> +MTKM: <Idx2>, <NoOfItems>, <Alpha Idx2>, <Help Info> […]]

The following table shows the +MTKM unsolicited identification parameters.

Table 191. +MTKM Unsolicited Identification Parameters

<Parameter>	Description
<Alpha Identifier menu>	Alpha Identifier of the main menu
<DefaultItem>	Default item
<Idx>	Menu item Identifier
<NoOfItems>	Number of items in the current menu
<Alpha Idx>	Alpha identifier of items

Table 191. +MTKM Unsolicited Identification Parameters *(Continued)*

<Parameter>	Description
<Help Info>	0 No help available 1 Help available

Example

> The following example is provider-specific, and is meant to demonstrate menu use via STK.

Note

AT+MTKM   //Display the main menu

+MTKM: SIM Applications   //Main menu title

+MTKM: 1,3,BANK,0   //The main menu contains 3 items.

+MTKM: 2,3,SHOPPING,0

+MTKM: 3,3,WEATHER,0

OK

AT+MTKM=1,3   //Item 3 in the main menu has been selected.

OK

                                //The Sel item menu has been sent from the SIM.

                                 //Display data about the WEATHER menu

+MTKM: "WEATHER"   //The WEATHER menu contains two items.

+MTKM: 1,2,"OVER THE WORLD",1

+MTKM: 2,2,"IN THE COUNTRY",0

AT+MTKM=1,1   //Select Item 1.

OK

+MTKP: 3,1,0,3,8,0,Enter Country name://User is requested to enter country name

AT+MTKP=3,1,"England"   //User enters the country.

OK

                                //Text information is sent from the SIM.

+ MTKP: 1,0,"Weather in England is 5ºC"

4.15.1.7 +MTKC, Motorola ToolKit Call Control

This unsolicited event notifies the terminal when supplementary services, SMS Control or Call Control are modified.

Command	Response/Action
+MTKC	+MTKC: <CCResult>[,<Number>]

The following table shows the +MTKC parameters.

Table 192. +MTKC Parameters

<Parameter>	Description
<CCResult>	0 Control response not allowed. 1 Control response with modification.
<Number>	Called number or SS String in ASCII format.

4.15.2   TCP/IP

4.15.2.1   +MIPCALL, Create a Wireless Link

This command sets up a PPP (Point to Point Protocol) connection with the GGSN (Gate GPRS Support Node), and returns a valid dynamic IP for the g20.

Note The DCD line changes only to reflect the state change from command mode to data mode.

Set Command

Command	Response/Action
+MIPCALL= <Operation> [<APN>, [<User name>, <Password>]]	OK +MIPCALL: <"local IP address"> or: ERROR: <err> +MIPCALL: 0

Note The +MIPCALL command does not return the prompt to the terminal until it the IP is received from the provider, or time out has occurred, therefore, no other commands can be issued in the meantime.

The +MIPCALL command does not have a general ABORT mechanism, therefore a command cannot be issued until the previous command ends.

Read Command

Command	Response/Action
+MIPCALL?	+MIPCALL: \<operation\>

> **Note**
> When a call exists the dynamic IP address will be returned.
> For example:
> AT+MIPCALL?
> +MIPCALL: 1,"172.17.237.80"

Test Command

Command	Response/Action
+MIPCALL=?	+MIPCALL: (list of supported \<operation\>s)

The following table shows the +MIPCALL parameters.

Table 193. +MIPCALL Parameters

\<Parameter\>	Description
Operation	0 Disconnect link. 1 Connect link.
"APN"	APN of service provider (in quotation marks). Contact your service provider for details.
"User name"	User name in provider server (in quotation marks). Contact your service provider for details.
"Password"	Password for provider server (in quotation marks). Contact your service provider for details.
Extended err	3 Operation not allowed. 4 Operation not supported.
Local IP-address	IP address given by server after PPP negotiation.

Example

at+MIPCALL=1,"internet","User1","Pswd"   //Connecting the provider 'Orange' and getting an IP

+MIPCALL: "123.145.167.230"

at+MIPCALL=0   //The terminal hangs up the link

OK

4.15.2.2   +MIPOPEN, Open a Socket (UDP or TCP)

This command causes the g20 to initialize a new socket and open a connection with a remote side. Each socket allocates an accumulating buffer whose size is 1372 bytes.

> **Note**
> The +MIPOPEN command returns a +MIPSTAT unsolicited event if it fails, for example, if it was rejected by the remote side.
>
> MIPxxx is a complete set of GPRS commands. This set should not be used with other GPRS commands, such as CGATT, CGACT, and so on.

Set Command

Command	Response/Action
+MIPOPEN= <Socket ID>, <Source Port>, <"Destination IP">, <Destination Port>, <Protocol>	OK +MIPOPEN: <Socket ID>,<State> or: ERROR: <err>

Read Command

The Read command returns the numbers of the sockets that can be opened.

Command	Response/Action
+MIPOPEN?	+MIPOPEN:[<SocketID>] for each socket that can be opened or: +MIPOPEN 0 if there are no free sockets.

Example

+MIPOPEN: 1 2 3 4   //All sockets closed

+MIPOPEN: 1 3 4   //Socket 2 opened

Test Command

Command	Response/Action
+MIPOPEN=?	+MIPOPEN: (list of supported <socket ID>s),(list of supported <source port>s),(list of supported<"Destination IP">s), (list of <destination port>s),(list of supported <protocol>s)

The following table shows the +MIPOPEN parameters.

Table 194. +MIPOPEN Parameters

<Parameter>	Description
Socket ID	A unique number that identifies a connection (provided by the terminal application). 0 Invalid socket number 1,2,3,4 Valid socket number
Source Port	Port of source site. Port range: 0-65535 (decimal digits)
"Destination IP"	IP of the destination site in the format "AAA.BBB.CCC.DDD". The range of each octant is 0-255. The value can be written in 1, 2, or 3 digits.
Destination Port	Port of destination site. Port range: 0-65535 (decimal digits)
Protocol	Type of protocol stack. 0 TCP 1 UDP
Extended err	3 Operation not allowed 4 Operation not supported
State	State of socket or error indication. 0 Inactive 1 Active

> **Note**
>
> Motorola does not recommend using port numbers below 1024. These numbers are defined to be reserved for operating systems.

Example

at+MIPOPEN=1,1200,"123.245.213.012",1234,0//Opening socket 1, using TCP protocol, from port 1200, targeting 123.245.213.012 port 1234

+MIPOPEN=2,1300,"123.133.074.192",1242,1 //Opening socket 2, using UDP protocol, from port 1300, targeting 123.133.074.192 port 1242

at+MIPOPEN=1,1222,"123.245.213.012",1234,0//Opening socket 1, using TCP protocol, from port 1222, targeting 123.245.213.012 port 1234

at+MIPOPEN: //Invalid command

ERROR

at+MIPOPEN?   //Terminal checking the free sockets

+MIPOPEN: 3 4

OK

4.15.2.3   +MIPCLOSE, Close a Socket

This command causes the g20 to free the socket accumulating buffer and to close the socket.

Note	All data stored in the accumulating buffer will be lost. Refer to "+MIPSETS, Set Size for Automatic Push" on page 361 and "+MIPPUSH, Push Data into Protocol Stack" on page 364.

Set Command

Command	Response/Action
+MIPCLOSE = <Socket ID>	OK +MIPCLOSE: <Socket ID> or: ERROR

Read Command

Command	Response/Action
+MIPCLOSE?	+MIPCLOSE 1234 +MIPCLOSE: [<socket ID>] - for all ACTIVE sockets.

Test Command

Command	Response/Action
+MIPCLOSE=?	+MIPCLOSE=(1-MAX_SOCKET_NUM)

The following table shows the +MIPCLOSE parameters.

Table 195. +MIPCLOSE Parameters

<Parameter>	Description
Socket ID	Unique number that identifies a connection: 0 Invalid socket number 1,2,3,4 Valid socket numbers
Extended err	3 Operation not allowed

Example

at+MIPCLOSE=1	//The terminal closes the opened socket
OK	
at+MIPCLOSE=2	//The terminal closes the socket that wasn't opened
ERROR	
at+mipclose?	//Sockets 1 and 2 are opened
+MIPCLOSE: 1 2	
at+mipclose?	//No opened sockets
+MIPCLOSE: 0	

4.15.2.4   +MIPSETS, Set Size for Automatic Push

This command causes the g20 to set a watermark in the accumulating buffer. When the watermark is reached, data is pushed from the accumulating buffer into the protocol stack.

Data chunks between the terminal and the g20 are limited to be smaller than 80 characters (160 characters in coded form). In order to reduce the overhead of sending small amounts of data over the air, the g20 uses an accumulating buffer. The terminal can specify a watermark within the accumulating buffer size limits to indicate how much data should be accumulated. When the data in the accumulating buffer exceeds the watermark, only data equal to the watermark is sent. Data remaining in the buffer is sent with the next packet.

> **Note**
>
> If there is data in the accumulating buffer, the +MIPSETS command will be rejected.

Set Command

Command	Response/Action
+MIPSETS= <Socket ID>,<Size>	OK or: ERROR +MIPSETS: <err>

Read Command

Command	Response/Action
+MIPSETS?	+MIPSETS: [<SocketID>,<Current Size Settings>] For all ACTIVE sockets.

Test Command

Command	Response/Action
+MIPSETS=?	+MIPSETS: (1-4),(list of supported <size>s)

The following table shows the +MIPSETS parameters.

Table 196. +MIPSETS Parameters

<Parameter>	Description
Size	Size of the buffer 1 < size ≤ 1372 The default value is 1372.
Extended err	3 Operation not allowed

Example

at+MIPSETS=1,340   //Asks the g20 to accumulate 340 bytes on socket 1 prior to sending (socket should be activated by the +mipopen command)

+MIPSETS: 0

OK

at+MIPSETS=1,200   //Asks the g20 to accumulate 200 bytes on socket 1 prior to sending (socket should be activated by the +mipopen command)

+MIPSETS: 0
OK

at+MIPSETS=2,400   //Asks the g20 to accumulate 400 bytes on socket 2 prior to sending
+MIPSETS: 0

OK
at+mipsets=?
+MIPSETS: (1-4),(1-1372)

OK
at+mipsets?
+MIPSETS: 1,100   //Information provided only for active sockets
+MIPSETS: 2,1372   //Information provided only for active sockets

OK

4.15.2.5   +MIPSEND, Send Data

This command causes the g20 to store the data that the terminal provides in the accumulating buffer, and then send this data using an existing protocol stack when the amount of data reaches the predefined amount (see "+MIPSETS, Set Size for Automatic Push" on page 361). Before sending data, a valid connection must be created using the +MIPCALL and +MIPOPEN commands.

Motorola recommends that the terminal sets the watermark in the accumulating buffer prior to this command, using the +MIPSETS command. By default, the watermark is set to 1372 bytes of data.

Set Command

Command	Response/Action
+MIPSEND = <Socket ID>,<Data>	ERROR +MIPSEND: <Socket ID>,<Free Size>

Note   Data in the +MIPSEND command is limited to 80 characters (160 in coded form).

Read Command

Command	Response/Action
+MIPSEND?	+MIPSEND <Socket ID>,<Free Size>>[<Socket ID><Free Size>]<CR><LF> For all ACTIVE sockets.

Test Command

Command	Response/Action
+MIPSEND=?	ERROR

The following table shows the +MIPSEND parameters.

Table 197. +MIPSEND Parameters

<Parameter>	Description
<socket ID>	1,2,3,4 Number of valid socket
<Free Size>	Free space in current buffer. Free size is calculated from the 1372. 0 < Free Size < 1372
<Extended err>	3 Operation not allowed

Table 197. +MIPSEND Parameters *(Continued)*

<Parameter>	Description
<Data>	User data string is sent encoded with 0-F hexadecimal digits (String ends with a <CR>)

Example

(Socket 4 was not opened using +MIPOPEN AT command)

at+mipsend=4,"4444"

ERROR

at+mipsend=1,"4444"

+MIPSEND: 1,1370   //1372- 2 chars 'aa' = 1370

OK

at+mipsend=?

ERROR

at+mipsend?

+MIPSEND: 1,1372   //Sockets 1 and 2 were opened using + MIPOPEN AT command

+MIPSEND: 2,1372   //Sockets 1 and 2 were opened using + MIPOPEN AT command

OK

4.15.2.6   +MIPPUSH, Push Data into Protocol Stack

This command causes the g20 to push the data accumulated in its accumulating buffers into the protocol stack. It is assumed that before using this command, some data should exist due to previous +MIPSEND commands.

Set Command

Command	Response/Action
+MIPPUSH = <Socket ID>[,<"Destination IP">,<Destination Port>]	+MIPPUSH: <Socket ID> OK or: ERROR or: +MIPPUSH: <err>

Optional parameters are used only for UDP connections. If the Destination IP and Destination Port are not provided by the user, a datagram is sent to the last target (or the default target provided by the +MIPOPEN command).

Note

Read Command

Command	Response/Action
+MIPPUSH?	MIPPUSH:[<socket ID>]

Test Command

Command	Response/Action
+MIPPUSH=?	MIPPUSH=<socket ID>,<IP>,<Port>

The following table shows the +MIPPUSH parameters.

Table 198. +MIPPUSH Parameters

<Parameter>	Description
Socket ID	1,2,3,4 Number of valid socket
Extended err	3 Operation not allowed
Destination IP	IP of destination site in the format AAA.BBB.CCC.DDD. The value can be written in 1, 2 or 3 digits.
Destination Port	0-65535 Port of destination site. Written in decimal digits.

Example

at+MIPPUSH=1   //Terminal asks the g20 to flush the buffer in socket 1 (was opened using the +MIPOPEN command)

+MIPPUSH: 0

OK

4.15.2.7   +MIPFLUSH, Flush Data from Buffers

This command causes the g20 to flush (delete) data accumulated in its accumulating buffers.

Set Command

Command	Response/Action
+MIPFLUSH = <Socket ID>	ERROR or: +MIPFLUSH: <Socket ID> OK

Read Command

Command	Response/Action
+MIPFLUSH?	+MIPFLUSH:[<socket ID>]

Test Command

Command	Response/Action
+MIPFLUSH=?	+MIPFLUSH=(<Socket ID>)

The following table shows the +MIPFLUSH parameters.

Table 199. +MIPFLUSH Parameters

<Parameter>	Description	
Socket ID	1,2,3,4	Number of valid sockets
Extended err	3	Operation not allowed

Example

at+mipflush=2   //Socket number 2 was previously opened using the +MIPOPEN command

+MIPFLUSH: 2

OK

at+mipflush=5

ERROR

at+mipflush?

+MIPFLUSH: 1 2

OK

4.15.2.8 +MIPRUDP, Receive Data from UDP Protocol Stack

This unsolicited event is sent by the g20 to the terminal when data is received from the UDP protocol stack.

Set Command

Event
+MIPRUDP:<Source IP>,<Source Port><socket ID>,<Left>,<Data>

The following table shows the +MIPRUDP parameters.

Table 200. +MIPRUDP Parameters

<Parameter>	Description
Source IP	IP of the source
Source Port	Port of the source
Socket ID	1,2,3,4 Number of valid sockets.
Left	Size of received Data still left in protocol stack.
Data	Data string received with 0-F hexadecimal digits. String ends with a <CR>.

Example

+MIPRUDP: 172.16.3.135,222,2,0,44444444

4.15.2.9 +MIPRTCP, Receive Data from TCP Protocol Stack

This unsolicited event is sent by the g20 to the terminal when data is received from the TCP protocol stack.

Set Command

Event
+MIPRTCP: <socket ID>,<Left>, <Data>

The following table shows the +MIPRTCP parameters.

Table 201. +MIPRTCP Parameters

<Parameter>	Description
Socket ID	1,2,3,4 Number of valid sockets.
Left	Size of received Data still left in protocol stack.
Data	Data string received with 0-F hexadecimal digits. String ends with a <CR>.

Example

+MIPRTCP: 3,0,7171

4.15.2.10   +MIPSTAT, Status Report

This unsolicited event is sent to the terminal indicating a change in status. Currently there are two possible sources of failure, a broken logical connection or a broken physical connection.

Event
+MIPSTAT: <socket ID>,<n>

The following table shows the MIPSTAT parameters.

Table 202. MIPSTAT Parameters

<Parameter>	Description
<n>	1 Broken protocol stack. 2 Broken call. All sockets that use the link fail too.

Example

+MIPSTAT: 1,4

4.15.2.11 MIPXOFF, Flow Control - Xoff

This command is the unsolicited response that the g20 sends to the terminal to stop sending data when it does not have enough memory to process new +MIPSEND requests. The g20 uses the accumulating buffer prior to pushing data into the protocol stack. This memory resource is protected by a Xoff_upper watermark.

Event
+MIPXOFF: <Socket ID>

Example

+MIPXOFF: //The g20 detects that the accumulating buffer 1 has reached its Xoff watermark.

From this point, the terminal is not allowed to send data, until it receives the +MIPXON command.

4.15.2.12 MIPXON, Flow Control - Xon

This command is the unsolicited event that the g20 sends to the terminal when it detects that it has free memory in the accumulating buffer and can process new +MIPSEND requests, after the +MIPXOFF event.

Event
+MIPXON: \<Socket ID\>

Example

+MIPXON: 1   //The g20 pushed the data into the protocol stack on socket 1 and is able to handle more data from the terminal.

4.16 RS232 MULTIPLEXER FEATURE

The MUX provides multiple logical communication channels between the DTE and g20 over one physical RS232 connection. This service enables the DTE device to run multiple applications (such as GPRS, CSD, SMS and voice calls) while communicating simultaneously with the g20.

4.16.1 MUX Details

4.16.1.1 Protocol Versions

• 3G TS27.010 v.3.3.0 (2000-03)

4.16.1.2 System Overview

The MUX service in the g20 provides multiple virtual channels for the DTE that can communicate simultaneously with the g20. This service allows the DTE to have channels for command and network indications while other channels are used for data sessions. This service is available when MUX software entities exist on both the DTE and the g20. These MUX entities communicate with each other and provide data connection management, which includes establishment, control, release and data transfer between matching channels in the DTE and g20.

> **Note**
> MUX over 232 is a software module. No PCB hardware changes are required at either the g20 or DTE side.
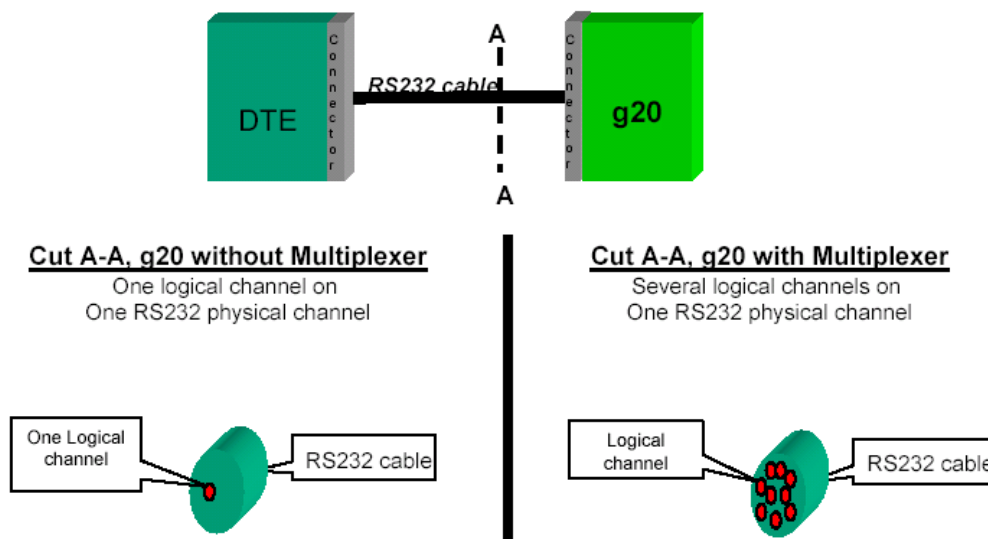
Figure 24. g20 with and without MUX

4.16.1.3   Product Architecture

The following figure shows the former architecture (PREMUX).
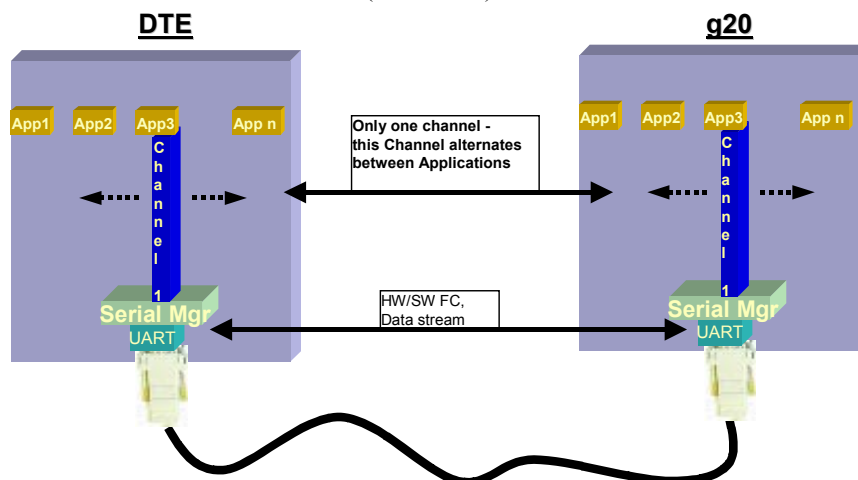
Figure 25. PREMUX Architecture

The following figure shows the current product architecture (MUX).
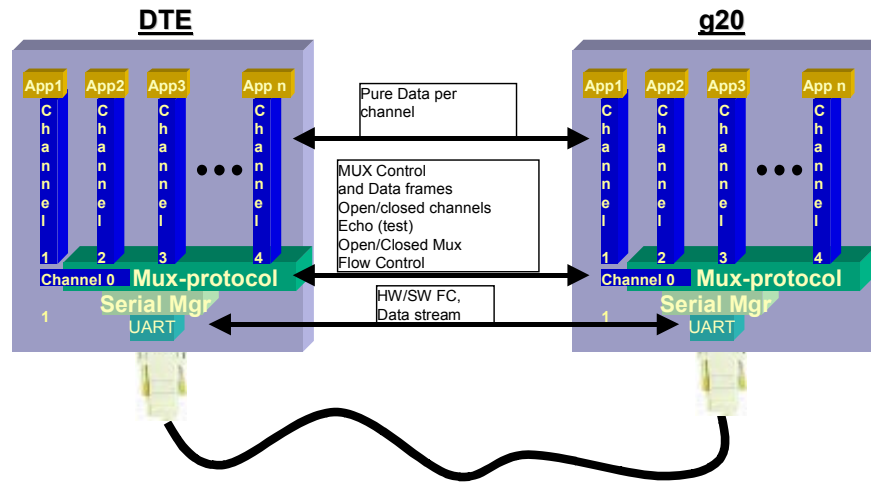
Figure 26. Current MUX Architecture

4.16.1.4   MUX States Overview

The g20 MUX module has three states:

- PREMUX
- MUX-Init
- MUX.
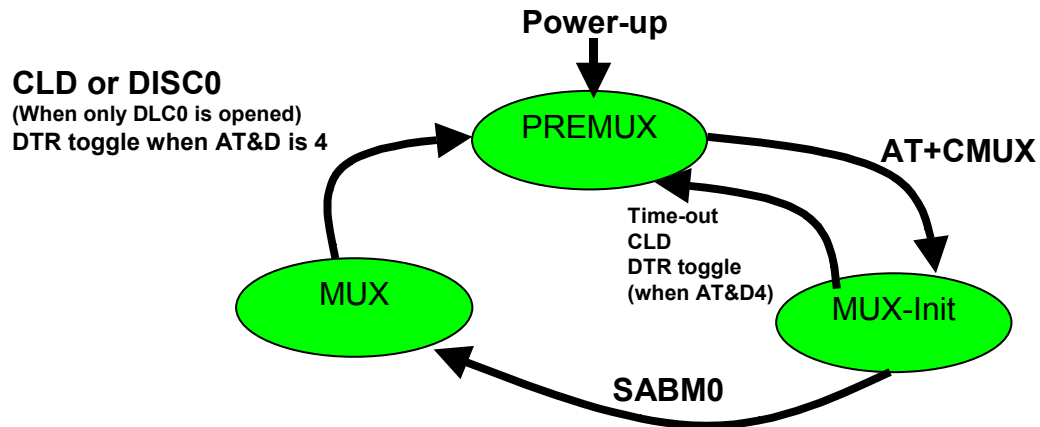
Figure 27. MUX States

4.16.1.4.1   PREMUX State

Once the GRLC logical communication channel between the DTE and g20 has been established, the RS232 cable is connected and the DTE device is ready to communicate.

4.16.1.5   MUX-Init State

This is an in-between state during which the g20 and DTE move from PREMUX to MUX.

Note	In this state there are no g20 indications or AT commands such as RING indicator (RI), and so on.

4.16.1.6   MUX State

In this state, the DTE and g20 communicate with the MUX 27.010 protocol stack over RS232.

4.16.1.7   Supported 27.010 Protocol Services

The following table lists the services defined in the 27.010 protocol that are supported by the MUX feature.

Table 203. MUX Services

Service	Description
Start Up	Used to start the multiplexer operation over the serial channel.
DLC Establishment Services	Used to open virtual multiplexer channels.
Data Services	
Power Control Services	Includes both sleep and wakeup services. This service will be supported in future versions.
DLC Release Services	Used to disconnect a DLC exclude control channel (DLCO).
Close Down Services (CLD, DISCO, Exception situations)	Used to terminate multiplexer operation on the serial channel and resume GRLC operation (returns to PREMUX state).

Table 203. MUX Services

Service	Description
Control Services	Includes services at the MUX entity level and at the specific DLC level. MUX Entity Level services (channel 0): 1. Test Service — Used to test the communication link between two MUX entities. 2. Flow Control Service — Issued by the MUX entity as a result of its buffer state. The initial state of the MUX entity is with data flow enabled. Specific DLC Level services (all DLC except 0): 1. DLC Control Parameter Service (MSC) — Used to control a specific DLC. A specific DLC HW modem status is reflected by logical (SW) means. A Modem Status Command (MSC) is used to control specific DLC modem signals and flow control, as a substitute for the HW lines in PREMUX. Initial values are expected to mirror the HW values in PREMUX. Note: The MSC break signal is not supported. 2. Non-supported Command Response (NSC)
Unsupported Control Services	PN, RPN, RLS, SNC (27.010 options)

4.16.1.8   UART Flow Control

The following sections describe UART flow control in the MUX.

4.16.1.8.1   UART Hardware Flow Control

g20 supports automatic UART hardware flow control.

4.16.1.8.2   UART Software Flow Control

Software flow control is supported only in MUX advanced mode. It is not supported in basic mode.

4.16.1.9   MUX UART Port Speed

Auto baud rate detection is disabled in the MUX. To set the UART baud rate, the g20 uses the <port speed> parameter in +CMUX command. If the parameter is absent, the MUX uses the same baud rate that was in PREMUX state.

4.16.2   +CMUX, MUX Startup Command

This command is used to enable/disable the GSM MUX multiplexing protocol stack. When the g20 receives a valid +CMUX command, it returns OK and changes its state to MUX-Init.If the parameters are left out, the default value is used.

Set Command

The Set command requests the g20 to open the MUX stack with various parameters. This command works only in PREMUX state.

Command	Response/Action
+CMUX=<mode>[,<subset>[,<port_ speed>[,<N1>[,<T1>[,<N2>[,<T2>[, <T3>[,<k>]]]]]]]]	+CME ERROR: <err>

Read Command

The Read command displays the current mode and settings. This command works only in MUX state.

Command	Response/Action
+CMUX?	+CMUX: <mode>, [<subset>], <port_speed>,<N1>, <T1>, <N2>, <T2>, <T3>+CME ERROR: <err>

Test Command

The Test Command displays a list of supported modes and parameters. This command works in both PREMUX and MUX states.

Command	Response/Action
+CMUX=?	+CMUX: (list of supported <mode>s),(list of supported<subset>s),(list of supported <port_speed>s),(list ofsupported <N1>s),(list of supported <T1>s),(list ofsupported <N2>s),(list of supported <T2>s),(list ofsupported <T3>s),(list of supported <k>s)

The following table shows the +CMUX parameters.

Table 204. +CMUX Parameters

<Parameter>	Description
<mode>	MUX mode: 0 Basic 1 Advanced

Table 204. +CMUX Parameters *(Continued)*

<Parameter>	Description
<subset>	Defines how the MUX control channel is set up. The virtual channel is set up according to this setting. 0 UIH frames used only
<port_speed>	Transmission rate: 1 9600 bit/sec 2 19200 bit/sec 3 38400 bit/sec 4 57600 bit/sec 5 115200 bit/sec
<N1>	Maximum frame size: 31 256 The default value is 31 in Basic mode, 64 in Advanced mode.
<T1>	Acknowledgement timer (in units of 10 ms). 1-255 Default value is 10 (100 ms)
<N2>	Maximum number of retransmissions. 0-100 Default value is 3
<T2>	Response timer for the DLC0 (in unit of 10 ms). <T2> must be longer than <T1>. 2-255 Default value is 30 (300 ms)
<T3>	Wake up response timer (in seconds). 1-255 Default value is 10.

Note   Due to non-ERM, the <k> parameter is not supported.

4.16.3   MUX Modes

The <mode> parameter in the +CMUX command determines whether the MUX protocol works in Basic mode or Advanced mode, including the transparency mechanism. When the g20 changes states from PREMUX to MUX-Init, the g20 opens the MUX stack in the selected mode.

In Advanced mode the following requirements apply:

• The length field is no longer be a part of the new frame structure.
• A transparency mechanism.
• XON/XOFF flow control is available.

4.16.4   MUX Customer Open Source Code Packet

The MUX is provided with an open source code packet to help speed the development process and reduce the incompatible interpretations of the protocol specifications. This source code packet is saved in the VOBS and supports both Basic and Advanced modes.

When implementing the MUX feature, the user should have the MUX entity installed with the product. The following two MUX integration options are available to the user:

• MIP (Mux Integration Packet): The user receives the source code, which is provided by Motorola, with known APIs for the MUX. The MIP is a Motorola open source code packet for the GSM 27.010 protocol with API functions provided for the user.
• MUI (Mux User Implementation): The GSM 27.010 protocol is implemented by the user. The MUI is the user implementation device for the GSM 27.010 protocol.

4.16.5   APIs

There are five API user integrations, as follows:

• Open service
• Close service
• Sending Data service
• Receiving Data service
• MUX service test, MSC, FC and so on (refers only to the control channel)

4.16.6   MUX Channels (Information Data Link Control - IDLC)

The following sections describe the MUX channels.

4.16.6.1 Basic MUX Channel Definitions

- Each MUX channel functions as a regular RS232 connection that follows ETSI 07.07 and ITU V.25 ver standards. However, there are some limitations, as described in this paragraph.
- The g20 IDLC channel switches to Data mode as specified in ETSI 07.07 [4].
- When the MUX protocol layer releases the IDLC channel, any GPRS/DATA session or established call is hung up. Only active voice calls remain connected.
- AT command requests by an IDLC may result in an ERROR, while in PREMUX state the same request would never have returned an ERROR. This may happen because the addressed resource in the g20 is busy with a second IDLC request. For example, if two channels send the AT+CLIP? command, which addresses the GSM engine, only one channel receives the +CLIP: response, while the other receives an ERROR.

4.16.6.2 Channel Priorities

The control channel has the highest priority. All other IDLCs have the same priority.

Note
All control frames are processed before any other channels. IDLC frame validation is also performed after all control frames are processed.

4.16.6.3 Multiple Channel Configuration

The configurations listed below are recommended to achieve maximum use of parallel channels with minimum conflicts.

4.16.6.3.1 Two Channel Configuration

- DLC1 – Data channel dedicated to CDS
- DLC2 – ACCH (AT command channel; includes all AT commands except CDS related commands)
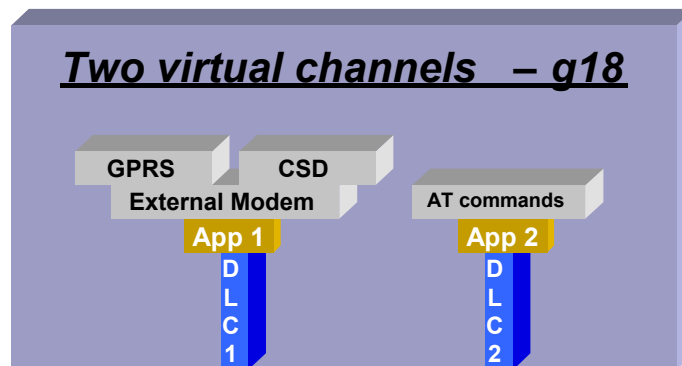
Figure 28. Two-Channel Configuration

Note
Between data sessions, DLC1 is IDLE (in command mode).

4.16.6.3.2 Four-channel Configuration

- DLC1 – GRLC or Logger
- DLC2 – ACCH
- DLC3 – GPRS
- DLC4 – CSD
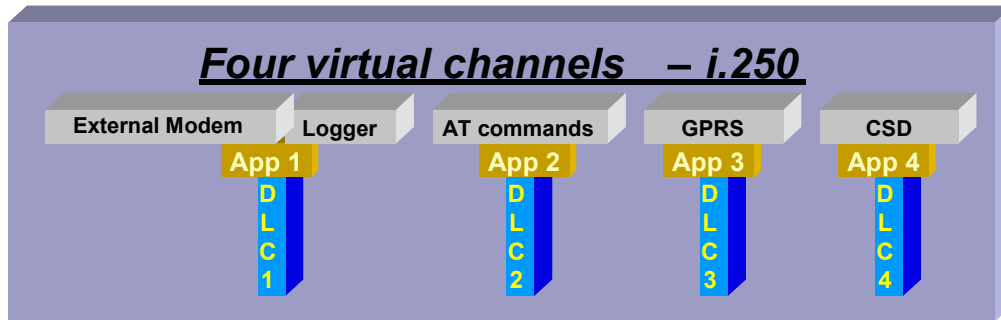
Figure 29. Four-Channel Configuration

Note Between sessions, the Data and GPRS channels are IDLE (in command mode).

DLC1 Explanation:

An external host interface is used as a regular g20 RS232 channel, without MUX capabilities. It is highly recommended to enable this channel when the others are in IDLE state. One purpose of adding this channel is to give outside users who cannot see the other three channels, which are used as internal channels, the option of using the product (such as a Palm computer with a built-in g20) as purely a modem, without its other benefits. Such a product could also use this channel as the g20 logger channel.

The purpose of the additional UART is to have a DTE processor bypass, enabling an external device (such as a PC, and so on) to be connected to this UART for receiving g20 services. When this UART is available, it can be used for Logger debugging by doing the following:

1. Connecting the additional UART to a PC COM port.
2. Sending the +CLOG command.

3.   Receiving the log data into a binary file.
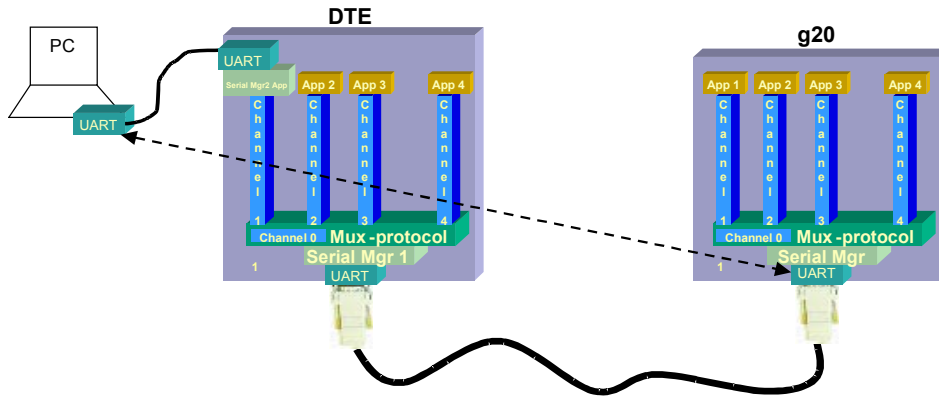
Figure 30. Using the Additional UART

> **Note**
>
> In this configuration, the DTE device might try to request multiple CDS services simultaneously. For example, it may try to establish CSD sessions in DLC1 and in DLC4. Such attempts will not work and will have unpredictable corresponding effects.

4.16.6.4   AT Commands per Channel Configuration

The following table provides the AT commands that are allowed for each channel.

> **Note**
>
> When DTE sends a "Not allowed" AT command to a specific channel the following might occur:
> - ERROR response will be returned.
> - OK response will be returned, but unexpected behavior will occur later.

Use the following legend for the Profile Definition column in Table 205, "AT Commands Limitations for 4-channel Configuration", below:

PCHS:	Per channel setting
PCHS - unsolicited:	Enable/disable unsolicited is per channel
Unsolicited - special:	Unsolicited can be enabled only in one channel, regardless of what is shown in the table below

Table 205. AT Commands Limitations for 4-channel Configuration

	IDLC-1 External	IDLC-2 AT + Voice Call + SMS + STK	IDLC-3	IDLC-4	Comment	PREMUX Support	Profile Definition
$		V				Yes	
%C	V	V	V	V	Ignored		
&C	V	V	V	V		Yes	PCHS
&D	V	V	V	V		Yes	PCHS
&K	V	V	V	V	MUX degenerated	Yes	
&G	V	V	V	V	Ignored		
&J	V	V	V	V			
&L	V	V	V	V	Ignored		
&M	V	V	V	V	Ignored		
&P	V	V	V	V	Ignored		
&Q	V	V	V	V			
&R	V	V	V	V	Ignored		
&S	V	V	V	V	Ignored		
&T	V	V	V	V	Ignored		
&V		V					
&W		V					
&Y		V					

Table 205. AT Commands Limitations for 4-channel Configuration *(Continued)*

	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Comment	PREMUX Support	Profile Definition
	External	AT + Voice Call + SMS + STK					
?	V	V	V	V		Yes	
\A	V	V	V	V	Ignored	Yes	
\S	V	V	V	V		Yes	
\K	V	V	V	V	Ignored		
\B	V	V	V	V	Ignored		
+++	V csd		V		Not a command	Yes	
+CACM		V				Yes	
+CALM		V				Yes	
+CAMM		V				Yes	
+CAOC		V				Yes	Unsolicited - special
+CBAND		V			Ignored		
+CBAUD		V			MUX degenerated	Yes	
+CBC		V				Yes	
+CBST	V csd		V csd			Yes	PCHS
+CCFC		V				Yes	
+CCLK		V				Yes	
+CCWA		V				Yes	PCHS - unsolicited
+CEER		V				Yes	
+CFUN		V				Yes	
+CGACT	V gprs			V		Yes	

Table 205. AT Commands Limitations for 4-channel Configuration *(Continued)*

	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Comment	PREMUX Support	Profile Definition
	External	AT + Voice Call + SMS + STK					
+CGCLASS	V gprs			V		Yes	
+CGDATA						No	
+CGDCONT	Vgprs			V		Yes	
+CGMI	V	V	V	V		Yes	
+CGMM	V	V	V	V		Yes	
+CGMR	V	V	V	V		Yes	
+CGPRS	V gprs	V		V		Yes	
+CGQMIN	Vgprs			V		Yes	
+CGREG		V				Yes	PCHS - unsolicited
+CGSMS		V				No	
+CGSN	V	V	V	V		Yes	
+CGT		V				Yes	
+CHLD		V				Yes	
+CHUP		V				Yes	
+CIMI		V				Yes	
+CKEV		V				Yes	PCHS - unsolicited
+CKPD		V				Yes	
+CLAC		V					
+CLCC		V				Yes	PCHS - unsolicited
+CLCK		V				Yes	

Table 205. AT Commands Limitations for 4-channel Configuration *(Continued)*

	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Comment	PREMUX Support	Profile Definition
	External	AT + Voice Call + SMS + STK					
+CLIP		V				Yes	PCHS - unsolicited
+CLIR		V				Yes	
+CLVL		V				Yes	
+CMEE	V	V	V	V		Yes	PCHS
+CMER		V				Yes	PCHS - unsolicited
+CMGD		V				Yes	
+CMGF		V				Yes	PCHS
+CMGL		V				Yes	
+CMGR		V				Yes	
+CMGS		V				Yes	
+CMGW		V				Yes	
+CMSS		V				Yes	
+CMT		V				Yes	PCHS - unsolicited
+CMTI		V				Yes	PCHS - unsolicited
+CMUT		V				Yes	
+CMUX		V				Yes	
+CNMA		V				Yes	PCHS
+CNMI		V				Yes	Unsolicited - special
+CNUM		V				Yes	

Table 205. AT Commands Limitations for 4-channel Configuration *(Continued)*

	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Comment	PREMUX Support	Profile Definition
	External	AT + Voice Call + SMS + STK					
+COLP		V				Yes	PCHS - unsolicited
+COPS		V				Yes	
+CPAS		V				Yes	
+CPBF		V				Yes	
+CPBR		V				Yes	
+CPBS		V				Yes	PCHS
+CPBW		V				Yes	
+CPIN		V				Yes	
+CPMS		V				Yes	
+CPOL		V				Yes	
+CPUC		V				Yes	
+CPWD		V				Yes	
+CR	V csd		V			Yes	
+CREG		V				Yes	PCHS - unsolicited
+CRLP		V				Yes	
+CRSL		V				Yes	
+CRSM		V					
+CRTT		V				Yes	
+CSCA		V				Yes	
+CSCB		V				Yes	
+CSCS		V				Yes	PCHS

Table 205. AT Commands Limitations for 4-channel Configuration *(Continued)*

	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Comment	PREMUX Support	Profile Definition
	External	AT + Voice Call + SMS + STK					
+CSDH		V				Yes	
+CSMS		V				Yes	PCHS
+CSNS	V csd	V	V			Yes	
+CSQ		V				Yes	
+CSSN		V				Yes	PCHS - unsolicited
+CSVM		V				Yes	
+CTFR1	V	V	V	V			
+CUSD		V				Yes	
+FCLASS	V csd		V			Yes	PCHS
+FMI	V csd		V			Yes	PCHS
+FMM	V csd		V			Yes	PCHS
+FMR	V csd		V			Yes	PCHS
+FRH	V csd		V			Yes	PCHS
+FRM	V csd		V			Yes	PCHS
+FRS	V csd		V			Yes	PCHS
+FTH	V csd		V			Yes	PCHS
+FTM	V csd		V			Yes	PCHS
+FTS	V csd		V			Yes	PCHS
+GCAP		V				Yes	
+GMI	V	V	V	V		Yes	
+GMM	V	V	V	V		Yes	

Table 205. AT Commands Limitations for 4-channel Configuration *(Continued)*

	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Comment	PREMUX Support	Profile Definition
	External	AT + Voice Call + SMS + STK					
+GMR	V	V	V	V		Yes	
+GSN	V	V	V	V		Yes	
+ICF		V			Affects UART; will be degenerated in future releases	Yes	
+IFC	V	V	V	V		Yes	
+IPR	V	V	V	V	MUX degenerated	Yes	
+MAFEAT		V				Yes	
+MAFVL		V				Yes	
+MAID		V				Yes	
+MAMUT		V				Yes	
+MAPTH		V				Yes	
+MAPV		V				Yes	
+MAVOL		V				Yes	
+MCSAT		V					
+MCSN		V					
+MCST		V				Yes	PCHS - unsolicited
+MCWAKE		V				Yes	
+MDBAD		V				Yes	
+MDBL		V				Yes	
+MDBR		V				Yes	

Table 205. AT Commands Limitations for 4-channel Configuration *(Continued)*

	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Comment	PREMUX Support	Profile Definition
	External	**AT + Voice Call + SMS + STK**					
+MDC		V					
+MDSI		V					
+MEGA		V				Yes	
+MFS		V					
+MHIG		V				Yes	
+MIPCALL				3	Command is not supported within MUX	Yes	
+MIPCLOSE						Yes	
+MIPFLUSH						Yes	
+MIPOPEN						Yes	
+MIPPUSH						Yes	
+MIPSEND						Yes	
+MIPSETS						Yes	
+MKPD		V				Yes	PCHS - unsolicited
+MMAR		V				Yes	
+MMGL		V				Yes	
+MMGR		V				Yes	
+MMICG		V				Yes	
+MODE		V				Yes	
+MPBF		V				Yes	
+MPBR		V				Yes	

Table 205. AT Commands Limitations for 4-channel Configuration *(Continued)*

	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Comment	PREMUX Support	Profile Definition
	External	AT + Voice Call + SMS + STK					
+MPBW		V				Yes	
+MPCM		V					
+MPDPM		V				Yes	
+MRST	V	V	V	V			
+MSCTS		V				Yes	
+MTCTS		V				Yes	
+MTDTR		V				Yes	
+MTKE		V				Yes	
+MTKM		V				Yes	
+MTKP		V				Yes	Unsolicited - special
+MUPB		V				Yes	PCHS - unsolicited
+CVIB		V				Yes	
+VTD		V				Yes	
+VTS		V				Yes	
A	V	V	V	V	Answers only a "self" ringing call. Refer to the RING definitions at the end of the table.	Yes	
A/	V	V	V	V	Obvious	Yes	
AT	V	V	V	V	Obvious	Yes	
ATS97	V	V	V	V			

Table 205. AT Commands Limitations for 4-channel Configuration *(Continued)*

	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Comment	PREMUX Support	Profile Definition
	External	**AT + Voice Call + SMS + STK**					
DL	V	V	V	V	Refer to the D definitions at the end of the table.	Yes	
B	V	V	V	V	Ignored	Yes	
E	V	V	V	V		Yes	PCHS
F	V	V	V	V	Ignored	Yes	
H	V	V	V	V		Yes	
L	V	V	V	V	Ignored	Yes	
M	V	V	V	V	Ignored	Yes	
N	V	V	V	V	Ignored	Yes	
O	V		V	V		Yes	
P		V			Ignored		
Q	V	V	V	V		Yes	
S0	V	V	V	V		Yes	PCHS
S102	V	V	V	V		Yes	
S12	V csd		V			Yes	PCHS
S2	V csd	V	V	V		Yes	PCHS
S24	V	V	V	V		MUX degener- ated	
S3	V	V	V	V		Yes	PCHS
S4	V	V	V	V		Yes	PCHS
S5	V	V	V	V		Yes	PCHS
S7	V	V	V	V		Yes	PCHS

Table 205. AT Commands Limitations for 4-channel Configuration *(Continued)*

	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Comment	PREMUX Support	Profile Definition
	External	AT + Voice Call + SMS + STK					
S94	V	V	V	V		Yes	
S96	V	V	V	V		Yes	
S97	V	V	V	V			
T	V	V	V	V	Ignored		
V	V	V	V	V		Yes	PCHS
X	V	V	V	V		Yes	PCHS
Y	V	V	V	V	Ignored		
Z	V	V	V	V		Yes	
+CGATT	V gprs	V		V		Yes	
+CGQREQ	V gprs			V		Yes	
+CRC	V	V	V			Yes	PCHS
+CRING	V	V	V			Yes	
RING - CSD Call (data/fax)	V csd		V			Yes	
RING - Voice Call		V				Yes	
RING - MT GPRS Alert					Also not supported by the network	No	
D*99#	V			V gprs	GPRS External	Yes	
D Voice Call		V				Yes	
D CSD Call	V csd		V			Yes	

RING Alert: When the call type is unrecognized, it is considered as a voice call. In such a case, RING will be sent to IDLC-2 only.

Note

When IDLC-1 (External modem) is active, no operation should be made in IDLC-3 and IDLC-4. When IDLC-3 or IDLC-4 are active, no operation should be made in IDLC-1.

Note

In the case of a 2-channel configuration (IDLC1 = External modem + GPRS + CSD; IDLC2 = AT and VC), the IDLC-1 commands that are allowed comprises the combination of the above DLC-1, IDLC-3 and IDLC-4 columns.

Note

4.16.6.5 Multiple Channel Definitions

The following table provides various multiple channel definitions.

Table 206. Multiple Channel Definitions

Term	Description
Command response	A response to a command is delivered back to the channel from which the command was sent.
Unsolicited indication	Unsolicited indications are sent only to the channel that enabled them. Enabling indications where it is not allowed may cause unexpected results. Exception: Some of the indications can be enabled only in one specific channel. For more information, refer to Table 205, "AT Commands Limitations for 4-channel Configuration".
AT+CMUX command	Any g20 IDLC receiving an AT+CMUX command returns an ERROR response – +CMEE: "operation not allowed".
Common settings for all channels	Settings that are not stored in the IDLC modem profile, but that are set in one of the g20 components. Any modification to these settings overrides the previous settings in all the other channels. For example, Database settings (phonebook, Flex, audio settings, network (SIM) settings, and so on. For this reason, parallel commands are not allowed in more than one channel. All the settings that are private for each channel (can be different in different channels) are mentioned in the Profile Definition column in Table 205, "AT Commands Limitations for 4-channel Configuration".

4.16.6.6   GPRS Definitions

• A GPRS session is suspended when a voice/CSD call is connected to the g20. The GPRS session is resumed when the voice/CSD call is disconnected. The voice/CSD call can be dialed when the GPRS session is either in online DATA mode or online COMMAND mode.

• A GPRS session cannot be started (ERROR returned) when there is an active or established Voice/CSD call.

• Simultaneous GPRS sessions of any kind (internal and/or external) are not supported.

> **Note**
> While g20 is operating network-related AT commands, such as SMS or Supplementary Services, GPRS session behavior will be the same as for Voice/CSD call, but for brief moments only.

4.16.6.7   IDLC Modem Profile in MUX State

Definitions

• Modem profile – g20 modem settings such as s-registers and flex values.

• GRLC profile – GRLC (PREMUX) settings such as s-registers and flex values.

• GRLC default profile – GRLC (PREMUX) settings on power up.

• When a new channel is established (open IDLC) its modem profile will be the GRLC default profile.

• When the g20 returns to PREMUX state from either MUX or MUX-INIT states, its modem profile is the GRLC default profile.

• The two requirements above have an exception regarding the UART configuration – the settings for UART port speed and flow control (AT&K and AT+CBAUD/AT+IPR). These settings are set in PREMUX state only, and will be kept unchanged until the g20 returns to PREMUX state. If an IDLC tries to change the settings it receives an OK response, but the real value is NOT changed. When the g20 is in MUX state, these two settings have either the values that were defined in PREMUX, or the value set by the AT+CMUX command. If a value was set with the AT+CMUX command, it is retained even after returning to PREMUX state.

5.1   SETTING UP THE g20 (POWER ON AND INITIAL ACTIONS)

There are three phases of connectivity for the g20:

- Init General

  In this phase, the g20 is asked to provide basic information which ensures that the phone is functioning properly.

- Enabling the SIM

- Registering the SIM on a network in order to see that wireless access is functioning properly.

After these three phases are completed, g20 is ready for action and you can send/receive voice calls, circuit switched data and GPRS.

The following figures show the phone state transactions:
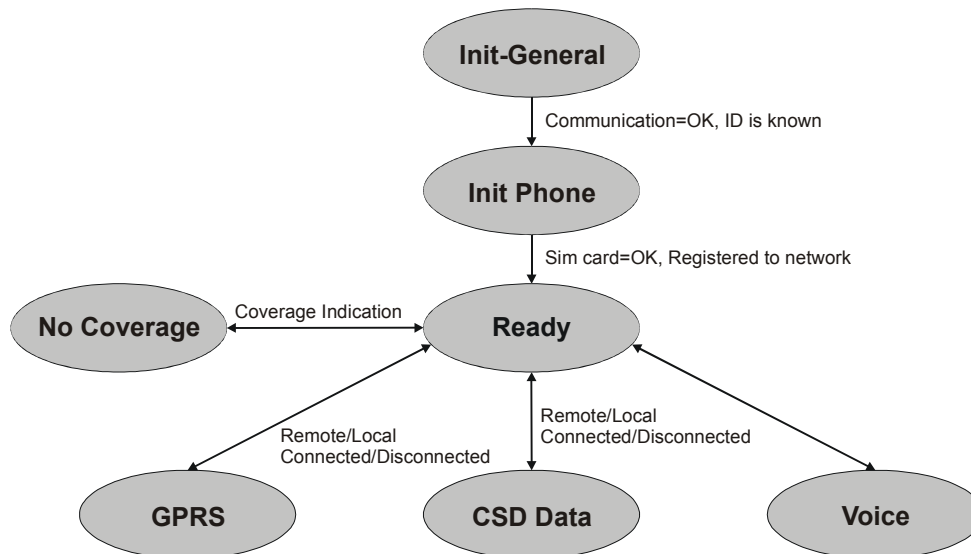
Figure 31. Phone State Transactions
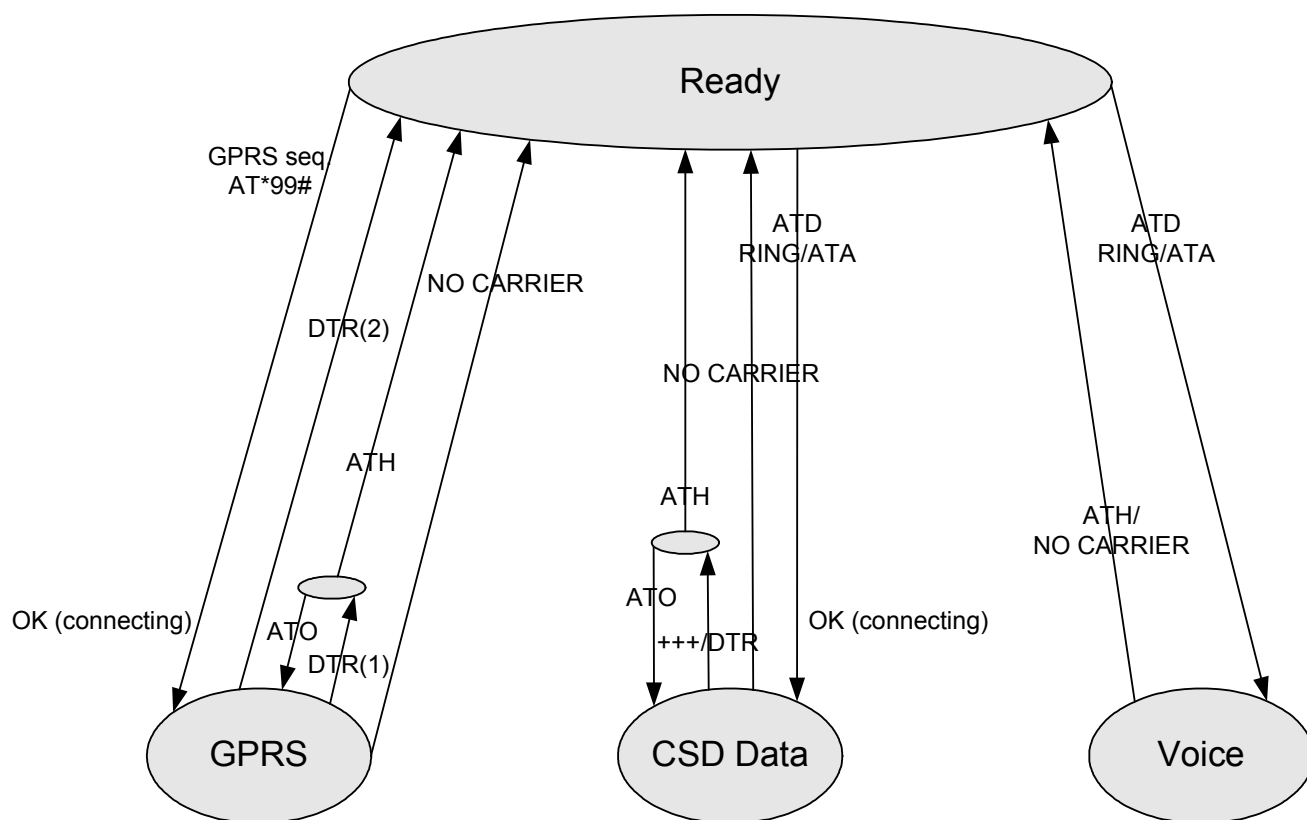
Figure 32. Detailed Phone State Transactions

5.2   RECOMMENDED g20 INITIALIZATION AFTER POWERUP

Figure 33 provides a recommended workflow for initializing the g20 after startup. The following sections explain this workflow in detail.

```
                    ┌─────────────┐
                    │    Start    │
                    └─────────────┘
                           │
                           ▼
                ┌─────────────────────┐
                │  RS232 Lines Setup  │
                └─────────────────────┘
                           │
                           ▼
                ┌─────────────────────┐
                │ Test g20 Communication │
                └─────────────────────┘
                           │
                           ▼
                ┌─────────────────────┐
                │ Configure the RS232 Connection │
                │      (Optional)     │
                └─────────────────────┘
                           │
                           ▼
                ┌─────────────────────┐
                │ Enable Extended Error Messages │
                │      (Optional)     │
                └─────────────────────┘
                           │
                           ▼
                ┌─────────────────────┐
                │   Basic Commands    │
                │      (Optional)     │
                └─────────────────────┘
                           │
                           ▼
                ┌─────────────────────┐
                │   SIM Card Status   │
                └─────────────────────┘
                           │
                           ▼
                ┌─────────────────────┐
                │ g20 Network Connection │
                └─────────────────────┘
                           │
                           ▼
                ┌─────────────────────┐
                │ g20 Phonebook Download Status │
                │      (Optional)     │
                └─────────────────────┘
                           │
                           ▼
                    ┌─────────────┐
                    │    Ready    │
                    └─────────────┘
```
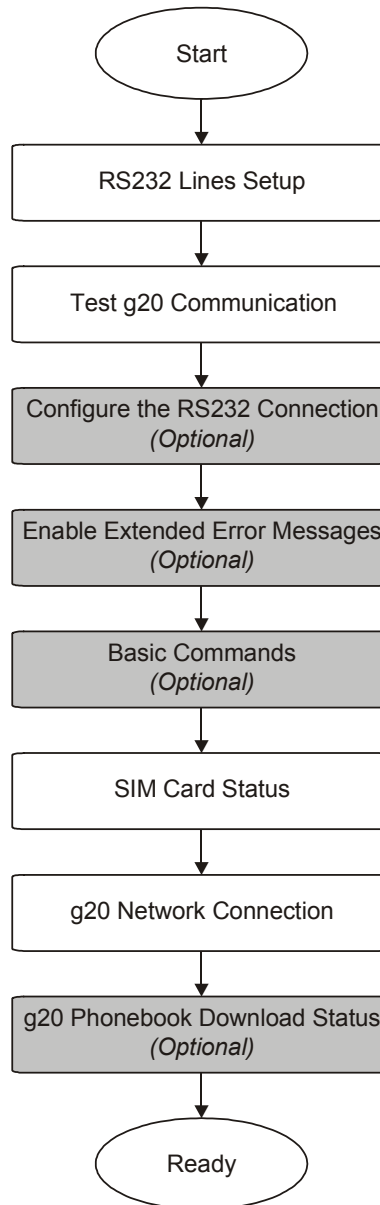
Figure 33. Recommended g20 Initialization Workflow

5.2.1   RS232 Lines Setup

There is no dynamic detection. Upon power up, the hardware is detected. If USB is detected, then USB is selected. If USB is not connected, then the RS232 is selected. For a pin description, refer to the g20 Developer's Kit Manual, 98-08901C67-A.

```
                    ┌──────────┐
                    │  Start   │
                    └────┬─────┘
        ┌────────────────┤
    Off │                ▼
        │           ╱ Check DSR Line ╲
        └──────────◇                 ◇
                    ╲               ╱
                         │ On
                         ▼
                  ┌──────────────┐
                  │ Activate DTR │
                  └──────┬───────┘
                         │
                         ▼
                  ┌──────────────┐
                  │ Activate RTS │
                  └──────┬───────┘
        ┌────────────────┤
    Off │                ▼
        │           ╱ Check CTS ╲
        └──────────◇             ◇
                    ╲           ╱
                         │ On
                         ▼
                    ┌──────────┐
                    │   End    │
                    └──────────┘
```
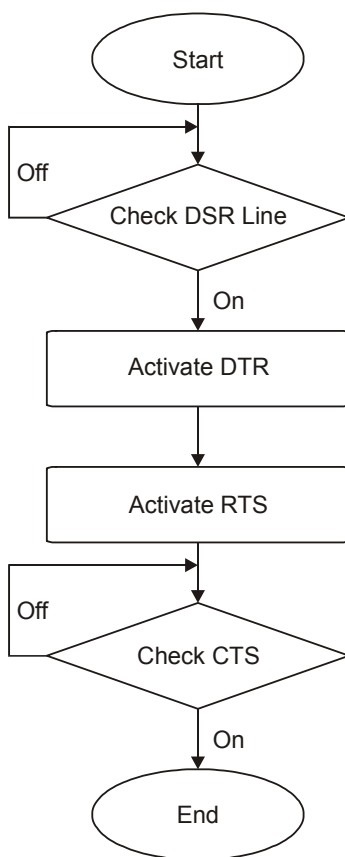
Figure 34. RS232 Lines Setup

5.2.2   Test g20 Communication

This is a preliminary step. During this step, the ability to communicate with the g20 using AT commands is tested.
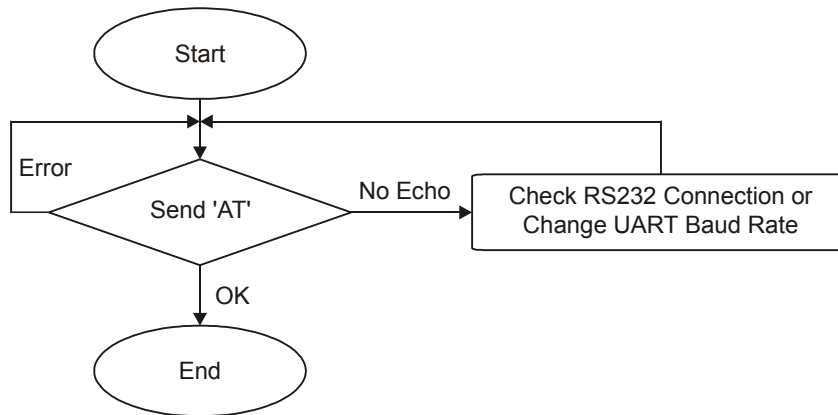
Figure 35. Test g20 Communication

Communication example:

AT

ATE1   //By default, the echo should be enabled

AT

OK   //Confirm that g20 replies with OK

5.2.3   Basic Configuration

These are optional steps. If required, specific RS232 pin behavior can be selected. Extended error notification is recommended for debugging and field-support purposes.
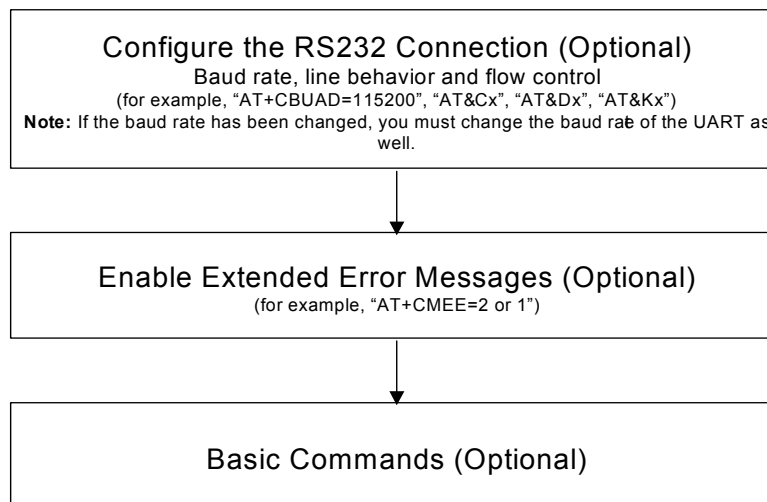
Figure 36. Basic Configuration

1. Baud setting example:

   at+cbaud=6   //Setting baud rate for 19200

   OK

   at+cbaud=19200   //Same as issuing this command

   OK

2. RS232 HW lines configuration: &C(DCD), &D(DTR), &K(flow-control).

   Default settings should be:

   AT&C1

   OK

   AT&D2

   OK

   AT&K3

   OK

3. Modem IDs (optional): ATI7, +CGMI,+CGMM,+CGMR,+CGSN

   ATI7

   g20 OEM Module

   OK

   at+cgmi

   +CGMI: "Motorola"

   OK

   at+cgmm

   +CGMM: "GSM900","GSM1800","GSM1900","GSM850","MODEL=g20"

   OK

   at+cgmr

   +CGMR: "G208_G_0C.00.0BR"

   OK

   AT+CGSN   //Read the IMEI number of the g20

   +CGSN: 448954035283579

   OK

4. Error messages (optional): +CMEE, +CEER

   AT+CMEE=2   //Enable +CME ERROR: error messages verbose string

   OK

   AT+CEER=2   //Enable +CEER: call status indication verbose string

   OK

5.2.4   SIM Card Status

To enable the module to transfer from basic commands to full operational mode, a SIM card must be ready and the PIN enabled.
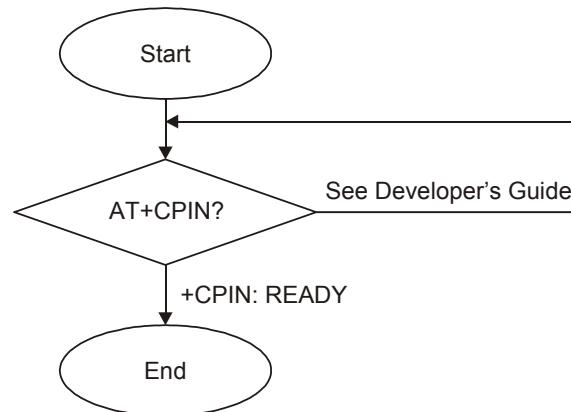
Figure 37. SIM Card Status

Note

For a full description of SIM states, see "+CPIN, Enter PIN for Unlocking SIM Card or Enter PUK for Unblocking SIM Card" on page 247.

The following steps are part of the SIM card status step:

1. Check SIM security: AT+CPIN?

2. Confirm that the result is +CPIN: READY

3. If the SIM PIN is required, then the following response appears: +CPIN: SIM PIN.

4. Unlock the SIM, if needed: AT+CPIN="XXXX".
    Note: XXXX is the PIN password (4-8 digits long).

5. If the SIM PUK/PUK2 is required, then the following response appears: +CPIN: SIM PUK/PUK2.

6. Unblock the SIM, if needed: AT+CPIN="YYYYYYYY", "ZZZZ".
    Note: YYYYYYYY is the PUK/PUK2 password (4-8 digits long).
    Note: ZZZZ is the new defined PIN/PIN2 password (4-8 digits long).

5.2.5   g20 Network Connection

In this step, the g20 detects existing networks (the user must register to a specific network).
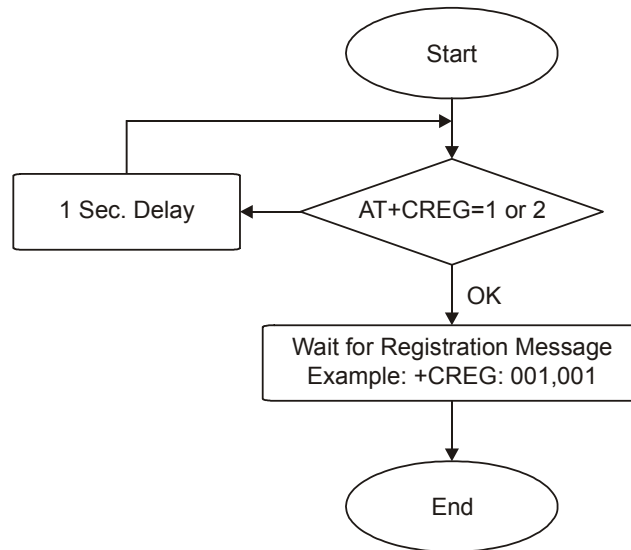
Figure 38. g20 Network Connection

1. Registration and call indications example: +CREG, +CLCC

   AT+CREG=2

   OK

   AT+CLCC=1

   OK

2. Get available networks example: +COPS

   AT+COPS=?   //To read all possible operators

   +COPS:(002,"ILORANGE","ORANGE","42501"), //g20 answer example

   (000,"AT&T Wireless", "AT&T","31038"),

   (001,"IL Cellcom","Cellcom","42502"),

   (003,"IL-77","IL-77","42577"),,(000,001,002,003,004),

   (000,001,002)

3. Get registration messages example: +CREG

   at+cgreg=1

   OK

   +CREG: 001   //g20 example output when it is registered on the home network

   Get GSM registration status: +CREG

   AT+CREG=2   //Get unsolicited GSM registration reports

   +CREG: 001,2648, 988b

4. Get GPRS registration status example: +CGREG

    AT+CREG=2   //Get unsolicited GPRS registration reports

    +CGREG: 001,2648,988b

5.2.6   Terminal Synchronization

In this step, the terminal requests the stored phonebook, SMS, and so on, from the g20.
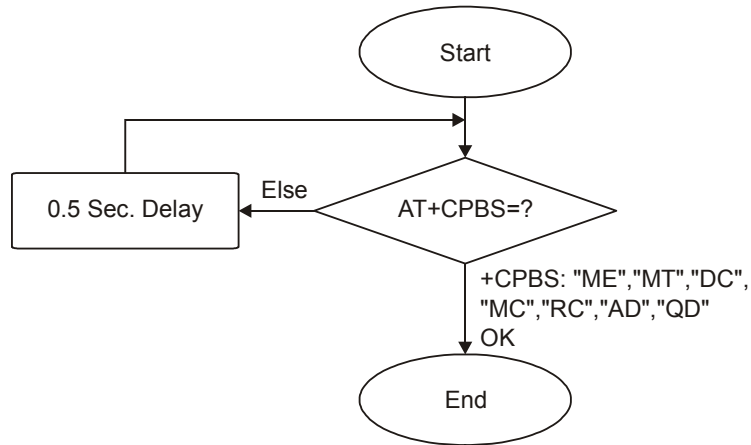
Figure 39. Terminal Synchronization

5.3   SMS

5.3.1   Managing Stored Messages in the g20 Memory

AT+CPMS=SM   //Select preferred memory storage using the +CPMS command

+CPMS: 11,352

OK

AT+CMGL="ALL"   //List all messages in memory storage

+CMGL: 223,"STO UNSENT","4565029"   //Example of g20 response

<Message body>

+CMGL: 222,"STO SENT","054565029"

<Message body>

+CMGL: 221,"STO SENT","054565132"

<Message body>

+CMGL: 220,"STO UNSENT",""

<Message body>

OK

AT+CMGL="STO UNSENT"   //List all messages of a certain type (for example, stored
                                              unsent messages)

+CMGL: 225,"STO UNSENT","054565132"

<Message body>

+CMGL: 223,"STO UNSENT","4565029"

<Message body>

+CMGL: 220,"STO UNSENT",""

<Message body>

OK

AT+CMGR=225   //Read any message from the list using its index

+CMGR: "STO UNSENT","054565132"

<Body of message 6 >

OK

AT+CMGR=9

+CMGR: "REC UNREAD","+97254565132"

<Body of message 4>

OK

5.3.2   Setting the Notification Indication for Incoming Messages (Using AT+CNMI)

AT+CNMI=,1   //To receive indications of new incoming MT messages, the second
                                              parameter of +CNMI should be set to 1

OK

+CMTI: "MT",4   //When a new MT message is received, the unsolicited response
                                              +CMTI will be displayed, denoting the message index

AT+CMGR=4   //Use the new message index to read it

+CMGR: "REC UNREAD","+97254565132"

msg text

OK

AT+CMGD=4   //Delete the message after reading it

OK

5.3.3   Another Possible Option for Setting the CNMI Notification Indication

AT+CNMI=,2   //To have new incoming MT messages displayed on the terminal, the
                                                    second parameter of +CNMI should be set to 2

OK

+CMT: "+97254565132","2003/3/24,15:38:55"
<message contents>   //When a new MT message is received, the unsolicited response
                                                    +CMT is displayed along with the message

AT+CNMA   //To acknowledge receipt of a message, use the AT+CNMA
                                                    command within 60 seconds of the +CMT unsolicited response

OK

The acknowledged message is not saved in the database. If the +CMT unsolicited response is not acknowledged within 60 seconds, the new message is saved in database.

5.3.4   Writing, Saving and Sending Messages (Using AT+CMGW and AT+CMSS)

Writing messages into the database, with or without destination address:

AT+CMGW   //Writing a message without destination address

> message text <ctrl z>

+CMGW: 142

OK

AT+CMGW="054565132"   //Writing a message with destination address

> message text <ctrl z>

+CMGW: 143

OK

:

AT+CMSS=143   //Send a message to the destination address with which it was stored,
                                       using the message index

OK

AT+CMSS=143,"054565029"   //Send a message to a destination address, regardless of the destination
                                       address with which it was stored (if any), using the message index

OK

AT+CMSS=3,"054565029"   //In this way, received messages (stored in the inbox) can also be sent

OK

5.3.5 Writing and Sending Messages (Using AT+CMGS)

In text mode (+CMGF=1):

AT+CMGS="054565028"	//Writing a message to be sent to specified destination address
>This is the message body <CTRL+Z>	//<CTRL+Z> ends the prompt text mode and returns to regular AT command mode
+CMGS: 238	//Message successfully sent

OK

AT+CMGS="+97254565028",145	//Writing a message to be sent to specified destination address
>message text <CTRL/Z>	
+CMGS: 239	//Message successfully sent

OK

5.3.6 Deleting Messages (Using AT+CMGD)

AT+CMGD=179	//Delete a message using its index
OK	

AT+CMGR=179	//The message index is now empty
+CMS ERROR: invalid memory index	

Delete a group of messages. Note that deletion of a number of messages may take a short time.

AT+CMGD=1, 1	//Delete all read messages
OK	

AT+CMGD= 1,2	//Delete all read and sent messages
OK	

AT+CMGD= 1,3	//Delete all read, sent and unsent messages
OK	

AT+CMGD= 1,4	//Delete all messages
OK	

5.4   CALL CONTROL

The following figure is a detailed view of the states the g20 goes through for Voice and CSD Data, as shown in Figure 32. Note that between the time the OK is received and the actual connection occurs, call state alerts are received.
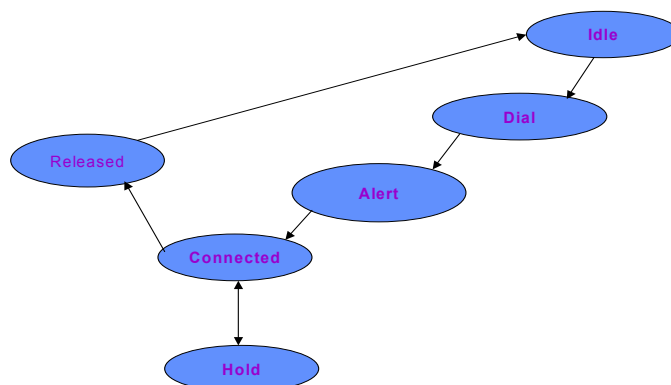
Figure 40. Call States

5.4.1   Dialing Using ATD

atd+44 34 56 78;   // VOICE call; number includes international access code

OK

OK

atd17085763400;   //Second VOICE call

OK

OK   //Call to 44345678 is being put on hold

ath   //Hang up active call

NO CARRIER

OK

at+chld=0   //Hang up held call

NO CARRIER

OK

atd+44 34 56 78   //DATA call

...

OK   //Move to online Data state

	//ESC sequence back to the Command state. +++ is sent from the terminal (+++ is not displayed)
ath	//Hang up data call
NO CARRIER	
OK	//Data call terminated
at+fclass=1	
OK	
atd+44 34 56 78	//FAX call
...	
NO CARRIER	//Fax call was terminated by remote side
atd035659260,345,22;	//VOICE call with tones sent after connecting
OK	
OK	
3 4 5	//Sent as DTMF tones
...	//Pause
2 2	//Sent as DTMF tones
ath	//Voice call is hung up
NO CARRIER	
OK	
atd0356592,60	//DATA/FAX call with comma //Comma is ignored; 035659260 is dialed
OK	

5.4.2 Direct Dialing from Phone Book

This example uses a phone book with these pre-saved items.

at+cpbs?	
+CPBS: "MT"	//Current phone book is now MT
at+cpbr=1,260	//This is a specific example with memory values
+CPBR: 5,"4444",129,"BE"	
+CPBR: 6,"+97235659260",145,"eran"	
+CPBR: 7,"035659260",129,"eran"	
+CPBR: 8,"+97251632603",145,"long"	
+CPBR: 9,"5555",129,"B"	
+CPBR: 77,"035619942",129,"er"	

atd>"long";

OK

OK   //Exact match; 051 632603 call dialed; voice call answered

atd>8;

OK

OK   //Speed-dial from current phone book; 051 632603 call dialed; voice call
                                      answered

atd>"era"

OK

OK   //Prefix pattern matched; entry for "eran" was selected; +97235659260
                                      call dialed

atd>"er"

OK

OK   // Exact match; overrides prefix match; 03 5619942 call connected

In the next example, the current phone book is changed. The numbers are matched via a specific phone book specified in the command.

at+cpbs="fd"   //Change the current phone book to Fix-dialing phone book

OK

atd>"MT"9;

OK

NO CARRIER   //Speed-dial number (using ") 5555 call dialed; number is incorrect

atd>MT;

OK

NO CARRIER   //Speed-dial number 5555 call dialed, number is incorrect

atd>"MT"17

 +CME ERROR "not found"   //Trying to dial from a non-existent entry

atd>"MT"1117

+CME ERROR: "invalid index"   //Speed-dial number is out of range

5.4.3   Dialing the Last Number Example

atd035658278;

OK

OK

ath

NO CARRIER

OK

atdl   //Last called number is "035658278"

ATDL: "035658278"

OK   //DATA call

atdl;

ATDL: "035658278"

OK

OK   //VOICE call

atdl   //Last called number is "035658278,123,78;"

ATDL: "035658278"

OK   //DATA call

5.4.4   Voice Call Manipulations

5.4.4.1   Call Waiting

at+ccwa=1   //Enabling the call waiting on g20

OK

atd9311234567;   //Originate a voice call

OK

OK   //Voice call connected

(...conversation...)

+CCWA: "+358317654321",145,1,"Bob"   //Call-waiting indication received by the g20; Bob is calling

+CCWA: "+358317654321",145,1,"Bob"

at+chld=0   //Release the waiting call

OK

NO CARRIER   //Current call is still active

5.4.4.2   Call Forwarding

at+ccfc=1,3,"0545658278"   //Network register UC forward-to of all classes

OK

at+ccfc=1,1   //Network activate UC forward-to of all classes

OK   //At this point, the g20 will not receive any calls; all calls will be
                                           forwarded by the network to phone number 0545658278

at+ccfc=1,2   //Interrogate reason unconditional of all classes

+CCFC: 1,1,"0545658278",129   //Class voice - UC forwarding is activated

+CCFC: 2,1,"0545658278",129   //Class data - UC forwarding is activated

+CCFC: 4,1,"0545658278",129   //Class fax - UC forwarding is activated

OK

5.4.4.3   Conference Call

atd051632601;   //Dialing the first member of the conference

OK

OK

at+chld=2   //Call hold, switch command

OK   //Active call switched to hold

atd035659260;   //Calling the second member of the conference

OK

OK

(Dual call state: one call on hold; 2nd is active.)

at+chld=3   //Call link command

OK   //Held call is linked to active call

(Active conference of two calls)

at+clcc	//Verifying call state through CLCC
	//(Verifying call state is optional.)

+CLCC: 1,0,0,0,1,"051632601",129,""

+CLCC: 2,0,0,0,1,"035659260",129,""

ath	//Hang up the conference call
NO CARRIER	//First member dropped
NO CARRIER	//Second member dropped

OK

5.5 DATA CALL

5.5.1 Switching Modes (Data Mode/Command Mode)

atd054565190	//Calling the remote modem
OK	
aaaaaaaaaaaaa	//Receiving binary data from remote side (g20 is in Data mode)
//Sending escape sequence +++ to g20 (the remote side does not treat +++ as escape)	
OK	//g20 is in Command mode
ati3	//Issuing an AT command
Motorola Mobile Phone	

OK

ato	//Switching back to Binary mode
OK	
fffffff	//Receiving binary data from remote side
fghhgatfhgfhfhghhfhfhfhgfhffhgfgfhgfhgfhhh	
	//Sending escape sequence +++ to the g20
ath	//Hang up the CSD call (return to Command mode)
OK	
NO CARRIER	

5.6   GPRS

When using the GPRS, it is recommended to implement a "keep alive" mechanism.

The g20 memory resources should not be used as a buffer for the user, the user maintains its own memory and flow control in its own application. The g20 has finite limited resources such as network related, SIM card and phone memory. In general the user should use a single resource at a time. As an example, when g20 GPRS network resources are in an active session, user should not manually detach from the network or place a CSD call etc.

Note	The basic GPRS concept is be "always connected" and there is no charge for being connected (only per real data transferred). GPRS users are advised to connect the GPRS network once in the beginning of a session and remain connected rather then to toggle from online to offline and back in a high rate. In specific cases when this is needed, contact customer care for advice and knowledge base.

5.6.1   Establishing GPRS PDP Context

When using the GPRS network for any IP data, you must be attached to the GPRS network before activating PDP context.

5.6.1.1   Activating a Saved Profile in g20

AT+CGATT=1   //By default, after power-up, the g20 attaches to the GPRS network, if possible (if the network and SIM allow)

AT+CGATT?   //Check your connection status

AT+CGDCONT=1,"IP","RTY","123.32.45.9"   //Context definition example

5.6.1.2   Two Ways to Activate PDP Context

Each of the two main ways in which to activate PDP context are described below.

5.6.1.2.1   Using the GPRS Wizard Application

1. Double-click the button predefined as the dialer for this provider to automatically establish PDP context. If the g20 was not previously attached to GPRS, it will be attached automatically.
2. Setup configuration.
3. Enter into the wizard, the parameters provided by your operator.
4. Set definitions to allow your http/ftp browser to use the g20 as a port to the Internet.
5. Usage:
   - Open the GPRS Manager.
   - Double-click the dialer icon to select and activate the provider of your choice (multiple providers may be displayed in the list).
   - After dialing, your temporary IP address, the GPRS DATA session message will be displayed.
   - Minimize the GPRS wizard window and use your http/ftp browser (Internet Explorer, Netscape).

5.6.1.2.2 Using the ATD* Command Set

Request GPRS service 'D':

ATD*99***(CID)#

The CID (Context ID) includes the APN (defined by the AT+CGDCONT command) to which you want to be connected. This depends on the ability of the SIM card to be attached to the different networks.

The format ATD*99# may also be used. In this case, the g20 will first try to activate a non-empty (predefined) CID. If the attempt fails, the g20 will try the next CID, and so on.

Note

When buffering the terminal message, data in the g20 (both inbound and outbound data), the following apply:

- Turning off the g20 clears any buffered data.
- Removing power from the g20 clears any buffered data.
- Whenever the terminal drops the PPP connection with the g20, via LCP terminate, the buffered data is cleared.
- Whenever the g20 drops the PPP connection with the terminal, with LCP terminate, the buffered data is cleared. LCP termination triggers the termination of the data in the g20 buffer.
- Whenever the g20 drops the PPP connection with the terminal, without an LCP terminate, the buffered data is cleared. Dropping the DTR also clears the buffer.
- When the network sends a deactivation message or a detached message, the g20 buffer is cleared.
- When the g20 transfers data in the uplink and GPRS coverage is lost, the data may flow-off. If the mobile has lost coverage and is unable to send the packets from the terminal to the network, the buffers will continue to store the packets until the buffers are full. The terminal will then be flowed off and the packets will be stored until they can be sent to the GPRS network.
- The amount of time that takes before the user is notified is specified in the T3312 timer that is located in the mobile side. The default delay time of T3312 is 54 minutes, as per the GSM 0408 specification. After 54 minutes, the g20 deactivates the PDP session.

5.7 CHANGING THE CHARACTER SET

Example

When an SMS messages with the following text: "Motorola g20 OEM Module", is saved inside the g20 at entry 128, you can read it using several character sets.

When the "ASCII" character set is used, the following is received by the terminal:

at+cscs?   //Read the current character set

+CSCS: "ASCII"   //Currently using ASCII character set

OK

at+cmgr=128   //Read SMS entry 128

+CMGR: "STO UNSENT",""

Motorola g20 OEM Module   //The content of SMS entry 128

OK

When the "USC2" character set is used, the following is received by the terminal:

at+cscs?   //Read the current character set

+CSCS: "UCS2"   //Currently using UCS2 character set

OK

at+cmgr=128

+CMGR: "STO UNSENT",""

004D006F0074006F0072006F006C0061002000067003200300020004F0045004D
0020004D006F00640075006C0065   //The content of SM entry 128

OK

The following is an ASCII translation of the SM contents:

004D   M

006F   o

0074   t

006F   o

0072   r

006F   o

006C   l

0061   a

0020   [space]

0067   g

0032   2

0030   0

0020   [space]

004F   O

0045   E

004D   M

0020   [space]

004D   M

006F   o

0064   d

0075   u

006C   l

0065   e

As this SMS was originally written in ENGLISH, meaning ASCII letters, each digit quadruplet starts with double zeros (00). When other languages are used, the quadruplets have different values.

5.8   SLEEP MODE

Note

The notation of TXD and RXD are from the perspective of the terminal unless otherwise specified.

The terminal should activate Sleep mode by sending ATS24=n (n - number of seconds). To disable Sleep mode, send ATS24=0.

Example of g20 Entering Sleep Mode

Terminal-TX: ATS24=n

Terminal-TX: ATxxx

Terminal-Wakeup-In=Inactive   //n seconds passed since last command (and other conditions met)

g20-CTS=Inactive   //g20 enters Sleep mode

Example of Terminal Wake g20 Sleep Mode

Terminal-Wakeup-In=Active

g20-CTS=Active   //g20 exits Sleep mode

Terminal-TX: ATxxx   //30 mseconds passed since Terminal-Wakeup-In became active

Example of g20 Wake Terminal Up

g20-CTS=Active   //g20 internal event occurred. Incoming call is pending
                                                              //g20 exits Sleep mode

g20-Wakeup-Out=Active

g20-TX: RING   //T mseconds passed since Terminal-Wakeup-Out became active
                                                              (T is defined by ATS102.)

The figure below shows a Sleep mode example when S24 > 0.
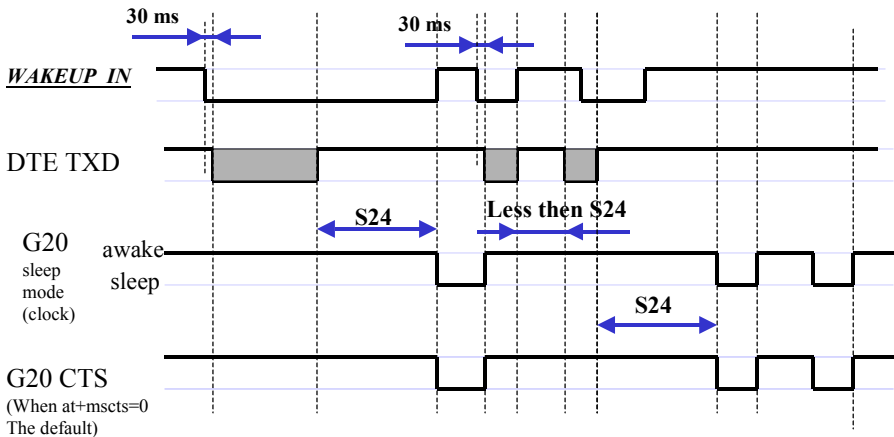
Figure 41. Sleep Mode when S24 > 0

5.9   STK

5.9.1   Display Text/Display Idle Mode Text

The SIM card requests to send text to the g20 and the g20 displays it on the terminal.
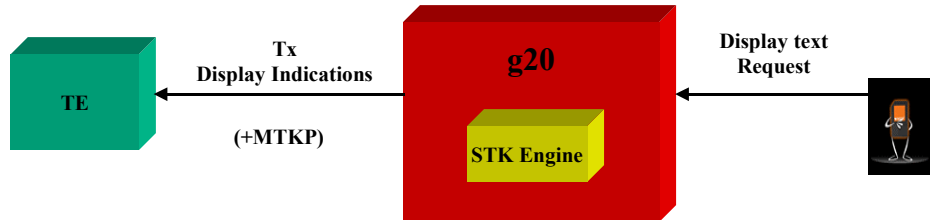
Figure 42. Display Text

5.9.2   Get Inkey

The SIM card requests to display text on the terminal, and waits for a response from the terminal (user). The response is a single character.
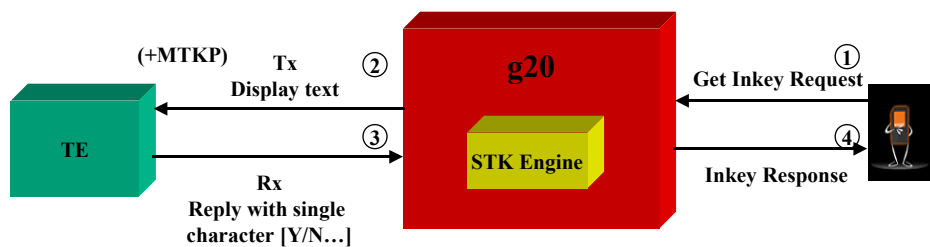
Figure 43. Get Inkey

Note All responses to unsolicited events are expected within one minute.

5.9.3   Get Input

The SIM card requests to display text on the terminal, and waits for a response from the terminal (user). The response is a string.
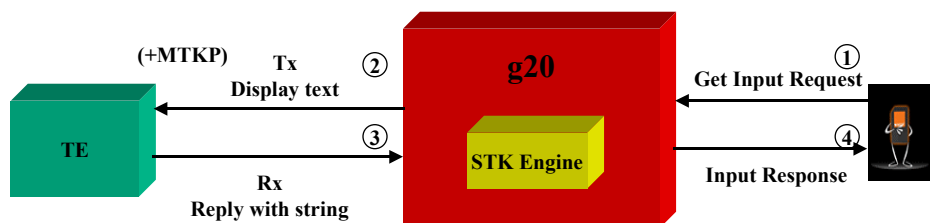
Figure 44. Get Input

> All responses to unsolicited events are expected within one minute.
>
> **Note**

5.9.4   Play Tone

The SIM card requests a tone to be played via the SIM. The g20 sends information about the play tone to the terminal.
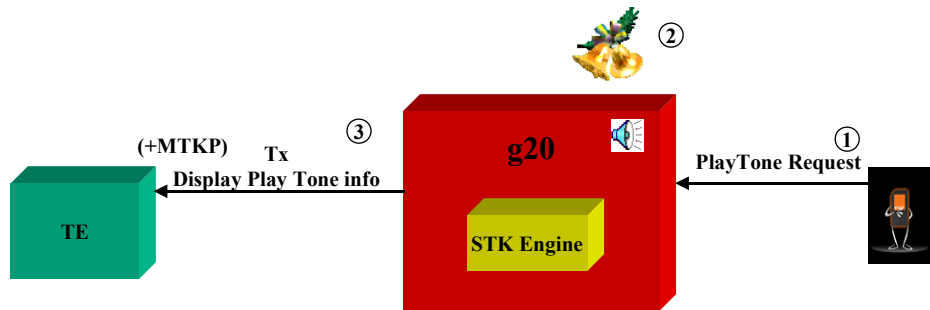
Figure 45. Play Tone

5.9.5   Set Up Menu

The terminal requests the STK menu. As a result, the SIM sends the menu items to the terminal. The user then selects an item from the menu.
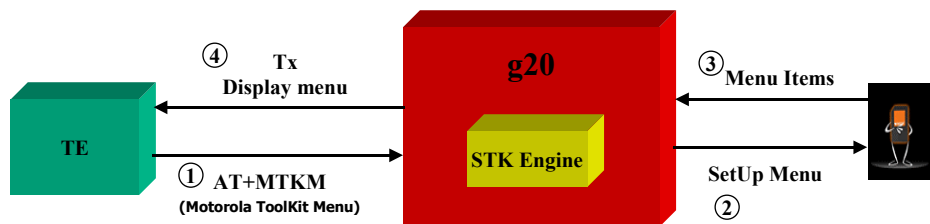
Figure 46. Set Up Menu

5.9.6   Select Item

The user selects an item. As a result, the SIM sends a response to the terminal.
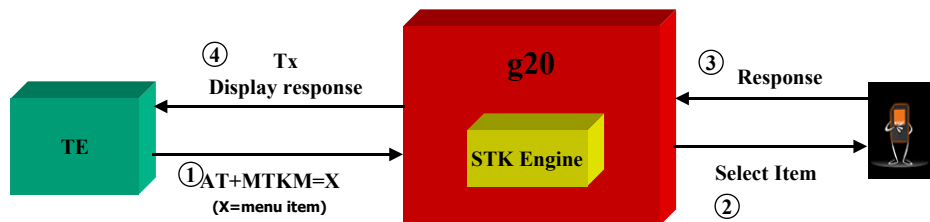
Figure 47. Select Item

5.9.7   Send SMS

The SIM requests to send SMS, and the SMS data is displayed on the terminal.
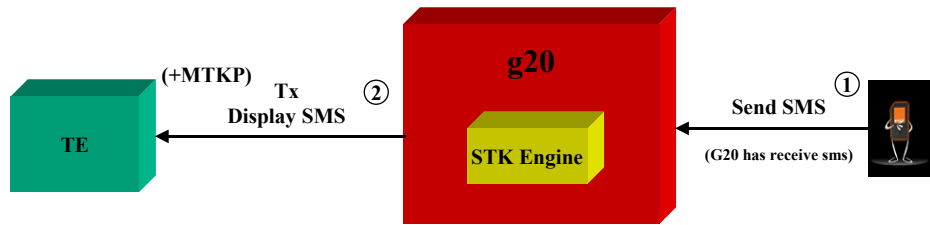
Figure 48. Send SMS

5.9.8   Set Up Call

The SIM initiates a call, and its data is displayed on the terminal.
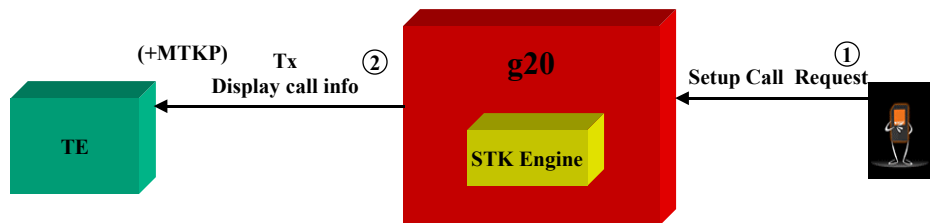
Figure 49. Set Up Call

5.9.9   Call Control

1.   First, the user makes a call.

2.   The call number is sent to the SIM, which decides whether to change the number or not. If the call has been changed, the new number is displayed on the terminal.
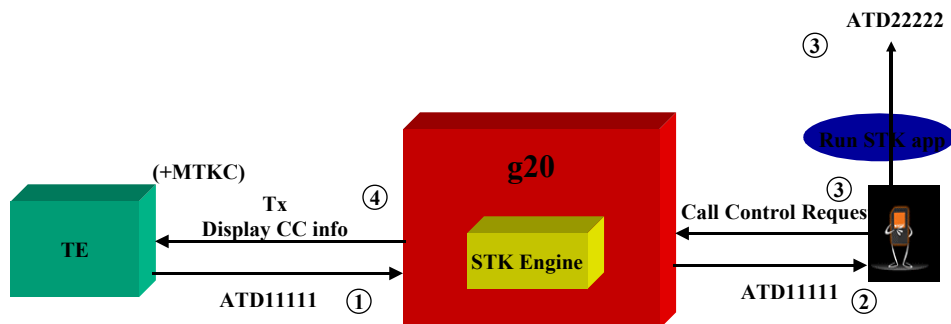
Figure 50. Call Control

Example

AT+MTKM	//Displays the main menu
+MTKM: SIM Applications	//Main menu title
+MTKM: 1,3,BANK,0	//The main menu contains three items
+MTKM: 2,3,SHOPPING,0	
+MTKM: 3,3,WEATHER,0	
OK	

AT+MTKM=1,3	//Item 3 in the main menu has been selected
OK	//The Sel item menu has been sent from the SIM

+MTKM: "WEATHER"	//Displays data about the WEATHER menu The WEATHER menu contains two items
+MTKM: 1,2,"OVER THE WORLD",1	
+MTKM: 2,2,"IN THE COUNTRY",0	

AT+MTKM=1,1	//Select Item 1.
OK	

+MTKP: 3,1,0,3,8,0,Enter Country name:	//User is requested to enter country name
AT+MTKP=3,1,"England"	//User enters the country
OK	

+ MTKP: 1,0,"Weather in England is 5ºC"	//Text is sent from the SIM

5.9.10   Send DTFM

The SIM card requests to send a DTMF string. The g20 sends the DTMF during an active voice call, and notifies the terminal using an +MTKP of this sending action. The g20 responds with the status of the sending result to the SIM.
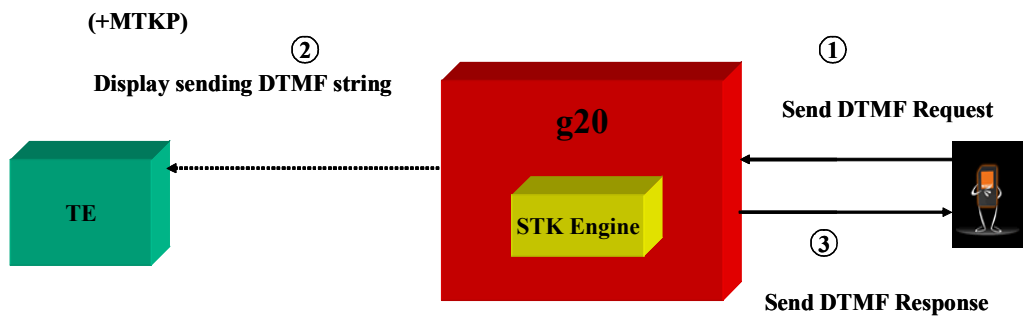
Figure 51. Send DTFM

5.9.11   Launch Browser

SIM card requests to open a browser with a specific URL and info. The g20 notifies the terminal and waits for the request results. The terminal must respond to the g20 with a result. The terminal result is passed to the SIM by the g20.
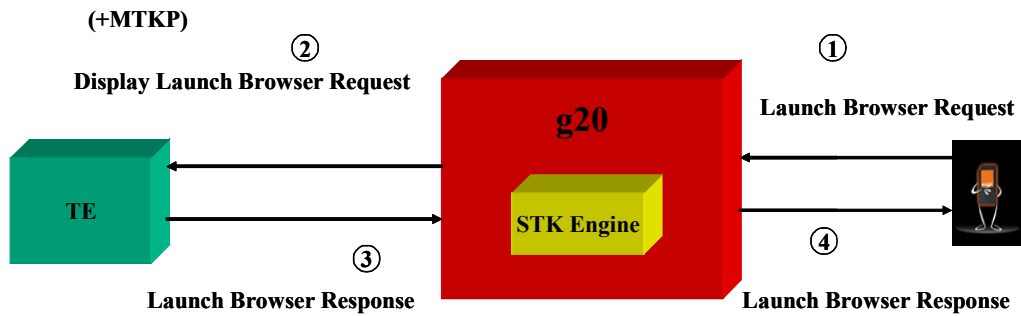
Figure 52. Launch Browser

5.9.12   Setup Event List

The terminal updates the g20 on any of the events. The g20 passes events from the terminal to the SIM card according to the event list. The event list is requested by the SIM using the "setup event list" command.
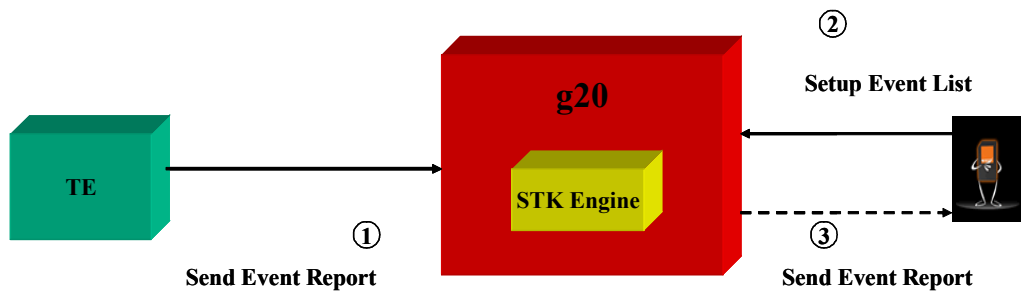
Figure 53. Setup Event List

5.10   TCP/IP

5.10.1   TCP Data Transfer Example

at+mipcall=1,"orange","test","test"

OK

+MIPCALL: 172.17.242.86

at+MIPOPEN=1,1222,"123.245.213.012",1234,0   //Opening socket 1 using TCP protocol, from port 1222,
                                                targeting 123.245.213.012 port 1234

OK

+MIPOPEN: 1,1

at+MIPOPEN?   //Terminal checking the status of socket to be opened
                                                 (socket 1 opened OK)

+MIPOPEN: 2 3 4

+MIPSETS=1,340   //Asking the g20 to accumulate 340 bytes on socket 1 prior to sending

+MIPSETS: 0

OK

at+mipsets?

+MIPSETS: 1 340

OK

at+mipsend=1,"444444"   //Sent coded "DDD" string

+MIPSEND: 1,1497   //Free storage in the accumulating buffer

OK

> **Note** This step can be repeated several times until the buffer is full or until the amount of data reaches 340 bytes and data pushed into the stack.

at+MIPSEND?   //Checking the size remaining (optional)

+MIPSEND: 1 1497

OK

+MIPPUSH=1   //Terminal asks g20 to flush the buffer in socket 1

+MIPPUSH: 0

+MIPCLOSE=1   //Terminal closes the socket

+MIPCLOSE: 1

OK

+MIPCALL=0   //Terminal hangs up the link

OK

5.10.2   Multi-point Data Transfer Example

at+mipcall=1,"orange","test","test"

OK

+MIPCALL: 172.17.242.86

at+mipopen=1,1001,"172.17.238.44",1001,0

OK

+mipopen: 1,1

at+mipopen=2,1111,"172.17.238.44",1111,0

 OK

+mipopen: 2,1

+MIPSETS=1,200   //Asking the g20 to accumulate 200 bytes on socket 1 prior to sending

+MIPSETS: 0

OK

+MIPSETS=2,400   //Asking the g20 to accumulate 400 bytes on socket 2 prior to sending

+MIPSETS: 0

OK

+MIPSEND=1,"444444"

+MIPSEND:1,1497

OK

+MIPSEND=2,"DD"   //Passing data to the g20 socket 2

+MIPSEND:2,1499

OK

+MIPPUSH=1   //Terminal asks the g20 to flush the buffer in sockets 1 and 2

+MIPPUSH:0

+MIPPUSH=2

+MIPPUSH:0

+MIPCLOSE=1   //Terminal closes sockets 1 and 2

+MIPCLOSE:1

OK

+MIPCLOSE=2

+MIPCLOSE:2

OK

+MIPCALL=0   //Terminal hangs up the link

OK

+MIPSETS=1,120   //Asking the g20 to accumulate 120 bytes on socket 1 prior to sending

+MIPSETS: 0

OK

+MIPSEND=1,"444444"   //Passing 3 bytes of data to the g20 socket 1

                                                          //(Note: Size remaining in socket 1 buffer is 1497 bytes)

+MIPSEND:1,1497

+MIPPUSH=1   //At this point, the terminal can decide on flushing the remainder to the stack

5.10.3   Xoff and Xon Example

In this example, it is assumed that the buffer size is 1500 and that some kind of error happened on the protocol stack.

+MIPSEND=1,"A344343ABC343438980BC...AB4" //Passing data to g20 socket 1

+MIPSEND:1,1200   //(Note: Size remaining in socket 1 accumulating buffer is 1200 bytes.)

+MIPSEND=1,"A344343ABC343438980BC...A23"

+MIPSEND:1,0   //(Note: No free space in buffer.)

+MIPXOFF: 1   //The g20 detects that the accumulating buffer on socket 1 has no free space to accumulate data and data cannot be sent to the protocol stack

From this point on, the terminal is not allowed to send data until it receives the +MIPXON command.

+MIPSEND=1,A344343ABC343438980BC...AB4   //Terminal disregards the Xoff request of g20 and keeps sending
                                                          //(Note: The terminal does not stop.)

ERROR 3

+MIPXON: 1   //g20 pushed the data into the protocol stack and is able to handle more sends from the terminal

5.10.4   Error in Reopening a Valid Socket

at+mipcall=1,"orange","test","test"

OK

+MIPCALL:123.145.167.230

+MIPOPEN=1,1222,"123.245.213.012",1234,0   //Opening socket 1 using TCP protocol, from port 1222, targeting 123.245.213.012 port 1234

OK

+MIPOPEN:1,1

+MIPOPEN?   //Terminal checking the status of socket to be ready

+MIPOPEN: 2 3 4

MIPOPEN=1,12,123.245.213.012,234,0   //Terminal tries to reopen socket 1

ERROR

5.11   AUDIO

5.11.1   Scenarios for Setting Up Handset Mode or Handsfree Mode

5.11.1.1   Handset Mode

AT+MAPATH=1,1   //Set the input path through the microphone

AT+MAPATH=2,1,3   //Set voice and keypad through the earpiece speaker

AT+MAPATH=2,3,12   //Set alerts and rings to go through the transducer

AT+MAFEAT=6,0   //Disable echo cancellation and noise suppression

AT+MAFEAT=1,1   //Enable sidetone

5.11.1.2   Handsfree Mode

AT+MAPATH=1,1   //Set the input path through the microphone

AT+MAPATH=2,1,15   //Set all tones through the earpiece speaker

AT+MAFEAT=1,0   //Disable sidetone

AT+MAFEAT=6,1   //Enable echo cancellation and noise suppression
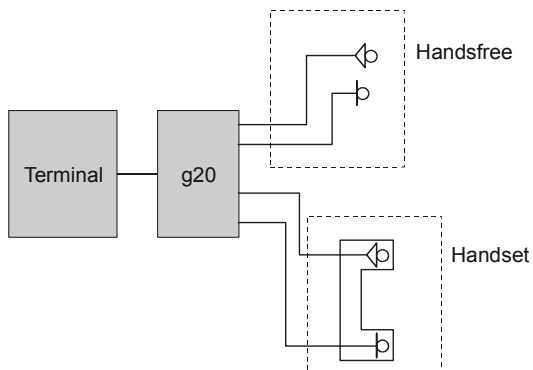
Figure 54. Handset or Handsfree Setup

6.1   TOOLS OVERVIEW

This chapter describes the PC Driver and PC Loader tools provided by the application. PC Driver enables the g20 to be used as a PC external modem for fax communication and for performing GPRS packet data connections. PC Loader is a PC-based software application that enables users to reprogram g20 modules through an RS232 interface.

6.2   PC DRIVER

6.2.1   Overview

The g20 can be used as a PC external modem for fax communication and for performing GPRS packet data connections. The g20 USB driver file is required for running a terminal application on the PC. The WinFAX application with the Standard 19200 bps Modem driver is recommended for fax connection. The GPRS Manager application with the Motorola Serial GPRS P2K 57.6 Kbps driver is recommended for GPRS packet data connections.

6.2.2   Fax Communication by Standard 19200 bps Modem

To install the modem driver, follow the procedure below:

1. From the Control Panel, select Modems > Add Modem.

2. Select "Don't detect my modem" and click Next.

3. Select "Standard 19200 bps modem" and click Next.

4. Select the valid com port.

5. Click Finish.

6.2.2.1   Using WinFAX

To configure the modem in WinFAX, follow the procedure below:

1. Run WinFAX.

2. Select Tools > Program Setup > Modems and Communications Devices > Properties.

3. Set the standard 19200 bps modem to Active.

4. Click Next and select CLASS 1 (Hardware Flow Control) > Next > Finish, Set Default (or other) > OK.

5. In the Modem and Communications Devices Properties window, click Properties.

6. In General > Communications port, set the COM port to which the modem is connected, and initialize it to 19200 bps.

6.2.3 Establishing GPRS PDP Context (Using GPRS Manager)

6.2.3.1 Installing GPRS Manager on a PC

To install and configure GPRS Manager and the Motorola Serial GPRS P2K 57.6 Kbps driver, follow the procedure below.

1. Run the GPRS Manager setup program.
2. Restart the computer.

6.2.3.2 Configuring a Dialer Icon

To configure a dialer icon, follow the procedure below.

1. After restarting, verify that g20 is powered up.
2. Run the GPRS Manager Configuration Wizard.
3. In the Wizard, click **Next** to continue to the next configuration step.
4. Read the instructions thoroughly before moving to the next step.
5. Enter the APN (Access Point Name) provided by your operator.
6. Set the definitions to allow your HTTP/FTP browser to use the g20 as a port to the Internet.

6.2.3.3 Establishing a Connection

To establish a connection, do the following:

1. Open the GPRS Manager.
2. Double-click the dialer icon to select and activate the provider of your choice (multiple providers may be displayed in the list).

REFERENCE TABLES

This appendix contains the following sections:

- AT Commands Alphabetical Summary, below
- Character Set Table CS1: (GSM -> UCS-2), page 438
- Character Set Table CS2: (ASCII <-> UTF-8), page 442
- Character Set Table CS3: (UCS-2 <-> UTF-8), page 442
- Character Set Table CS6: (UCS-2 Full Table), page 443
- Character Set Table CS7: (ASCII table), page 443

Note Character Set Table CS6: (UCS-2) is provided on CD due to its size.

A.1 AT COMMANDS ALPHABETICAL SUMMARY

The following table contains an alphabetical list of all the g20 AT commands.

Table 207. AT Commands (Alphabetical)

AT Command	Description	Page
$	This command displays a list of all the AT commands supported by the g20.	53
%C	This command is supported for backward compatibility only, and has no effect.	312
&C	This command determines how the state of the DCD line relates to the detection of the received line signal from the distant end.	203
&D	This command determines how the g20 responds when the DTR (Data Terminal Ready) status is changed from ON to OFF during the online data state.	205
&F	This command restores the factory default configuration profile.	266
&G	This command is supported for backward compatibility only, and has no effect.	312
&J	This command is supported for backward compatibility only, and has no effect.	312
&K	This command configures the RTS/CTS flow control.	202
&L	This command is supported for backward compatibility only, and has no effect.	312

Table 207. AT Commands (Alphabetical) *(Continued)*

AT Command	Description	Page
&M	This command is supported for backward compatibility only, and has no effect.	312
&P	This command is supported for backward compatibility only, and has no effect.	312
&Q	This command selects the asynchronous mode	89
&R	This command is supported for backward compatibility only, and has no effect.	312
&S	This command is supported for backward compatibility only, and has no effect.	312
&T	This command is supported for backward compatibility only, and has no effect.	312
&V	This command displays the current active configuration and stored user profiles.	291
&W	This command stores the user profile.	293
&Y	This command displays the default user profile.	294
?	This command displays the most recently updated value stored in the S-register.	266
\A	This command is supported for backward compatibility only, and has no effect.	312
\B	This command is supported for backward compatibility only, and has no effect.	312
\G	This command sets the use of the software control.	265
\J	This command adjusts the terminal auto rate.	265
\K	This command is supported for backward compatibility only, and has no effect.	312
\N	This command links the type.	266
\S	This command displays the status of selected commands and S-registers.	265
ATS97	This command indicates whether the antenna is connected and whether the hardware supports this feature.	213
+CACM	This command resets the Advice of Charge accumulated call meter value in the SIM file, EFACM.	104
+CALM	This command handles the selection of the g20's alert sound mode.	241
+CAMM	This command sets the Advice of Charge accumulated call meter maximum value in the SIM file, EFACMmax.	105
+CAOC	This command enables the subscriber to get information about the cost of calls.	101
+CBAND	This command is supported for backward compatibility only, and has no effect.	266

Table 207. AT Commands (Alphabetical) *(Continued)*

AT Command	Description	Page
+CBAUD	This command sets the baud rate.	197
+CBC	This command enables a user to query the battery charger connection.	196
+CBM	This unsolicited message forwards the SMS upon its arrival.	166
+CBST	This command selects the bearer service and the connection element to be used when data calls are originated.	86
+CCFC	This command enables control of the call-forwarding supplementary service.	81
+CCLK	This command reads/sets the g20's current date and time settings.	156
+CCWA	This command controls the Call Waiting supplementary service, including settings and querying of the network by the g20.	72
+CDEV	An unsolicited indication regarding display changes that is sent to the DTE when the <disp> parameter of the +CMER command is set to 1.	289
+CEER	This command returns an extended error report containing one or more lines of information text <report>, determined by the manufacturer, providing reasons for errors. The errors are call clearing codes.	279
+CFUN	This command shuts down the phone functionality of smart phones and PDAs with phone capabilities.	208
+CGACT	This command activates/deactivates the PDP Context.	306
+CGATT	This command attaches the g20 to the GPRS network.	306
+CGCLASS	This command sets the GPRS mobile station class.	297
+CGDCONT	This command specifies the PDP (Packet Data Protocol) context.	299
+CGMI	This command requests manufacturer identification.	45
+CGMM	This command requests the model identification.	46
+CGMR	This command requests the revision identification.	47
+CGPRS	This command indicates whether there is GPRS coverage.	309
+CGQMIN	This command sets the minimum acceptable quality of service profile.	302
+CGQREQ	This command returns the requested quality of service profile.	304
+CGREG	This command enables/disables the GPRS network status registration unsolicited result code.	189

Table 207. AT Commands (Alphabetical) *(Continued)*

AT Command	Description	Page
+CGSMS	This command handles the selection of the service or service preference used by the g20 to send mobile-originated SMS messages.	177
+CGSN	This command requests the product serial number identification.	47
+CHLD	This command controls the Call Hold and Multiparty Conversation supplementary services.	77
+CHUP	This command causes the TA to hang up the current GSM call of the g20.	89
+CIEV	An unsolicited indication regarding various phone indications that is sent to the DTE when the <ind> parameter of the +CMER command is set to 1.	290
+CIMI	This command requests the International Mobile Subscriber Identity number.	50
+CKEV	This command causes the g20 to send an unsolicited message when a key is pressed on the g20 keypad, and local key press echo is enabled.	288
+CKPD	This command enables the emulated pressing of keys, or virtual keycodes, as if entered from the g20 keypad or from a remote handset.	283
+CLAC	This command displays a list of all the AT commands supported by the g20.	53
+CLCC	This command returns a list of all current g20 calls and their statuses, and also enables/disables the unsolicited indication of the call list.	97
+CLCK	This command locks, unlocks or interrogates a g20 or a network facility <fac>.	253
+CLIP	This command controls the Calling Line Identity (CLI) presentation to the terminal when there is an incoming call.	70
+CLIR	This command enables/disables the sending of caller ID information to the called party, for an outgoing call.	83
+CLVL	This command sets the volume of the internal loudspeaker (which also affects the key feedback tone) of the g20.	243
+CMEE	This command enables/disables the use of result code +CME ERROR: <err> as an indication of an error relating to the functionality of the g20.	274
+CMER	This command enables an external accessory to receive key press information from the g20's internal keypad.	287
+CMGD	This command deletes messages from the g20 memory.	176
+CMGF	This command handles the selection of message formats.	161
+CMGL	This command displays a list of SMS messages stored in the g20 memory.	169

Table 207. AT Commands (Alphabetical) *(Continued)*

AT Command	Description	Page
+CMGR	This command enables the user to read selected SMS messages from the g20 memory.	171
+CMGS	This command sends an SM from the g20 to the network.	178
+CMGW	This command writes and saves messages in the g20 memory.	174
+CMSS	This command selects and sends pre-stored messages from the message storage.	173
+CMUT	This command mutes/unmutes the currently active microphone path by overriding the current mute state.	230
+CMT	This unsolicited message forwards the SMS upon its arrival.	166
+CMTI	This unsolicited message, including the SMS index, is sent upon the arrival of an SMS.	167
+CNMA	This command acknowledges the receipt of a +CMT response.	166
+CNMI	This command sends an unsolicited indication when a new SMS message is received by the g20.	164
+CNUM	This command returns up to five strings of text information that identify the g20.	51
+COLP	This command refers to the GSM supplementary service COLP, Connected Line Identification Presentation, which enables a calling subscriber to get the connected line identity (COL) of the called party after setting up a mobile originated call.	119
+COPS	This command enables accessories to access the network registration information, and the selection and registration of the GSM network operator.	191
+CPAS	This command returns the current activity status of the g20, for example, call in progress, or ringing.	96
+CPBF	This command enables the user to search the currently active phone book for a particular entry, by name.	128
+CPBR	This command recalls phone book entries from a specific entry number, or from a range of entries.	123
+CPBS	This command selects the memory that is to be used for reading and writing entries in g20s that contain more than one phone book memory.	121
+CPBW	This command enables the user to store a new entry in the phone book, or delete an existing entry from the phone book.	132
+CPIN	This command is only relevant for phones that use SIM cards. It unlocks the SIM card when the proper SIM PIN is provided, and unblocks the SIM card when the proper SIM PUK is provided.	247

Table 207. AT Commands (Alphabetical) *(Continued)*

AT Command	Description	Page
+CPMS	This command handles the selection of the preferred storage area for messages.	160
+CPOL	This command is used to edit the list of preferred operators located in the SIM card.	194
+CPUC	This command sets the parameters of the Advice of Charge-related price per unit and currency table found in the SIM file, EFPUCT.	108
+CPWD	This command sets a new password for the facility lock.	250
+CR	This command controls whether or not the extended format of an outgoing call is displayed or not.	110
+CRC	This command controls whether to present the extended format of the incoming call indication.	67
+CREG	This command enables/disables the network status registration unsolicited result code.	187
+CRING	This unsolicited event indicates the type of incoming call.	67
+CRLP	This command returns the Radio Link Protocol parameters.	185
+CRSL	This command handles the selection of the incoming call ringer and alert tone (SMS) sound level on the alert speaker of the g20.	223
+CRSM	This command enables you to read UNSU, GID1, GID2 and ICC ID data from the SIM card	295
+CRTT	This command plays one cycle of a ring tone, stops the cycle in the middle, and sets the ring tone to be used.	219
+CSCA	This command handles the selection of the SCA and the TOSCA.	162
+CSCB	This command handles the selection of cell broadcast message types and data coding schemes received by the g20.	179
+CSCS	This command selects the g20 character set.	48
+CSMS	This command handles the selection of the SMS service type.	158
+CSNS	This command handles the selection of the bearer or teleservice to be used when a mobile terminated single numbering scheme call is established.	89
+CSSN	This command handles the enabling and disabling of supplementary service-related, network-initiated, notifications.	111
+CSQ	This command returns the signal strength received by the g20.	184
+CSVM	This command handles the selection of the number to the voice mail server.	137

Table 207. AT Commands (Alphabetical) *(Continued)*

AT Command	Description	Page
+CTFR1	This command terminates an incoming call and diverts the caller to the number previously defined in CCFC, or to a voice mail if one exists for the subscriber.	93
+CUSD	This command allows control of Unstructured Supplementary Service Data (USSD), according to GSM 02.90.	114
+CVIB	This command handles the enabling and disabling of the vibrator alert feature of the g20 during a mobile-terminated incoming call.	225
+FAR	This command is supported for backward compatibility only, and has no effect.	314
+FCL	This command is supported for backward compatibility only, and has no effect.	314
+FCLASS	This command places the terminal in particular mode of operation (data, fax, voice).	315
+FDD	This command is supported for backward compatibility only, and has no effect.	314
+FIT	This command is supported for backward compatibility only, and has no effect.	314
+FMI	This command requests manufacturer identification.	45
+FMM	This command requests the model identification.	46
+FMR	This command requests the revision identification.	47
+FRH	This command causes the g20 to receive HDLC framed data and deliver the next received frame to the terminal.	322
+FRM	This command causes the g20 to enter the receive mode.	320
+FRS	This command causes the g20 to listen and to report back an OK result code when the line has been silent for the specified amount of time.	317
+FTH	This command causes the g20 to transmit data framed in the HDLC protocol.	321
+FTM	This command causes the g20 to transmit data.	318
+FTS	This command causes the g20 to stop any transmission.	316
+GCAP	This command requests the overall capabilities of the g20.	200
+GMI	This command requests manufacturer identification.	45
+GMM	This command requests the model identification.	46
+GMR	This command requests the revision identification.	47
+GSN	This command requests the product serial number identification.	47

Table 207. AT Commands (Alphabetical) *(Continued)*

AT Command	Description	Page
+ICF	This command determines the local serial port start/stop (asynchronous) character framing used by the DCE when accepting DTE commands and transmitting information text and result codes, whenever these are not done automatically.	210
+IFC	This command controls the operation of the local flow control between the terminal and the g20.	323
+IPR	This command is responsible for setting and saving the request baud rate.	199
+MADIGITAL	This command switches between analog and digital audio modes.	234
+MAFEAT	This command controls the various algorithm features, such as sidetone, echo cancel and noise suppress.	238
+MAID	This command returns the AT Feature Review that is supported in the g20.	55
+MAMUT	This command controls the muting/unmuting of all input paths (MIC, HDST_MIC, DIGITAL_RX).	239
+MAPATH	This command sets/requests the active input accessory, and the output accessory for each feature.	231
+MAPV	This command returns the version of the user protocol that is supported by the g20.	57
+MAVOL	This command enables you to determine a volume setting for a particular feature in a particular accessory.	235
+MCSAT	This command enables/disables/exercises SMS alert tone for an arriving SMS.	181
+MCSN	This command sets EFmsisdn in the SIM.	145
+MCWAKE	This command requests reports on the status of the GPRS coverage.	206
+MDBAD	This command sets/reads the auto-delete user preference setting in the date book database.	154
+MDBL	This command locks/unlocks the date book database.	151
+MDBR	This command reads entries stored in the date book.	153
+MDC	This command enables you to select the desired messages to be displayed upon connection of a voice call with a remote party.	92
+MDSI	This command enables unsolicited reporting of indications of SIM deactivation and invalidation.	142
+MEGA	This command updates the Email Gateway Address.	183
+MFS	This command is used to determine how long the g20 waits before attempting to re-register after a registration attempt has failed and the g20 is not registered.	139

<p style="text-align: center;">Table 207. AT Commands (Alphabetical) *(Continued)*</p>

AT Command	Description	Page
+MHIG	This command enables an intelligent car kit to indicate the ignition state of the vehicle to the g20, which enables the g20 to turn on and off with the ignition, or to enter a power saving state when the ignition is turned off.	283
+MIPCALL	This command creates a wireless PPP connection with the GGSN, and returns a valid dynamic IP for the g20.	356
+MIPCLOSE	This command causes the g20 module to free the socket accumulating buffer and disconnect the g20 from a remote side.	360
+MIPFLUSH	This command causes the g20 module to flush (delete) data accumulated in its accumulating buffers.	366
+MIPOPEN	This command causes the g20 module to initialize a new socket and open a connection with a remote side.	358
+MIPPUSH	This command causes the g20 module to push the data accumulated in its accumulating buffers into the protocol stack.	364
+MIPRTCP	This unsolicited event is sent to the terminal when data is received from the TCP protocol stack.	367
+MIPRUDP	This unsolicited event is sent to the terminal when data is received from the UDP protocol stack.	367
+MIPSEND	This command causes the g20 to transmit the data that the terminal provides, using an existing protocol stack.	363
+MIPSETS	This command causes the g20 to set a watermark in the accumulating buffer. When the watermark is reached, data is pushed from the accumulating buffer into the protocol stack.	361
+MIPSTAT	This unsolicited event is sent to the terminal indicating a change in link status.	368
+MIPXOFF	This unsolicited event is sent to the terminal to stop sending data.	368
+MIPXON	This unsolicited event is sent to the terminal when the g20 has free memory in the accumulating buffer.	369
+MKPD	This command enables accessories to control the press and release of key presses.	286
+MMAR	This command changes the status of an SMS message in the g20 memory from "REC UNREAD" to "REC READ".	172
+MMICG	This command handles the selection of microphone gain values.	244
+MMGL	This command displays a list of SMS messages stored in the g20 memory.	169
+MMGR	This command enables the user to read selected SMS messages from the g20 memory.	171

Table 207. AT Commands (Alphabetical) *(Continued)*

AT Command	Description	Page
+MPBF	This command enables the user to search the currently active phone book for a particular entry, by name, and returns fields that are unique to Motorola phones.	129
+MPBR	This command recalls phone book entries from a specific entry number, or from a range of entries.	125
+MPBW	This command enables the user to store a new entry in the phone book, or to delete an existing entry from the phone book.	134
+MPCMC	This command defines whether the PCM clock runs continuously or not.	211
+MPDPM	This command returns the collective percentage of memory used by the phonebook and datebook in their shared dynamic memory storage.	150
+MRST	This command enables customer software to perform a hard reset to the g20 unit.	215
+MSCTS	This command defines the behavior of the CTS line when the g20 is in Sleep mode.	273
+MTCTS	This command sets the CTS pin of the RS232 to not active (high), waits one second and then returns the CTS to active (low).	202
+MTDTR	This command checks and outputs the physical current status of the DTR pin of the RS232.	201
+MTKC	This unsolicited event notifies the terminal when supplementary services, SMS Control or Call Control are modified.	356
+MTKE	This command enables/disables the SIM ToolKit functionalities.	337
+MTKM	This is both a command and an unsolicited event. The command selects items from the menu.	353
+MTKP	This is both a command and an unsolicited event. The command enables the user to respond to an unsolicited event.	338
+MTKR	This command displays the profile that is downloaded from the g20 to the SIM during the SIM initialization process	326
+MUPB	This command causes the g20 to send an event when a phone book entry is accessed or modified by the user.	291
+VTD	This command handles the selection of tone duration.	227
+VTS	This command transmits DTMF tones when a voice call is active.	228
A	This command answers an incoming call, placing the g20 into the appropriate mode, as indicated by the RING message.	66

Table 207. AT Commands (Alphabetical) *(Continued)*

AT Command	Description	Page
A/	This command repeats the last command entered on the terminal.	246
AT	This command checks the AT communication and only returns OK.	246
B	This command is supported for backward compatibility only, and has no effect.	312
D	This command places a voice call on the current network, when issued from an accessory device.	60
D*99	This command enables the MT to perform the actions necessary for establishing communication between the terminal and the external PDN.	307
D>	This command places a voice/fax/data call on the current network by dialing directly from the g20 phone book.	61
DL	This command places a voice call to the last number dialed.	63
E	This command defines whether the g20 echoes the characters received from the user, (whether input characters are echoed to output).	260
F	This command is supported for backward compatibility only, and has no effect.	312
H	This command hangs up, or terminates a particular call.	65
I	This command requests various g20 information items.	51
L	This command is supported for backward compatibility only, and has no effect.	312
M	This command is supported for backward compatibility only, and has no effect.	312
N	This command is supported for backward compatibility only, and has no effect.	312
O	This command returns a phone to the Online Data mode and issues a CONNECT or CONNECT <text> result code.	88
P	This command is supported for backward compatibility only, and has no effect.	312
Q	This command determines whether to output/suppress the result codes.	259
RING	This unsolicited event is received when an incoming call (voice, data or fax) is indicated by the cellular network.	67
S102	This S-register sets the value of the delay before sending the data to the terminal.	272
S24	This S-parameter activates/disables the Sleep mode. If the parameter value is greater than 0, it represent the number of seconds till the g20 enters sleep mode.	271
S94	This S-parameter represents the Boolean status, On/Off, of the sidetone feature.	221

Table 207. AT Commands (Alphabetical) *(Continued)*

AT Command	Description	Page
S96	This S-parameter represents the Boolean status, On/Off, of the echo cancelling feature in the handsfree.	222
Sn	This command reads/writes values of the S-registers, and includes registers 1-49.	262
T	This command is supported for backward compatibility only, and has no effect.	312
V	This command determines the response format of the data adapter and the contents of the header and trailer transmitted with the result codes and information responses.	257
X	This command defines the data adaptor response set, and the CONNECT result code format.	260
Y	This command is supported for backward compatibility only, and has no effect.	312
Z	This command resets the default configuration.	267

A.2   CHARACTER SET TABLE CS1: (GSM -> UCS-2)

The following table shows the conversion between the GSM and UCS-2 character sets.

Table 208. GSM to UCS-2 Encoding

Symbol	GSM (GSM 03.38)	UCS-2 (ISO 10646-1)
@	0x00	0x0040
£	0x01	0x00A3
$	0x02	0x0024
¥	0x03	0x00A5
è	0x04	0x00E8
é	0x05	0x00E9
ù	0x06	0x00F9
ì	0x07	0x00EC
ò	0x08	0x00F2
Ç	0x09	0x00C7
LF	0x0A	0x000A
Ø	0x0B	0x00D8
ø	0x0C	0x00F8
CR	0x0D	0x000D
Å	0x0E	0x00C5

Table 208. GSM to UCS-2 Encoding *(Continued)*

Symbol	GSM (GSM 03.38)	UCS-2 (ISO 10646-1)
å	0x0F	0x00E5
Ä	0x10	0x0394
_	0x11	0x005F
Ö	0x12	0x03A6
Ã	0x13	0x0393
Ë	0x14	0x039B
Ù	0x15	0x03A9
Đ	0x16	0x03A0
Ø	0x17	0x03A8
Ó	0x18	0x03A3
È	0x19	0x0398
Î	0x1A	0x039E
1)	0x1B	0x258A
Æ	0x1C	0x00C6
æ	0x1D	0x00E6
ß	0x1E	0x03B2
É	0x1F	0x00C9
SP	0x20	0x0020
!	0x21	0x0021
"	0x22	0x0022
#	0x23	0x0023
¤	0x24	0x00A4
%	0x25	0x0025
&	0x26	0x0026
'	0x27	0x0027
(	0x28	0x0028
)	0x29	0x0029
*	0x2A	0x002A
+	0x2B	0x002B
,	0x2C	0x002C
-	0x2D	0x002D
.	0x2E	0x002E

Table 208. GSM to UCS-2 Encoding *(Continued)*

Symbol	GSM (GSM 03.38)	UCS-2 (ISO 10646-1)
/	0x2F	0x002F
0	0x30	0x0030
1	0x31	0x0031
2	0x32	0x0032
3	0x33	0x0033
4	0x34	0x0034
5	0x35	0x0035
6	0x36	0x0036
7	0x37	0x0037
8	0x38	0x0038
9	0x39	0x0039
:	0x3A	0x003A
;	0x3B	0x003B
<	0x3C	0x003C
=	0x3D	0x003D
>	0x3E	0x003E
?	0x3F	0x003F
¡	0x40	0x00A1
A	0x41	0x0041
B	0x42	0x0042
C	0x43	0x0043
D	0x44	0x0044
E	0x45	0x0045
F	0x46	0x0046
G	0x47	0x0047
H	0x48	0x0048
I	0x49	0x0049
J	0x4A	0x004A
K	0x4B	0x004B
L	0x4C	0x004C
M	0x4D	0x004D
N	0x4E	0x004E

Table 208. GSM to UCS-2 Encoding *(Continued)*

Symbol	GSM (GSM 03.38)	UCS-2 (ISO 10646-1)
O	0x4F	0x004F
P	0x50	0x0050
Q	0x51	0x0051
R	0x52	0x0052
S	0x53	0x0053
T	0x54	0x0054
U	0x55	0x0055
V	0x56	0x0056
W	0x57	0x0057
X	0x58	0x0058
Y	0x59	0x0059
Z	0x5A	0x005A
Ä	0x5B	0x00C4
Ö	0x5C	0x00D6
Ñ	0x5D	0x00D1
Ü	0x5E	0x00DC
§	0x5F	0x00A7
¿	0x60	0x00BF
a	0x61	0x0061
b	0x62	0x0062
c	0x63	0x0063
d	0x64	0x0064
e	0x65	0x0065
f	0x66	0x0066
g	0x67	0x0067
h	0x68	0x0068
i	0x69	0x0069
j	0x6A	0x006A
k	0x6B	0x006B
l	0x6C	0x006C
m	0x6D	0x006D
n	0x6E	0x006E

Table 208. GSM to UCS-2 Encoding *(Continued)*

Symbol	GSM (GSM 03.38)	UCS-2 (ISO 10646-1)
o	0x6F	0x006F
p	0x70	0x0070
q	0x71	0x0071
r	0x72	0x0072
s	0x73	0x0073
t	0x74	0x0074
u	0x75	0x0075
v	0x76	0x0076
w	0x77	0x0077
x	0x78	0x0078
y	0x79	0x0079
z	0x7A	0x007A
ä	0x7B	0x00E4
ö	0x7C	0x00F6
ñ	0x7D	0x00F1
ü	0x7E	0x00FC
à	0x7F	0x00E0

A.3 CHARACTER SET TABLE CS2: (ASCII <-> UTF-8)

The following table shows the conversion between the ASCII and UTF-8 character sets.

Table 209. ASCII to UTF-8 Encoding

ASCII-7bit Byte Encoding	UTF-8 Bit Encoding
00 - 7F	0xxxxxxx

A.4 CHARACTER SET TABLE CS3: (UCS-2 <-> UTF-8)

The following table shows the conversion between the UCS-2 and UTF-8 character sets.

Table 210. UCS-2 to UTF-8 Encoding

UCS2		UTF-8		
Byte Encoding	Bit Encoding	Byte 1	Byte 2	Byte 3
0000 - 007F	000000000xxxxxxx	0xxxxxxx		
0080 - 07FF	00000yyyyyxxxxxx	110yyyyy	10xxxxxx	
0800 - FFFF	zzzzyyyyyyxxxxxx	1110zzzz	10yyyyyy	10xxxxxx

> **Note**
> Conversion from the default GSM alphabet to the above character set is straightforward. Conversions of the characters listed below the table are not supplied.

A.5 CHARACTER SET TABLE CS6: (UCS-2 FULL TABLE)

Character Set Table CS6: (UCS-2) is provided on CD due to its size.

A.6 CHARACTER SET TABLE CS7: (ASCII TABLE)

The following table shows the conversion for the ASCII character set.

Table 211. ASCII Table

Decimal	Octal	Hex	Binary	Value	Description
000	000	000	00000000	NUL	(Null char.)
001	001	001	00000001	SOH	(Start of Header)
002	002	002	00000010	STX	(Start of Text)
003	003	003	00000011	ETX	(End of Text)
004	004	004	00000100	EOT	(End of Transmission)
005	005	005	00000101	ENQ	(Enquiry)
006	006	006	00000110	ACK	(Acknowledgment)
007	007	007	00000111	BEL	(Bell)
008	010	008	00001000	BS	(Backspace)
009	011	009	00001001	HT	(Horizontal Tab)
010	012	00A	00001010	LF	(Line Feed)
011	013	00B	00001011	VT	(Vertical Tab)
012	014	00C	00001100	FF	(Form Feed)
013	015	00D	00001101	CR	(Carriage Return)
014	016	00E	00001110	SO	(Shift Out)
015	017	00F	00001111	SI	(Shift In)
016	020	010	00010000	DLE	(Data Link Escape)
017	021	011	00010001	DC1	(XON) (Device Control 1)
018	022	012	00010010	DC2	(Device Control 2)
019	023	013	00010011	DC3	(XOFF)(Device Control 3)
020	024	014	00010100	DC4	(Device Control 4)
021	025	015	00010101	NAK	(Negative Acknowledgement)
022	026	016	00010110	SYN	(Synchronous Idle)
023	027	017	00010111	ETB	(End of Trans. Block)
024	030	018	00011000	CAN	(Cancel)

Table 211. ASCII Table *(Continued)*

Decimal	Octal	Hex	Binary	Value	Description
025	031	019	00011001	EM	(End of Medium)
026	032	01A	00011010	SUB	(Substitute)
027	033	01B	00011011	ESC	(Escape)
028	034	01C	00011100	FS	(File Separator)
029	035	01D	00011101	GS	(Group Separator)
030	036	01E	00011110	RS	(Request to Send)(Record Separator)
031	037	01F	00011111	US	(Unit Separator)
032	040	020	00100000	SP	(Space)
033	041	021	00100001	!	(exclamation mark)
034	042	022	00100010	"	(double quote)
035	043	023	00100011	#	(number sign)
036	044	024	00100100	$	(dollar sign)
037	045	025	00100101	%	(percent)
038	046	026	00100110	&	(ampersand)
039	047	027	00100111	'	(single quote)
040	050	028	00101000	(	(left/opening parenthesis)
041	051	029	00101001	)	(right/closing parenthesis)
042	052	02A	00101010	*	(asterisk)
043	053	02B	00101011	+	(plus)
044	054	02C	00101100	,	(single quote)
045	055	02D	00101101	-	(minus or dash)
046	056	02E	00101110	.	(dot)
047	057	02F	00101111	/	(forward slash)
048	060	030	00110000	0	
049	061	031	00110001	1	
050	062	032	00110010	2	
051	063	033	00110011	3	
052	064	034	00110100	4	
053	065	035	00110101	5	
054	066	036	00110110	6	
055	067	037	00110111	7	
056	070	038	00111000	8	
057	071	039	00111001	9	
058	072	03A	00111010	:	(colon)
059	073	03B	00111011	;	(semi-colon)

Table 211. ASCII Table *(Continued)*

Decimal	Octal	Hex	Binary	Value	Description
060	074	03C	00111100	<	(less than)
061	075	03D	00111101	=	(equal sign)
062	076	03E	00111110	>	(greater than)
063	077	03F	00111111	?	(question mark)
064	100	040	01000000	@	(AT symbol)
065	101	041	01000001	A	
066	102	042	01000010	B	
067	103	043	01000011	C	
068	104	044	01000100	D	
069	105	045	01000101	E	
070	106	046	01000110	F	
071	107	047	01000111	G	
072	110	048	01001000	H	
073	111	049	01001001	I	
074	112	04A	01001010	J	
075	113	04B	01001011	K	
076	114	04C	01001100	L	
077	115	04D	01001101	M	
078	116	04E	01001110	N	
079	117	04F	01001111	O	
080	120	050	01010000	P	
081	121	051	01010001	Q	
082	122	052	01010010	R	
083	123	053	01010011	S	
084	124	054	01010100	T	
085	125	055	01010101	U	
086	126	056	01010110	V	
087	127	057	01010111	W	
088	130	058	01011000	X	
089	131	059	01011001	Y	
090	132	05A	01011010	Z	
091	133	05B	01011011	[	(left/opening bracket)
092	134	05C	01011100	\	(back slash)
093	135	05D	01011101	]	(right/closing bracket)
094	136	05E	01011110	^	(caret/circumflex)

Table 211. ASCII Table *(Continued)*

Decimal	Octal	Hex	Binary	Value	Description
095	137	05F	01011111	_	(underscore)
096	140	060	01100000	`	
097	141	061	01100001	a	
098	142	062	01100010	b	
099	143	063	01100011	c	
100	144	064	01100100	d	
101	145	065	01100101	e	
102	146	066	01100110	f	
103	147	067	01100111	g	
104	150	068	01101000	h	
105	151	069	01101001	i	
106	152	06A	01101010	j	
107	153	06B	01101011	k	
108	154	06C	01101100	l	
109	155	06D	01101101	m	
110	156	06E	01101110	n	
111	157	06F	01101111	o	
112	160	070	01110000	p	
113	161	071	01110001	q	
114	162	072	01110010	r	
115	163	073	01110011	s	
116	164	074	01110100	t	
117	165	075	01110101	u	
118	166	076	01110110	v	
119	167	077	01110111	w	
120	170	078	01111000	x	
121	171	079	01111001	y	
122	172	07A	01111010	z	
123	173	07B	01111011	{	(left/opening brace)
124	174	07C	01111100	|	(vertical bar)
125	175	07D	01111101	}	(right/closing brace)
126	176	07E	01111110	~	(tilde)
127	177	07F	01111111	DEL	(delete)

B

C

U

V

W