

H24 AT Commands Reference Guide

80389ST10086a Rev.3 – 2013-02-10



APPLICABILITY TABLE

PRODUCT
H24



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1. Introduction

1.1. Scope

This manual introduces the H24 AT commands, and describes how software developers can use these commands to communicate with the H24 device, and to create software applications that communicate with the H24 using these commands.

Note: The integrator should read the corresponding SW release notes for the H24 version he is using to get information about differences from this manual.

1.2. Audience

This manual is intended for software developers who communicate with the H24 device using the AT commands, and create applications to communicate with the H24 device using the AT commands.

1.3. Contact Information, Support

For general contact, technical support, to report documentation errors and to order manuals, contact Telit Technical Support Center (TTSC) at:

TS-EMEA@telit.com
TS-NORTHAMERICA@telit.com
TS-LATINAMERICA@telit.com
TS-APAC@telit.com

Alternatively, use:

<http://www.telit.com/en/products/technical-support-center/contact.php>

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:

<http://www.telit.com>

To register for product news and announcements or for product questions contact Telit Technical Support Center (TTSC).

Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

Telit appreciates feedback from the users of our information.



1.4. Text Conventions



Danger – This information MUST be followed or catastrophic equipment failure or bodily injury may occur.



Caution or Warning – Alerts the user to important points about integrating the module, if these points are not followed, the module and end user equipment may fail or malfunction.



Tip or Information – Provides advice and suggestions that may be useful when integrating the module.

All dates are in ISO 8601 format, i.e. YYYY-MM-DD.



1.5. Related Documents

- H24 Module Hardware Description
- H24 Developer's Kit

1.6. General Safety

1.6.1. Remember!. . . safety depends on you!

The following general safety precautions must be observed during all phases of operation, service, and repair of the equipment described in this manual. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the equipment. Motorola, Inc. assumes no liability for the customer's failure to comply with these requirements. The safety precautions listed below represent warnings of certain dangers of which we are aware. You, as the user of this product, should follow these warnings and all other safety precautions necessary for the safe operation of the equipment in your operating environment.

1.6.2. Ground the instrument

To minimize shock hazard, the equipment chassis and enclosure must be connected to an electrical ground. If the equipment is supplied with a three-conductor AC power cable, the power cable must be either plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter. The three-contact to two-contact adapter must have the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. The power jack and mating plug of the power cable must meet International Electrotechnical Commission (IEC) safety standards.

1.6.3. Do not operate in an explosive atmosphere

Do not operate the equipment in the presence of flammable gases or fumes. Operation of any electrical equipment in such an environment constitutes a definite safety hazard.

1.6.4. Do not service or adjust alone

Do not attempt internal service or adjustment unless another person, capable of rendering first aid is present.

1.6.5. Keep away from live circuits

Operating personnel must:



- Do not remove equipment covers. Only Factory Authorized Service Personnel or other qualified maintenance personnel may remove equipment covers for internal subassembly, or component replacement, or any internal adjustment
- not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed
- always disconnect power and discharge circuits before touching them

1.6.6. Do not substitute parts or modify equipment

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification of equipment. Contact Motorola Warranty and Repair for service and repair to ensure that safety features are maintained.

1.6.7. Dangerous procedure warnings

Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed. You should also employ all other safety precautions that you deem necessary for the operation of the equipment in your operating environment.

Warning example:

WARNING:

Dangerous voltages, capable of causing death, are present in this equipment. Use extreme caution when handling, testing, and adjusting.

1.7. Limitation of Liability

The Products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body; in other applications intended to support or sustain life; for the planning, construction, maintenance, operation or use of any nuclear facility; for the flight, navigation, communication of aircraft or ground support equipment; or in any other application in which the failure of the Product could create a situation where personal injury or death may occur. If CUSTOMER should use any Product or provide any Product to a third party for any such use, CUSTOMER hereby agrees that TELIT is not liable, in whole or in part, for any claims or damages arising from such use, and further agrees to indemnify and hold TELIT harmless from any claim, loss, cost or damage arising from such use.

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Under no circumstances shall TELIT be liable to CUSTOMER or any other party for any costs, lost revenue or profits or for any other special, incidental or consequential damages, even if TELIT has been informed of such potential loss or damage. And in no event shall TELIT's liability to CUSTOMER for damages of any nature exceed the total purchase price CUSTOMER paid for the Product at issue in the dispute, except direct damages resulting from patent and/or copyright infringement, which shall be governed by the "INDEMNITY" Section of this Agreement.

The preceding states TELIT's entire liability for TELIT's breach or failure to perform under any provision of this Agreement.



2. Product Features

2.1. Connectivity Interface

The user can use two types of connections in order to establish an AT command session with the H24:

- RS232 connection
- USB connection

2.2. H24 Technologies

The H24 provides access to 2G & 3G in the following networks:

- HSUPA rel 6 - provides packet data-rate up to 7.2 Mbps downlink and 5.76Mbps Uplink
- HSDPA rel 5 - provides packet data-rate up to 7.2 Mbps downlink 384Kbps Downlink
- UMTS rel 99 - provides packet data-rate Up to 384Kbps Uplink/Downlink and CS voice and data over WCDMA
- EDGE
- GPRS
- GSM
- GPS/A-GPS
- MUX (see “RS232 Multiplexer Feature”)

2.3. Data Operation

2.3.1. Overview

The GPRS is a data link between H24 and a cellular network. It utilizes packet-mode techniques to transfer high-speed and low-speed data and signaling in an efficient manner. The packet domain optimizes the use of network and radio resources.

In order to use GPRS services, an MS shall first make its presence known to the network by performing a **GPRS attach**. This makes the MS available for SMS over GPRS, paging via the SGSN, and notification of incoming packet data.

In order to **send and receive packet data** by means of GPRS services, the MS shall activate Packet Data Protocol (PDP) context holding information on the data connection. This operation makes the MS known in the corresponding GGSN, and interworking with data networks can start.



The following diagram demonstrates the GPRS environment in an abstract view:

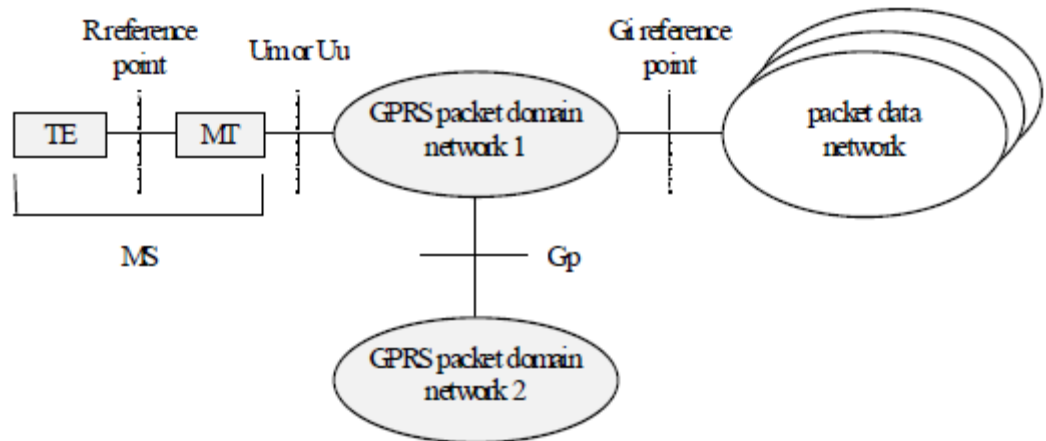


Figure 2-1: GPRS Abstract View

Figure 2-2: GPRS Environment - Module Perspective below is a concept diagram describing the GPRS environment from H24 Module perspective.

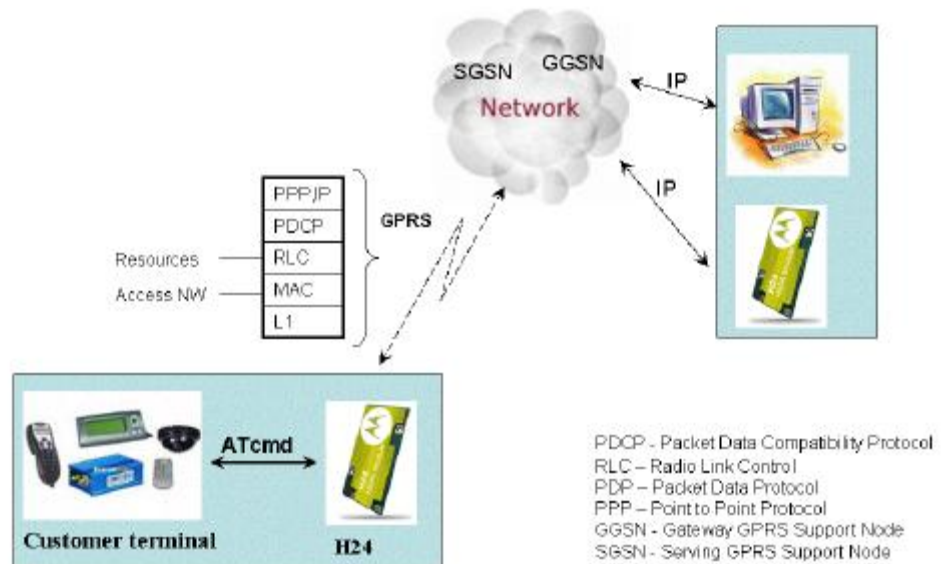


Figure 2-2: GPRS Environment - Module Perspective

The following is a list of terms used in the GPRS functionary explanations:

- **Route** - is an ordered list of nodes used for the transfer of messages within and between the PLMN(s). Each route consists of the originating node, zero or more relay nodes and the destination node.
- **A/Gb** interfaces - are for 2G core network.
- **Iu-PS & IuCS** interfaces - are for 3G core network.



2.3.2. GPRS High Level Functionalities

The following describes the main functionalities of GPRS NW:

- Network Access Control Functions - The means by which module is connected to network in order to use the services and/or facilities of that network.
NW access includes the following top level functionalities:
 - Registration - Module Id is associated with the packet data protocol(s) and address (es) within the PLMN
 - Authentication and Authorisation - A procedure that checks if module is authorizes to use the GPRS service
 - Resources allocation by NW
 - Start of charging data collection function - for billing
- Packet Routing and Transfer Functions -
 - Build bidirectional route between source and destination nodes
 - Provides Relay & Routing functions
 - Addressing - translation / Mapping for internet working
- Mobility Management Functions.
- Logical Link Management Functions (A/Gb mode).
- Radio Resource Management Functions.
- Network Management Functions.

2.3.3. Technical Description (GPRS - Class A Operation)

As Class A device, H24 is able to attach to both PS and CS domain, and supports simultaneous operation of PS and CS (voice) domain services.



Figure 2-3: Class A Mode of Operation shows a Class A mode of operation.

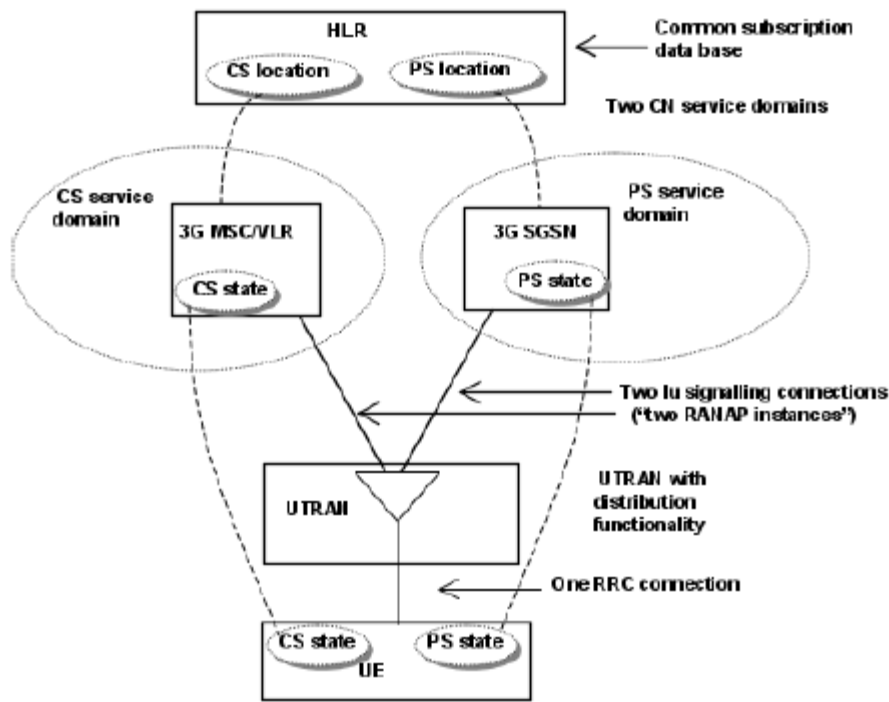


Figure 2-3: Class A Mode of Operation

In order to use the GPRS services, the H24 performs the following (TS 23122-650):

1. PLMN selection.
2. Cell selection.
3. Location registration - by GPRS Attach.
At this stage, H24 is able to receive system information from the PLMN; Initiate a call; Receive "paging" ; Respond to "paging" ; receive cell broadcast messages.
4. Authentication with HLR.
If USIM - H24 originates "UMTS authentication" (TS 33.102) -
This is a mutual authentication in which NW authenticates H24, and H24 authenticates the NW.
If SIM - H24 performs "GSM authentication" in which H24 is authenticated by the NW (No mutual authentication).
5. PDP context activation -
The PDP context contains mapping and routing information for transferring PDP PDUs for that particular PDP address between the MS and the GGSN.
PDP context can be activated by H24 or by the NW.



Figure 2-4: PDP Context Activation Diagram Originated by H24 describes PDP context activation originated by the H24:

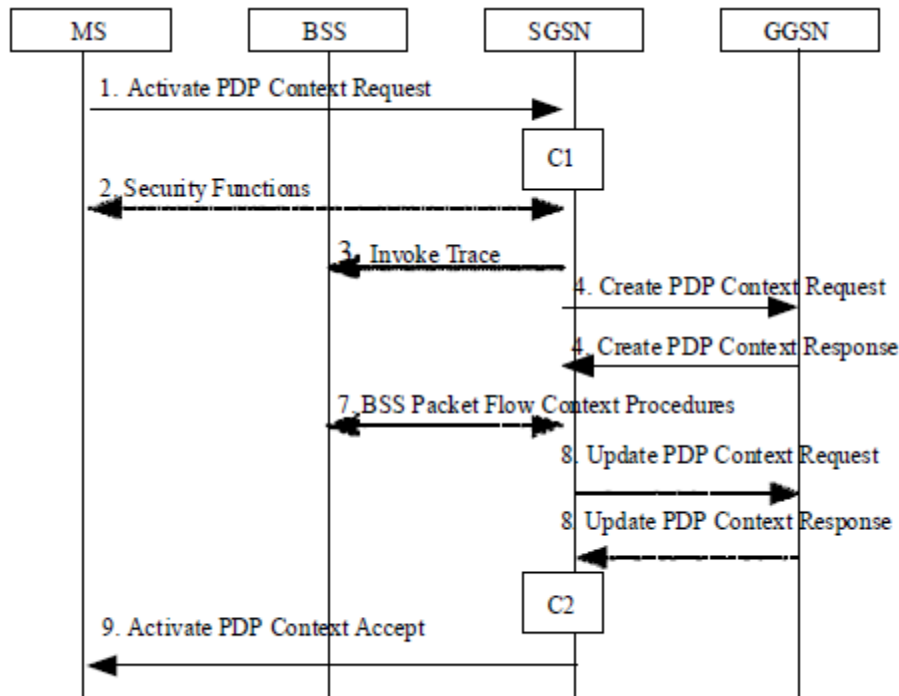


Figure 2-4: PDP Context Activation Diagram Originated by H24

2.3.4. Related AT Commands

The following are the AT commands that a Terminal uses to control H24 packet switched services. Other aspects of a Packet Domain MT are described in 3GPP TS 27.060 [34].:

- +CGATT - Attach the H24 to, or detach the H24 from the Packet Domain service.
- +CGREG - Enables/disables the packet data network status registration (DG).
- +CGACT - PDP Context Activate or Deactivate.
- ATD*99# - Create PPP link and activate PDP context.
- +CGSMS - Select Service for MO SMS Messages.

2.3.4.1. PDP Context

- +CGDCONT - Define PDP context.
- +CGPADDR - Show PDP address.



- +MPAUTH - Set PDP-IP Authentication Parameters.

2.3.4.2. QoS

- +CGQREQ - Set QoS Profile to be used when the H24 activates PDP Context.
- +CGQMIN - Terminal specifies minimum acceptable QoS profile against the negotiated profile returned in the Activate PDP Context Accept message.
- +CGEQREQ - 3G Quality of Service Profile (Requested) in UMTS NW.
- +CGEQMIN - 3G Quality of Service Profile (Minimum acceptable).

2.4. CSD Operation

2.4.1. Overview

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.

2.4.2. 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. 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.
- Available both on GSM and WCDMA technologies. CSD in WCDMA technology supports also Transparent & Synchronous connections. See “+CBST, Select Bearer Service Type”.

2.4.3. Technical Description

Network operators typically support the asynchronous CSD bearer service through a modem interworking function. This means that a H24 initiates a data call and the network routes the call to the modem interworking function, which is located at the Mobile Switching Center (MSC) of the network. The modem interworking function then dials the number supplied by



the mobile station.

This is different from voice calls, where the network itself routes the call, often to another mobile station on the same network. The 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 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.

2.5. Fax

2.5.1. Overview

A Service Class 1 facsimile H24 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.

2.5.2. Features and Benefits

Sending and receiving Fax services.

2.5.3. 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

2.6. Improved OEM Features

H24 contains the following new and improved features:

- HSxPA data services
- Simultaneous Voice and Packet Data
- USB 2.0 device
- UMTS SIM Application Toolkit (USAT)
- TCP/IP support
- Audio (digital and analog) - Routing, calibration etc.
- User-defined profiles
- Device management OTA



For a full list of H24 features, refer to the H24 Module Hardware Description manual.

2.6.1. HSxPA Data Services

Data services for the HSxPA are basically bi-directional (Up-link/Down-link) real-time high-volume packet data applications. Such application can be real-time person-to-person video conference, Net meeting, gaming and more. These applications run on a terminal while H24 provides high data rate pipe.

Another high volume data service application is FTP (File Transfer protocol), although data is sent in the “Background”. H24 supports embedded internal IP stack.

The HSDPA is used for application that utilize heavy downlink data rate such as YouTube, Multimedia application, FOTA and more.

2.6.2. Simultaneous Voice and Packet Data

H24, as a 3.5G device, supports simultaneous services. This means that between Network and H24 there is a pipe that is composed of multi channels that forward data and/or voice at the same time.

This way H24 is able to simultaneously forward a file; receive a voice call, handle SMS and also browse the internet. Performance is derived from throughputs provided by the network.

2.6.3. USB 2.0 Device

The main connection channel between H24 and Host is done utilizing USB 2.0 physical interface. H24, by its nature, is the USB device and the Terminal is the USB host.

At startup, H24 is enumerated with terminal as a Motorola device. It also supports mass storage functionality.

H24 supports multi-channeling over USB for AT commands and Data connectivity. More information can be found in the “connectivity” section.

USB 2.0, called High Speed USB, supports bandwidth up to 480 Mbit/s baud-rate. Also see “H24 USB Compositions”. For power management detailed documentation, contact H24 customer care team. See “Contact Us” .

2.6.4. SIM/USIM

H24 supports USIM, In addition, it supports also SIM for GSM 2G networks.

2.6.5. TCP/UDP IP Connection

Refer to “TCP/UDP IP”.



2.6.6. Audio

2.6.6.1. Overview

The audio (digital and analog) feature in the H24 module involves three main issues: path (routing of the audio through the different devices), gain and other calibrations. For more information, refer to “Audio”.

2.6.6.2. Features and Benefits

The audio control in the H24 provides an extended control over the different modules both in the codec and in the DSP. The user may control the different audio paths, their volume steps and even gain multipliers. Echo cancellation, noise suppression and sidetone can be controlled easily for these audio paths.

More advanced calibration of the FIR coefficients, AGC (Automatic Gain Control) and AVC (Automatic Volume Control) modules can be achieved through dedicated AT commands that their spec will be supplied upon request from Telit’s Wireless Modules Customer Care.

2.6.6.3. 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.

2.7. Multi Channeling

2.7.1. Overview

H24 supports Multi Channeling.

H24 with the Multi Channeling support utility provides the following capabilities:

- Provides the terminal with more than one channel connection, currently up to two channels.
- Provides simultaneous data (CSD/Packet) and command (AT command set) services.
This enables a user to make network and phone service inquiries and maintain data communication at the same time.



These capabilities are illustrated in Figure 2-5: H24 with Multi Channel Support Capabilities

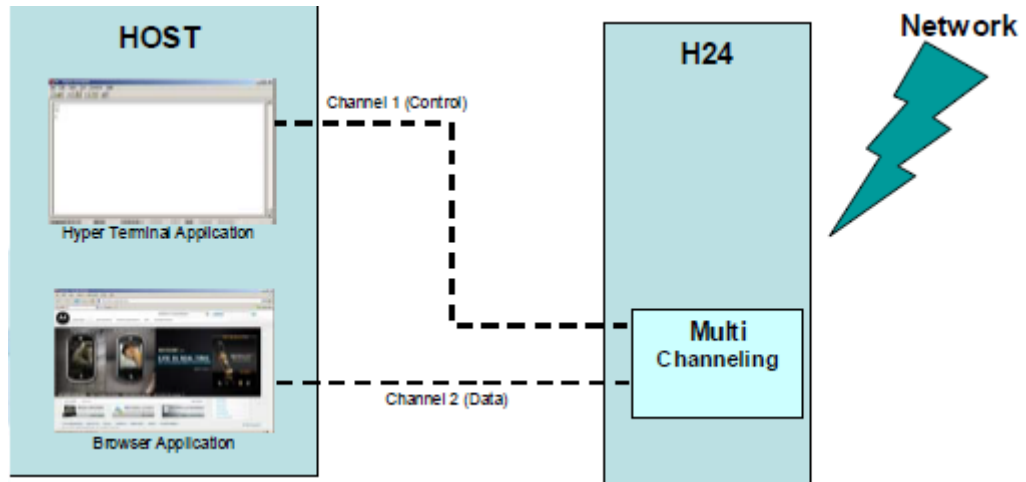


Figure 2-5: H24 with Multi Channel Support Capabilities

2.7.2. Features and Benefits

H24 with Multi channeling enables multiple channel operation and simultaneous data and control operation. For example, it allows a user to be connected to an Internet website (packet session connected), perform a voice call, and query the H24 phone book all at the same time.

Below are some of the actions which are enabled during a data session:

- Incoming call alert string RING (while H24 is in packet session)
- Answering to incoming voice call via the ATA command (while H24 is in packet session)
- Receive Incoming SMS indication
- Inquiry GSM coverage indication
- Setup a voice call (while H24 is in GPRS session)
- Send & Receive SMS
- Read/write to/from Phone Book
- Local modem operation
- Network interrogation and settings
- Perform socket operations using the H24 TCP/IP stack

2.7.3. Technical Description

Multi channeling allows to connect to multiple serial channels simultaneously (up to two channels in current implementation). The available channels are:

- USB MODEM
- USB COM PORT
- UART1
- UART2



2.8. Short Message Service (SMS)

2.8.1. Overview

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

H24 SMS implementation is based on the GSM 27.005 V7.0.0 specification.

2.8.2. Features

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

- A single short message can be up to 160 characters of IRA text in length (7-bit coded).
- Short messages can be written and displayed in various coding schemes, supported by H24 and SMS data coding scheme.
- 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 may also be indicated to TE by +CNMI configuration.
- Short messages can be sent and received simultaneously with GSM voice, data and fax calls.
- Cell broadcast messages can be selected and received on the H24. The H24 enables registration to specific broadcast channels (+CSCB).

2.8.3. Technical Description

"SM" memory capacity is SIM-dependent. SMSs indexing stored in "SM" (<index> parameter) start from 0 till maximum SMSs allowed being stored in SIM (EF-SMS files - refer to GSM11.11).

"ME" memory range is [0...22]. SMSs indexing stored in "ME" (<index> parameter) start from 0 till 22.

SMS Storage	SMS Index	Max Number of SMS
"ME"	0	23
	1	
	...	
	23	
"SM"	0	SIM-dependent
	1	
	...	



2.9. Device management OTA

H24 supports Firmware Update Over The Air (FOTA) capability and also supports BootStrap downloading OTA.

This is done by utilizing OMA DM protocol (parts that are relevant for FOTA). For future versions, H24 will support also Flex update OTA.

2.10. Character Sets

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

- CS1 - GSM to/from UCS2.
- CS2 - GSM to/from IRA.
- CS3 - UCS-2 full table.
- CS4 - IRA Table.

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

2.10.1. IRA Character Set Management

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

2.10.2. GSM Character Set Management

In H24, 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.

2.10.3. 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 IRA 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).

2.11. Personalization

2.11.1. Overview

H24 supports personalization feature in accordance with 3GPP TS 22.02.

2.11.2. Features and Benefits

- Support of five categories:
 1. PF - very-first-inserted-SIM card. SIM/USIM personalization is an anti theft feature. H24 is enabled to be personalized for particular SIM/USIM. H24 locks the extracted IMSI from SIM/USIM which is inserted in the ME. The locking operation is allowed when the ME is not previously locked.
 2. PN - Network. H24 is enabled to be personalized for particular network. H24 locks the extracted MCC+MNC from IMSI of the SIM/USIM. The locking operation is allowed when the H24 is not previously locked.
 3. PU - sUbset network. Network subset personalization is a refinement of network personalization, which allows network operators to limit the usage of a ME to a well defined subset of SIMs/USIMs; e.g. where the ME is the property of a third party. H24 is enabled to be personalized for sub network. H24 locks the extracted MCC+MNC+6 and 7 digitals from IMSI of SIM/USIM. The locking operation is allowed when the H24 is not previously locked.
 4. PP - Service Provider. H24 is enabled to be personalized for particular service provider and it can work only with support of SIM/USIM with GID1. H24 locks the extracted MCC+MNC from IMSI of SIM/USIM and GID1. The locking operation is allowed when the H24 is not previously locked.
 5. PC - Corporate. Corporate personalization is a refinement of SP personalization which allows companies to prevent the use of MEs they provide for their employees or customers with other SIMs/USIMs without that corporate personalization. H24 is enabled to be personalized for corporate and it can work only with support of SIM/USIM with GID1 and GID2. H24 locks the extracted MCC+MNC from IMSI of SIM/USIM and GID1 and GID2. The locking operation is allowed when the H24 is not previously locked.
- The categories are independent in so far as each category can be activated or de-activated regardless of the status of the others.
- There are priorities between the categories. When some categories are locked, the user has to unlock first the category having low priority up to high priority. There isn't possibility select, any category will be unlocked. The priorities that are shown here are listed by low up to high order:

PIN1/PIN
PN
PU
PP
PC
PF



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- The feature allows locking, unlocking, unblocking actions and querying one or more of selected categories.
 - H24 enters into "limited service state" in case it is locked or blocked and emergency calls can only be activated.
 - The configuration of personalization is backed-up automatically after each change that is done into the configuration.
 - +MRPERSO command - customer can restore the configuration of the personalization feature from backup partition at all times. The restore mechanism overrides the existing configuration if there is.
 - +TPIN command - enables to query the number of remaining PIN/PUK PERSONALIZATION entering attempts.



2.12. A-GPS

2.12.1. Overview

gpsOne technology merges global positioning system (GPS) satellite and network information to provide a high-availability solution that offers industry-leading accuracy and performance. This solution performs well, even in very challenging environmental conditions where conventional GPS receivers fail, and provides a platform to enable wireless operators to address both location-based services and emergency mandates such as the United States Federal Communications Commission (FCC) E911 mandate.

In mobile-assisted mode, when a request for position location is issued, available network information is provided to the location server (e.g., cell-ID) and assistance is requested from the location server. The location server sends the assistance information to the handset. The module/mobile unit measures the GPS observables and provides the GPS measurements along with available network data (that is appropriate for the given air interface technology) to the location server. The location server then calculates the position location and returns results to the requesting entity.

In mobile-based mode, the assistance data provided by the location server encompasses not only the information required to assist the module in measuring the satellite signals, but also the information required to calculate the module's position. Therefore, rather than provide the GPS measurements and available network data back to the location server, the mobile calculates the location on the module and passes the result to the requesting entity.

In standalone (autonomous) mode, the module demodulates the data directly from the GPS satellites. This mode has some reduced cold-start sensitivity, and a longer time to first fix as compared to the assisted modes. However, it requires no server interaction and works out of network coverage.

Getting Location (position fix information) can be acquired in two different formations

- Application level location requests and reports. See “Application Level Location Request and Report”.
- Streaming output of GPS NMEA messages over serial connection. See “NMEA Streaming Output”.



2.13. AT Commands Summary

The following list contains a summary of all the H24 AT commands sorted by functionality.

Table 2-1: AT Commands

AT Command	Description	Page
+CGMI	This command displays manufacturer identification.	on page 4-1
+GMI	This command displays manufacturer identification.	on page 4-1
+FMI	This command displays manufacturer identification.	on page 4-1
+CGMM	This command displays the model identification.	on page 4-2
+GMM	This command displays the model identification.	on page 4-2
+FMM	This command displays the model identification.	on page 4-2
+CGMR	This command displays the revision identification.	on page 4-2
+GMR	This command displays the revision identification.	on page 4-2
+FMR	This command displays the revision identification.	on page 4-2
+CGSN	This command displays the product serial number identification.	on page 4-3
+GSN	This command requests the product serial number identification.	on page 4-3
+CSCS	This command selects the H24 character set.	on page 4-4
+CIMI	This command displays the International Mobile Subscriber Identity number.	on page 4-5
+ATI	This command displays various H24 information items.	on page 4-5
+CNUM	This command displays up to five strings of text information that identify the H24.	on page 4-6
+CLAC	This command displays a list of all the AT commands supported by the H24.	on page 4-7
Call Control		
Call Control Commands		
D	This command places a voice call on the current network, when issued from an accessory device.	on page 4-11
D>	This command places a voice/fax/data call on the current network by dialing directly from the H24 phone book.	on page 4-13
DL	This command places a voice call to the last number dialed.	on page 4-14
H	This command hangs up, or terminates a particular call.	on page 4-15
A	This command answers an incoming call, placing the H24 into the appropriate mode, as indicated by the RING message.	on page 4-17



AT Command	Description	Page
+CRC	This command controls whether to present the extended format of the incoming call indication.	on page 4-17
RING	This unsolicited event is received when an incoming call (voice, data or fax) is indicated by the cellular network.	on page 4-17
+CRING	This unsolicited event indicates the type of incoming call.	on page 4-17
+CLIP	This command controls the Calling Line Identity (CLI) presentation to the terminal when there is an incoming call.	on page 4-20
+CCWA	This command controls the Call Waiting supplementary service, including settings and querying of the network by the H24.	on page 4-22
+CHLD	This command controls the Call Hold and Multiparty Conversation supplementary services.	on page 4-25
+CCFC	This command controls the call-forwarding supplementary service.	on page 4-31
+CLIR	This command enables/disables the sending of caller ID information to the called party, for an outgoing call.	on page 4-34
+MDC	This AT command enables you to select the desired messages to be displayed upon connection of a voice call with a remote party.	4-36 on page 4-36
+CBST	This command handles the selection of the bearer service and the connection element to be used when data calls are originated.	on page 4-38
O	This command returns a phone to the Online Data mode and issues a CONNECT or CONNECT <text> result code.	on page 4-43
+CR	This command controls whether or not the extended format of an outgoing or incoming data call is displayed or not.	on page 4-44
+MVC	This AT command is used to choose and configure the priority order of the supported voice codecs (vocoders).	on page 4-45
+MTTY	This command is used to enable/disable the TTY (Tele Typewriter) support in the H24.	on page 4-47
Call Status Messages		
+CPAS	This command displays the current activity status of the H24, for example, call in progress, or ringing.	on page 4-49
+CLCC	This command displays a list of all current H24 calls and their statuses, and also enables/disables the unsolicited indication of the call list.	on page 4-51
Supplementary Services		
+CSSN	This command handles the enabling and disabling of supplementary service-related, network-initiated, notifications.	on page 4-54
+CUSD	This command allows control of Unstructured Supplementary Service Data (USSD), according to GSM 02.90.	on page 4-59



+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.	on page 4-63
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Table 2-1: AT Commands (Cont.)

AT Command	Description	Page
Fax Class 1		
Fax Commands		
+FCLASS	The H24 facsimile service maintains a parameter for identification and control of facsimile services.	on page 4-67
+FTS	This command causes the H24 to stop any transmission.	on page 4-68
+FRS	This command causes the H24 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.	on page 4-68
+FTM	This command causes the H24 to transmit data to the remote party using the modulation selected in <MOD>.	on page 4-69
+FRM	This command causes the H24 to receive data from the remote party using the modulation specified in <MOD>.	on page 4-70
+FTH	This command causes the H24 to transmit data framed in the HDLC protocol, using the modulation mode selected, to the remote party.	on page 4-72
+FRH	This command causes the H24 to receive HDLC framed data using the modulation mode selected in <MOD>, and deliver the next received frame to the terminal.	on page 4-73
Phonebook and Clock		
Directory Access Commands		
+CPBS	This command handles the selection of the memory to be used for reading and writing entries in H24s that contain more than one phone book memory.	on page 4-74
+CPBR	This command recalls phone book entries from a specific entry number, or from a range of entries.	on page 4-76
+CPBF	This command searches the currently active phone book for a particular entry, by name.	on page 4-78
+CPBW	This command stores a new entry in the phone book, or deletes an existing entry from the phone book.	on page 4-79
System Date and Time Access Commands		
+CCLK	This command reads/sets the H24's current date and time settings.	on page 4-81
SMS		
SMS Commands		
+CSCA	This command handles the selection of the SCA and the TOSCA.	on page 4-83



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+CPMS	This command handles the selection of the preferred storage area for messages.	on page 4-86
+CMGF	This command handles the selection of message formats.	on page 4-88
+CSMP	This command sets the Text Module parameters.	on page 4-90
+CSDH	This command shows the Text Mode parameters.	4-92 on page 4-92

Table 2-1: AT Commands (Cont.)

AT Command	Description	Page
+CMGS	This command sends an SM from the H24 to the network.	on page 4-93
+CMGW	This command writes and saves messages in the H24 memory.	on page 4-94
+CMSS	This command selects and sends pre-stored messages from the message storage.	on page 4-97
+CMGC	Execution command sends a command message from a TE to the network (SMS-COMMAND).	on page 4-98
+CSMS	This command handles the selection of the SMS message service type.	on page 4-99
+CNMI	This command sends an unsolicited indication when a new SMS message is received by the H24.	on page 4-101
+CNMA	This command acknowledges the receipt of a +CMT response.	on page 4-104
+CMTI	This unsolicited message, including the SMS message index, is sent upon the arrival of an SMS message.	on page 4-106
+CMT	This unsolicited message forwards the SMS upon its arrival.	on page 4-107
+CDSI	The +CDSI unsolicited response is sent to the TE upon receipt of a new SMS-STATUS-REPORT SM, if the +CNMI parameter <ds> is set to '2'.	on page 4-108
+CDS	The +CDS unsolicited response is sent to the TE upon reception of a new SMS-STATUS-REPORT SM if +CNMI parameter <ds> is set to '1'.	on page 4-109
+CBM	This unsolicited message forwards the SMS upon its arrival.	on page 4-110
+CMGR	This command reads selected SMS messages from the H24 memory.	on page 4-111
+MMGR	This command reads selected SMS messages from the H24 memory.	on page 4-111
+CMGL	This command displays a list of SMS messages stored in the H24 memory.	on page 4-115
+MMGL	This command displays a list of SMS messages stored in the H24 memory.	on page 4-115
+CMGD	This command deletes messages from the H24 memory.	on page 4-119
+CGSMS	This command handles the selection of the service or service preference used by the H24 to send mobile-originated SMS messages.	on page 4-121
+CSCB	This command handles the selection of cell broadcast message types and data coding schemes received by the H24.	on page 4-122



DCS Handling		
+MRICS	This command allows configuring the behavior of RI line in a case of SMS arrival.	on page 4-133



Table 2-1: AT Commands (Cont.)

AT Command	Description	Page
Network Network Commands		
+CSQ	This command displays the signal strength received by the H24.	on page 4-135
+CRLP	This command displays the Radio Link Protocol parameters.	on page 4-136
+CREG	This command enables/disables the network status registration unsolicited result code.	on page 4-138
+CGREG	This command enables/disables the GPRS network status registration unsolicited result code.	on page 4-139
+COPS	This command enables accessing the network registration information, as well as select and register the GSM network operator.	on page 4-142
+COPN	This command returns the list of operator names from the H24.	on page 4-145
+CPOL	This command is used to edit the list of preferred operators located in the SIM card.	on page 4-146
+CPLS	This command is used to select PLMN list in the SIM/USIM.	on page 4-149
+MBAND	This command configures the RF bands that the unit will use for communicating with the Network.	on page 4-150
+MCI	This command reports to TE information of a current serving cell and neighbor cells.	on page 4-153
+MCICFG	This command Enables/Disables Motorola Cell Information process (cell data gathering on background and MCI request).	on page 4-156
+WS46	This command is used to query the current cellular network (Access Technology selected).	on page 4-157
+MPDS	This command indicates current available type of Packet Data Service.	on page 4-158
+PACSP	This command shows the Network Selection Menu availability.	on page 4-159
+MLOPS	This command enables/disables LOPS (Limited Operator Selection) feature, while USIM/SIM is not inserted.	on page 4-160
Hardware Information		
Hardware Information Commands		
+CBC	This command queries the battery charger connection.	on page 4-164
+CBAUD	This command sets the baud rate.	on page 4-165
+IPR	This command is responsible for setting and saving the request baud rate.	on page 4-166
&K	This command configures the RTS/CTS flow control.	on page 4-167
&C	This command determines how the state of the DCD line relates to the detection of the received line signal from the distant end.	on page 4-169



Table 2-1: AT Commands (Cont.)

Table

AT Command	Description	Page
&D	This command determines how the H24 responds when the DTR (Data Terminal Ready) status is changed from ON to OFF during the online data state.	on page 4-171
+MCWAKE	This command displays reports on the status of the GPRS/GSM coverage.	on page 4-172
+CFUN	This command shuts down the phone functionality of smart phones and PDAs with phone capabilities.	on page 4-174
+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.	on page 4-176
+IFC	This parameter controls the operation of the local flow control between the terminal and the H24 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.	on page 4-177
+MIOC	This command defines the H24 8 GPIO pins data value.	on page 4-178
+MIOD	This command defines the H24 8 GPIO pins configuration.	on page 4-179
+MIOI	This command supports the H24 8 GPIO pins configuration as interrupt lines.	on page 4-182
+MPCMC	This command defines whether the PCM clock is generated continuously or not, when module is in digital audio mode.	on page 4-186
+MVREF	This command defines the behavior of Vref regulator.	on page 4-188
+MFTM	This command is used to enter and exit FTM mode.	on page 4-189
+TGFCC	This command defines RF parameters for signal transmission.	on page 4-190
+TWFC	This command defines RF parameters for signal transmission.	on page 4-195
+MPWRDN	This command enables the customer software to perform a power down to the H24 unit.	on page 4-198
+MRST	This command enables the customer software to perform a hard reset to the H24 unit.	on page 4-198
+MTMP	This command enables a user to query the temperature level in Celsius degrees.	on page 4-199
Antenna Physical Connection Detection		
+MUANTYPED ET	This command allows recognizing the attached antenna type.	on page 4-199
+MUANTYPE	This command sets the user antenna type used.	on page 4-200
ATS97	This command indicates the status of the antenna physical connection to the H24 RF connector.	on page 4-201
Audio		
Standard Audio Commands		

2-1: AT



Commands (Cont.)

AT Command	Description	Page
+CRSL	This command sets the different alerts volume level of the active audio mode.	on page 4-205
+CLVL	This command sets the voice volume level of the active audio mode.	on page 4-206
+CMUT	This command mutes/unmutes the currently active microphone path by overriding the current mute state.	on page 4-207
+CALM	This command handles the selection of the H24's alert sound mode.	on page 4-208
+CRTT	This command plays one cycle of a ring tone, stops the cycle in the middle, and sets the ring tone to be used.	on page 4-209
+VTD	This command handles the selection of tone duration.	on page 4-210
+VTS	This command transmits a string of DTMF tones when a voice call is active.	on page 4-211
Motorola Extended Audio Commands		
+MACRXG	Sets Codec RX gain of the active audio mode.	on page 4-213
+MACSTG	Sets Codec ST gain of the active audio mode.	on page 4-213
+MACTXG	Sets Codec TX gain of the active audio mode.	on page 4-214
+MAMOD	This command selects the active audio mode.	on page 4-215
+MAHSD	This command Enables/disables the headset switch detect mechanism.	on page 4-217
+MAGRST	An action command that restores manufacturer's default RX, TX and ST gain values for all audio modes.	on page 4-218
+MAEC	Selects EC type.	on page 4-218
+MAFRST	An action command to restore manufacturer's audio features defaults.	on page 4-219
+MANS	This command enables/disables NS for the active audio mode.	on page 4-220
+MAST	This command enables/disables sidetone for the active audio mode.	on page 4-221
+MATXV	This command sets uplink (microphone) volume.	on page 4-221
Access Control Commands		
A/	This command repeats the last command entered on the terminal.	on page 4-223
AT	This command checks the AT communication and only returns OK.	on page 4-223
+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.	on page 4-224
+EPIN	This command is only relevant for phones that use SIM cards. It verifies the PIN2 indicator.	on page 4-227
+TPIN	This command queries the number of remaining SIM PIN/PUK entering attempts.	on page 4-228



Table 2-1: AT Commands (Cont.)

AT Command	Description	Page
+CPWD	This command sets a new password for the facility lock.	on page 4-231
+CLCK	This command locks, unlocks or interrogates a H24 or a network facility <fac>.	on page 4-233
+MCTYPE	This AT command queries the card type currently used by H24 (SIM card or USIM card).	on page 4-236
+MGSMSIM	This command adjusts the H24 to work with a 2G SIM or a 3G SIM card types.	on page 4-237
Personalization Commands		
+MRPERSO	This command restores the configuration of personalization from a backup partition and overrides the existing configuration if exists.	on page 4-238
Note: The commands: +CPIN, +CLCK and +TPIN are common to the personalization as well as to other locking facilities of the H24.		
FOTA Commands		
+MFOTAWSCFG	This command sets the Web-Session default entry.	on page 4-239
+MFOTACNFG	This command enables setting the DM session as Automatic/Non-Automatic (i.e. Transparent/Non-Transparent).	on page 4-240
+MFOTAREQ	This command sends FOTA requests toward DTE.	on page 4-242
+MFOTARSP	This command is used to send response to +MFOTAREQ reports.	on page 4-243
+MFOTAINSTL	Installs the updated package.	on page 4-244
+MFOTAABORT	Aborts the DM session.	on page 4-244
+MFOTAIND	This command sends Unsolicited FOTA indications toward DTE.	on page 4-245
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.	on page 4-249
Q	This command determines whether to output/suppress the result codes.	on page 4-251
E	This command defines whether the H24 echoes the characters received from the user, (whether input characters are echoed to output).	on page 4-252
X	This command defines the data adaptor response set, and the CONNECT result code format.	on page 4-252
Sn	This command reads/writes values of the S-registers, and includes registers 1-49, 94, 96 (Audio) and 102 (Sleep mode).	on page 4-254
\S	This command displays the status of selected commands and S-registers.	on page 4-258



Table 2-1: AT Commands (Cont.)

AT Command	Description	Page
&F	This command restores the factory default configuration profile.	on page 4-258
Z	This command resets the default configuration.	on page 4-259
&V	This command lists the user's profile configurations.	on page 4-260
&W	This command stores the user profile configuration to the NV.	on page 4-260
&Y	This command sets the user profile to the power up configuration.	on page 4-263
Sleep Commands Description		
+MSLEEP	This command enables or disables the H24 to enter Sleep Mode.	on page 4-267
S24	This command sets the amount of time, in seconds, which H24 waits from the moment it detects that it can enter Sleep Mode until it actually enters Sleep Mode.	on page 4-268
S102	This command enables or disables (with zero value) the WKUPOUT pulses generation.	on page 4-269
S100	In order to limit the number of interrupts on the Terminal side and reduce data sending delay time on H24 side, the H24 can configure to generate WKUPOUT pulses when the interval (in [seconds]) between one burst of sent data to the other is bigger than specified in ATS100.	on page 4-270
+MSCTS	This command defines the behavior of the CTS line when the H24 is in Sleep mode.	on page 4-271
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 H24.	on page 4-272
+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.	on page 4-279
User Interface		
+CRSM	This command provides limited access to the Elementary Files on the SIM.	on page 4-285
+CSIM	This command allows a direct control of the SIM by a distant application on the TE.	on page 4-288
+CIND	This command is used to query the status of various ME indicators.	on page 4-289
+MIND	This command enables/disables some user indications to the TE.	on page 4-291
+MDSI	This command enables unsolicited reporting of indications of SIM deactivation and invalidation. The indications include the cause for deactivation and invalidation.	on page 4-293
Unsolicited UI Status Messages		
+CMER	Set command enables or disables sending of unsolicited result codes to TE in the case of indicators state changes.	on page 4-296



Table 2-1: AT Commands (Cont.)

AT Command	Description	Page
+CIEV	When an H24 indication is changed and the <ind> parameter of the +CMER command is set to 1, the +CIEV indication is sent to the DTE.	on page 4-297
GPRS/EDGE/UMTS		
GPRS Commands		
+CGCLASS	This command sets the GPRS mobile station class.	on page 4-299
+CGDCONT	This command specifies the PDP (Packet Data Protocol) context.	on page 4-300
+MPPP	This command sets PPP configuration.	on page 4-303
+MPAUTH	This command sets authentication parameters for PDP-IP packet data call.	on page 4-303
+CGQMIN	This command sets the minimum acceptable quality of service profile.	on page 4-306
+CGQREQ	This command displays the requested quality of service profile.	on page 4-308
+CGATT	This command attaches the H24 to the GPRS network.	on page 4-310
D*99	This command enables the ME to perform the actions necessary for establishing communication between the terminal and the external PDN.	on page 4-311
+CGACT	This command activates/deactivates the PDP Context.	on page 4-313
+CGPADDR	This command reads the allocated PDP addresses for the specified context identifiers.	on page 4-315
3G and EDGE Commands		
+CGEQREQ	This command allows the TE to specify a UMTS/EDGE Quality of Service Profile that is used when the UE sends an Activate PDP Context Request message to the network.	on page 4-316
+CGEQMIN	This command allows the TE to specify a minimum acceptable profile, which is checked by the UE against the negotiated profile returned in the Activate/Modify PDP Context Accept message.	on page 4-322
TCP/UDP IP		
MIP Commands Description		
+MIPCALL	This command creates a wireless PPP connection with the GGSN or CSD service provider and returns a valid dynamic IP for the H24.	on page 4-327
+MIPOPEN	This command causes the H24 module to initialize a new socket and open a connection with a remote side.	on page 4-330
+MIPCLOSE	This command causes the H24 module to free the socket accumulating buffer and disconnect the H24 from a remote side.	on page 4-334
+MIPSETS	This command causes the H24 to set a watermark in the accumulating buffer. When the watermark is reached, data is pushed from the accumulating buffer into the protocol stack.	on page 4-335



+MIPSEND	This command causes the H24 to transmit the data that the terminal provides, using an existing protocol stack.	on page 4-338
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Table 2-1: AT Commands (Cont.)

AT Command	Description	Page
+MIPPUSH	This command causes the H24 module to push the data accumulated in its accumulating buffers into the protocol stack.	on page 4-340
+MIPFLUSH	This command causes the H24 module to flush (delete) data accumulated in its accumulating buffers.	on page 4-342
+MIPCONF	This command allows to configure TCP stack parameters, such as retransmissions number, upper and bottom limits of retransmission timeout, close delay. It can be used to configure TCP socket parameters before socket activation or when the socket is in active state.	on page 4-343
+MIPXOFF	This unsolicited event is sent to the terminal to stop sending data.	on page 4-348
+MIPXON	This unsolicited event is sent to the terminal when the H24 has free memory in the accumulating buffer.	4-348on page 4-348
+MIPRTCP	This unsolicited event is sent to the terminal when data is received from the TCP protocol stack.	on page 4-349
+MIPRUDP	This unsolicited event is sent to the terminal when data is received from the UDP protocol stack.	on page 4-349
+MIPSTAT	This unsolicited event is sent to the terminal indicating a change in link status.	on page 4-350
+MIPDATA	This unsolicited event is sent to the terminal indicating a data comes from Network when H24 is in pseudo-command mode.	on page 4-351
+MPING	This command will allow verifying IP connectivity to another remote machine (computer) by sending one or more Internet Control Message Protocol (ICMP) Echo Request messages.	on page 4-352
+MPINGSTAT	This is the unsolicited response that the H24 sends to the terminal to inform of ping execution status update and provides summary statistics of ping request when ping request execution is completed.	on page 4-355
+MIPCSC	This AT command is used to configure the SSL feature behavior in case of non - fatal alerts.	on page 4-357
+MIPSSL	This unsolicited event is sent to the terminal indicating an errors, warnings or alerts that occurred during SSL connection.	on page 4-359
A-GPS		
Positioning Methods Configuration		
+MGPSMODE	Positioning mode configuration.	on page 4-364
+MGPSPROTO COL	Positioning assisted protocol configuration.	on page 4-365
User Plane Protocol Specific Configurations		
+MGPSURL	Set user plane server parameters.	on page 4-368



+MGPSSUPL	Set user plane security.	on page 4-369
Time To First Fix (TTFF)		

Table 2-1: AT Commands (Cont.)

AT Command	Description	Page
+MGPSTTFF	This command sets/gets TTFF mode.	on page 4-371
Application Level Location Request and Report		
+MGPSLOC	Location request and report.	on page 4-372
+MGPSQOS	Set QoS parameters.	on page 4-375
NMEA Streaming Output		
+MPNMEA	Configure NMEA path.	on page 4-377
+MNMEA	This command starts/stops NMEA messages.	on page 4-377
A-GPS LCS Standard Support		
+MGPSMOLR	Enables assistance data and/or location estimates.	on page 4-386
+MGPSECALL	GPS behavior in emergency call.	on page 4-387
A-GPS General		
+MGPSAPWR	Set Antenna Mode.	on page 4-388
RS232 Multiplexer Feature		
+CMUX	This command is used to activate the MUX protocol stack.	on page 4-393
Connectivity Configuration		
Connectivity Configuration Commands		
+MCONN	This command allows switching between listed connectivity configurations.	on page 4-396
+MPLOG	This command configures the logging channel.	on page 4-397





3. Introduction to AT Commands

3.1. AT Commands Overview

AT commands are sets of commands used for communication with the H24 cellular modem. AT commands are comprised of assemblies of IRA 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 H24 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:

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 H24 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 H24.

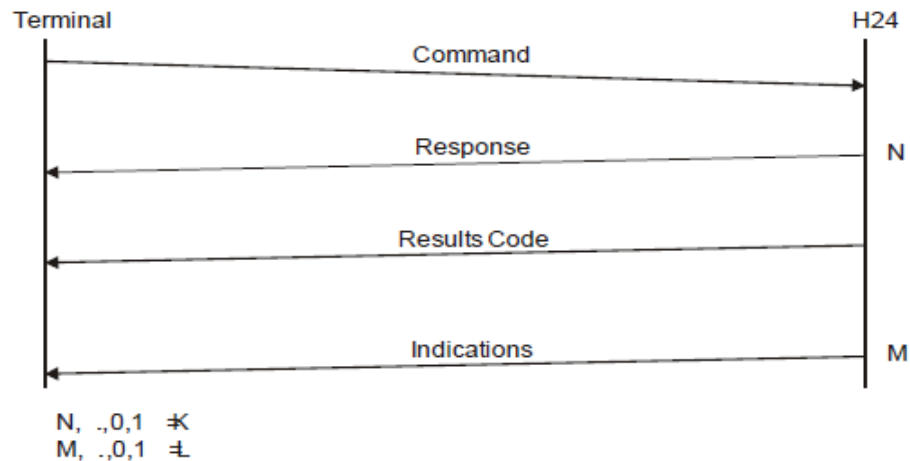


Figure 3-1: AT Commands Protocol

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 "result code" from the H24. 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 H24, "Indicator" messages are sent asynchronously. Indicators can be between 0 to L.

The H24 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:

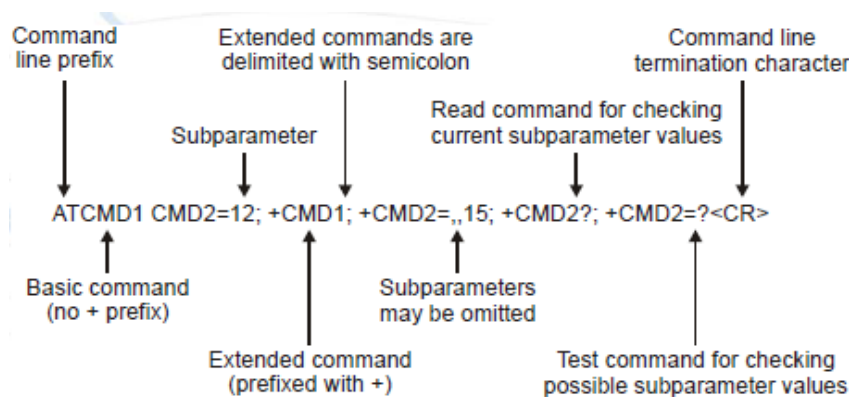


Figure 3-2: Basic Structure of a Command Line

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 IRA character to the modem.
- To execute the command line, send the <CR> IRA character.

3.3.2. Results Code Structure

When a command is issued, the H24 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 H24 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>.

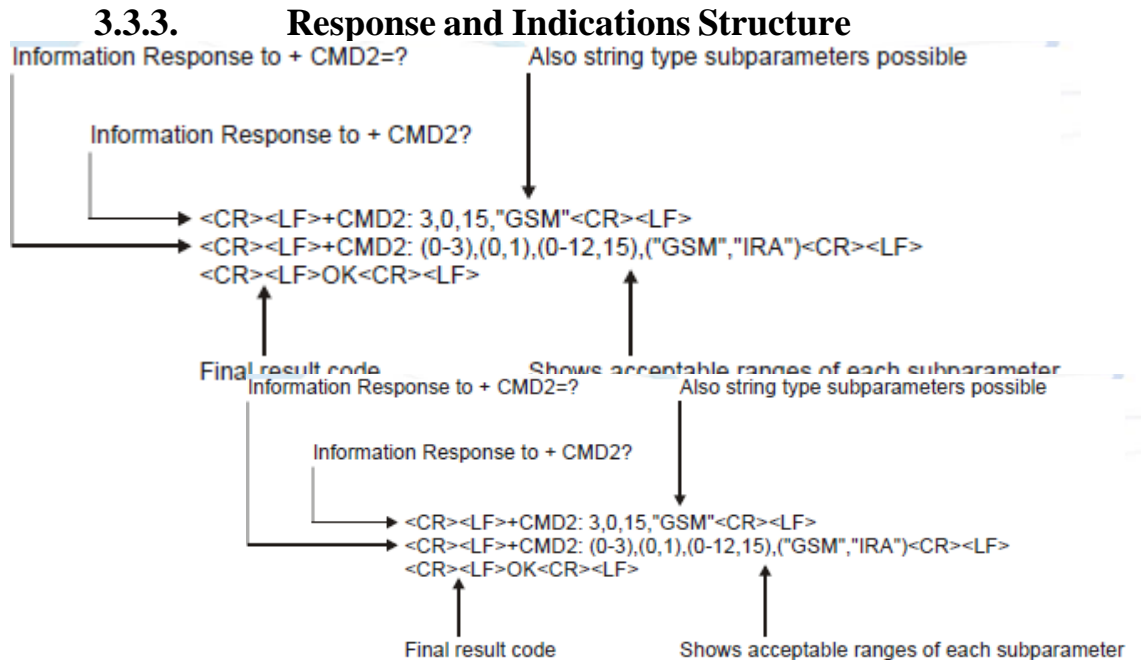


Figure 3-3: Response to a Command Line

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 H24 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 H24 (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 H24 operation.

3.4. AT Commands Protocol & Structure Configuration

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

The H24 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:



Command	Description
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 H24 does not echo commands).
Q[<value>]	Result code suppression (default 0, meaning the H24 transmits result codes).
V[<value>]	H24 response format (default 1, meaning verbose format).
X[<value>]	Defines CONNECT result code format.

The figure below shows the flow and structure configuration commands:

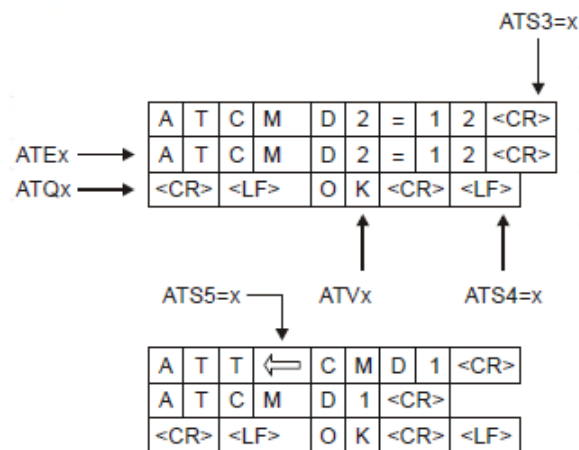


Figure 3-4: Flow and Structure Configuration Commands



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 H24, 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 H24, 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:

Value Range	Description
(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 H24. A single character is sufficient to abort the command in progress. To ensure that the aborting character is recognized by the H24, it should be sent at the same rate as the preceding command line. The H24 may ignore characters sent at other rates. When an aborting event is recognized by the H24, 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 H24, although the command is aborted following H24-network negotiation, the operation might be fully completed, partially completed or not executed at all.



4. AT Commands Reference

4.1. Modem ID

4.1.1. 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.

4.1.1.1. +CGMI, +GMI, +FMI, Request Manufacturer ID

These commands display manufacturer identification. The H24 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"
```



4.1.1.2. +CGMM, +GMM, +FMM, Request Model ID

These commands request the model identification. The H24 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: "GSM1800","GSM900","GSM1900","WCDMA2100","MODEL=H24"
OK
AT+GMM
+GMM: "GSM1800","GSM900","GSM1900","WCDMA2100","MODEL=H24"
OK
AT+FMM
+FMM: "GSM1800","GSM900","GSM1900","WCDMA2100","MODEL=H24"
OK
```

4.1.1.3. +CGMR, +GMR, +FMR, Request Revision

These commands request the revision identification. The H24 outputs a string containing the revision identification information of the software version contained within the device.

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

Example

```
R: "HAT+CGMR
+CGMR: "H24_U_OC.32.29R"
OK
```



```
AT+GMR  
+GM24_U_0C.32.29R"  
OK  
AT+FMR  
+FMR: "H24_U_0C.32.29R"
```

4.1.1.4. +CGSN, +GSN, Request Product Serial Number Identification

This command displays the product serial number identification IMEI (International Mobile station Equipment Identity). If the IMEI does not exist, an error will be returned. The command can be used even when the SIM card is not inserted.

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

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

Table 4-1: +CGSN, +GSN Parameters

<Parameter>	Description
<sn>	The IMEI (International Mobile Station Equipment Identity) number is composed of 15 digits, as specified by 3GPP TS 23.003 [3]. IMEI numbers are composed of the following elements, all in decimal digits: Type Approval Code (TAC) - 8 digits Serial Number (SNR) - 6 digits Spare digit - 1 digit The TAC and SNR are protected against unauthorized changes.

Example

```
AT+CGSN?  
+CGSN: "004400013805666"  
OK  
AT+GSN  
+GSN: "004400013805666"  
OK  
AT+CGSN=?  
OK
```



4.1.1.5. +CSCS, Select Terminal Character Set

This command selects the H24 character set. The H24 supports the following character sets: IRA, GSM, and UCS2.

The default value, set upon system initialization or when omitting <chest> in set command, is IRA.

Command Type	Syntax	Response/Action
Set	+CSCS=[<chset>]	OK or: +CME ERROR: <err>
Execute	AT+CSCS	OK or: +CME ERROR: <err>
Read	AT+CSCS?	+CSCS: <selected character set>
Test	AT+CSCS=?	+CSCS: (<supported character sets>)

The following table shows the +CSCS parameter optional values.

Table 4-2: +CSCS Parameters

<chset>	Character Set	Input/Output Format
"IRA"	IRA (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.)

```

Example
AT+CSCS=?
+CSCS: ("IRA","GSM","UCS2")
OK
AT+CSCS?
+CSCS: "IRA" 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="IRA" OK
AT+CPBR=1
    
```



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

4.1.1.6. +CIMI, Request IMSI

This command displays the International Mobile Subscriber Identity number.

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

Example

```
AT+CIMI
+CIMI: 314566320021400
```

4.1.1.7. ATIn, Request Identification Information

This command displays various H24 information items.

(The Set, Read and Test command are not supported for ATiXX).

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

The following table shows the information items that are supported by the H24.

ATIn	Description	Output
3	Reports Product Title	Motorola M2M Cellular Module
5	Reports Software Architecture	QC AMSS
7	Reports Product Description	H24 OEM Module
8	Reports Software Version	<current software revision>
9	Report manufacturing and generic/customer configuration file names	<manufacturing file name> <generic/customer file name>



10	Display factory tracking data	<Model number> <Kit number> <MSN>
-----------	-------------------------------	-----------------------------------------

Example

```
ATI3
Motorola M2M Cellular Module
OK ATI5
QC AMSS OK
ATI7
H24 OEM Module
OK ATI8
H24_OC.31.01_R06
OK ATI9
```

```
UC0H24000AA001
UM0H24000AA001
OK ATI10
Model Number: 1234567890
Kit number: 1234567890
MSN: 1234567890
OK
```

4.1.1.8. +CNUM, Request MSISDN(s)

This command displays up to five strings of text information that identify the H24. The output string contains double quotes.

On SIM cards that have EFmsisdn file, the string(s) returned are the MSISDN numbers and their associated data.

On SIM cards that don't have EFmsisdn file, the strings returned are the MSISDN numbers and their associated data stored in H24 NVM.

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 4-3: +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 //MSISDNs supported
+CNUM: "PHONENUM1", "2173848500", 129
+CNUM: "PHONENUM2", "2173848501", 129
+CNUM: "PHONENUM3", "2173848502", 129
```

```
AT+CNUM //MSISDNs not supported
```

OK

4.1.1.9. +CLAC, List of All Available AT Commands

This command is used to print out all AT commands supported by the H24.

Command	Syntax	Response/Action	Remarks
Execute	+CLAC	List of available AT commands	The Execute command displays a list of all the AT commands supported by the H24.

4.1.2. Capability Reporting

This set of commands enables a user to determine H24’s protocol level. It also enables other support provided by the H24, such as information about the currently implemented protocol version (used to detect older H24s that may not support all commands), as well as determining which optional commands are implemented in a particular H24 software load.



4.2. Call Control

4.2.1. Managing a Circuit Switched Call

Basic managing of CS (Circuit Switched) calls in H24 follows the ITU V.25ter recommendation.

Specific details for each call control operations are found below in the Call Control AT Commands section.

The D, A, and H basic AT commands are used for basic Dialing Answering and Releasing CS calls.

The main behavior difference between established voice and data call is the working mode. Once a voice call is established the working mode remains being command mode while once a data call is established the working mode is data mode.

- **Data Mode:** In this mode, once the H24 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 H24 becomes a transparent link, connecting the terminal with the remote side.
- **Command Mode:** In this mode, the H24 responds to the AT commands issued by the terminal. This is the default working mode.

In case of a data call, it is possible to switch between the working modes. Though the command mode is now slight different and it behaves as “online command mode”. More of that is described below and in the ITU V.25ter.

Learn mode on simultaneous working modes in the Multi channeling section.

Voice call allows extended features such as call manipulation multi party and sending DTMF tones. See below the +CCWA and +CHLD AT commands.

Call status and information can be received by using the +CLCC command.

More information on fax calls in the Dial command and Fax sections.

4.2.1.1. Simple Circuit Switched Dialing

To dial a data call, send ATD<number> for example ATD8765555

After issuing the Dial command, and if the remote modem answers the call, the two modems negotiate to establish the transmission speed and other parameters for the data connection. After successful negotiation process, the message, "CONNECT" 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.

To dial a voice call, send ATD<number>; for example ATD8765555;

Once request is sent to the network the message, "OK" is received; once call is connected a 2nd



message "OK" is received. In case user wishes to receive "CONNECT" instead of "OK" in the 2nd message, it can be configured using the +MDC command. 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.

When voice call is established the voice is routed to the audio lines (Microphones, Speakers or PCM) see more in Audio section. Once a voice call is active it is possible to send DTMF tones using the +VTS command. It is also possible to prepare a DTMF string in advance within the dial command, the tones will be sent once the voice connection established see below "Dialing to an Electronic Telephone Service". More details in the dial command "D".

4.2.1.2. Circuit Switched Data - Baud Rate

Baud rate must be set higher than the network's rate.

4.2.1.3. Circuit Switched Data - Switching From Data Mode to Online Command Mode

While in an active data call, to switch the connection from Data mode to Online Command mode, send the Escape Sequence command (+++) or toggle the DTR line, while &D parameter is configured to 1 a priori.

If the modem responds with "OK" to the Escape command, the modem is in Online Command mode and the data connection is still active, but the AT command set can be used. To switch back to Data mode use the "O" command.

Note: The character '+' in the Escape Sequence pattern can be changed using the S2 S-register. Refer to "S, Bit Map Registers".
As well the timing between each '+' can be controlled using the S12 S-register.
Escape is detected only by the H24 and not by the remote side. The remote side stays in the Data mode.

4.2.1.4. Hanging Up a Circuit Switched call

Use the hang-up command ATH to release a CS call. The message "NO CARRIER" is received indicating connection is closed followed by "OK". In case of more then one call (multi party) involved pay attention to the different behaviors described in the ATH command and the +CHLD command. For example in case of an alerting waiting call, hanging it up requires sending the AT+CHLD=0 command, ATH just hangs up the active call.

To hang up an active data call, return to the Online Command mode by typing the Escape Sequence, +++, and then hang up by sending ATH. A 2nd option is to toggle the DTR line, while &D parameter is configured to 2 a priori.



4.2.1.5. Answering a Circuit Switched Call

Incoming call is indicated to the terminal in two options through toggling of the RI line and the RING indication.

Extended information on the incoming call can be achieved using the +CRC (call type) command and the +CLIP command.

Once alert is indicated to the terminal answering the incoming call is done by basic A command. When answering a data call the modem negotiates with the calling modem to establish the transmission speed and other parameters for the data connection. Successful negotiation will

result in receiving the message "CONNECT" and the mode is changed to data mode; failure will result in receiving the message "NO CARRIER" indicating call is released.

When answering a voice call successful answer will result in receiving the message "OK"; failure will result in receiving the message "NO CARRIER" indicating call is released.

4.2.1.6. Dialing to an Electronic Telephone Service

When dialing 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 dial command might look like this:
`ATD876-5555,1234,,56;`

The modem dials the number `5555', it then wait for the call connection. The 1st comma in the dial string indicates this request. The rest of the digits after the `, ' will be sent as DTMF tones. Other colons after the 1st one will be considered pause mark with a constant value. A longer pause can be created by several commas. The constant value of the comma time length can be configured using the S-register S8.

4.2.1.7. Circuit Switched Voice and Data Call Interaction

The following table shows the voice and data call interaction.

RAT	Active Call	Interrupt	Result
X	CS Voice	MO CSD call	MO CSD is rejected.
X	CSD	MO CS voice call (not emergency)	MO CS voice call is rejected.
X	CSD	MO emergency voice call	CSD is released and CS Data and Voice interaction emergency call is established.
3G	CSD	Incoming CS voice	Waiting call is rejected.



3G	CS Voice	Incoming CSD	Waiting call is rejected.
2G	CSD	Incoming CS voice	CS voice is alerting and can be answered.
2G	CS Voice	Incoming CSD	CSD is alerting but can't be answered.

4.2.2. Call Control AT Commands

4.2.2.1. 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 "CONNECT" notification is sent to the terminal from the device, and it moves to the online Data/Fax state.

Note 1: If there is an active voice call and the terminal sends another ATD voice call command to the device, the active call is put on hold and the new number is called.

Note 2: Dialing a fax call is possible under two conditions, first the correct bearer service has to be set, see +CBST command. The second condition is that the RAT has to be GSM; fax is not supported in WCDMA RAT. In order to manually switch to GSM RAT the +COPS command should be used.

The format of the command is provided below:

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



The following table shows the D parameters.

Table 4-4: D Parameters

<Parameter>	Description
<number>	<p>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.</p>
semicolon (;)	When given after <number string>, a voice call is originated to the given address, otherwise a data call is originated.

Note: ATDP, ATDT, <T> and <P> 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"
For dialing emergency numbers see "EN" storage at "+CPBS, Select Phone Book Memory Storage".

Example

```

atd44345678; //VOICE call (with semicolon) OK
OK
atd44345678 //DATA/ FAX call (without semicolon)
...
CONNECT //Move to online Data state

```



4.2.2.2. D>, Direct Dialing from Phone Books

This command places a FAX/DATA/VOICE call on the current network by dialing directly from the H24 phone book.

- Notes:**
- "+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.
 - When SM phonebook is searched and the given entry value is of the ME phonebook, ME phonebook will be searched as well (result code would be the same as if MT phonebook was searched).

The format of ATD> command is provided below:

Command	Detailed Description
D><alpha>[;]	Originates a call to a phone number with the corresponding alphanumeric field <alpha>. The Current Phone Book (Set by +CPBS) 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=?. 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 Current Phone Book (Set by +CPBS).

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

The following table shows the D> parameters.

Table 4-5: 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 not be placed in quotes.
<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">	This parameter is not case-sensitive, and should be placed in quotes ("mem").

Example

```
AT+CMEE=2 //extended errors AT+CPBS="me" //Phone flash memory OK
AT+CPBW=1,"035659090",129,"VoiceMail" OK
```



```

AT+CPBR=1
+CPBR: 1,"035659090",129,"VoiceMail" OK
AT+CPBR?
+CPBS: "ME",6,500 // test of phone memory's Phonebook
OK
AT+CPBF="" //list of current Phonebook entrance
+CPBF: 1,"035659090",129,"VoiceMail"
+CPBF: 2,"046750227",129,"jv"
+CPBF: 3,"0576750228",129,"505"
atd>VoiceMail;//Phonebook by name
OK OK
    
```

```

ath
NO CARRIER OK
atd>1; //Speed dial from phonebook
OK // call to number- 035659090
OK
ath
NO CARRIER OK
atd>501;
+CME ERROR: not found //there is no number on index 501 or with name - 501 atd>505;
OK // call to number- 0576750228
OK
ath
    
```

NO CARRIER OK

4.2.2.3. 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”)

The format of the command is provided below:

Command	Detailed Description
ATDL[;]	<p>VOICE CALL: 1st response - Voice call place begins OK 2nd response - Voice call connected: OK</p> <p>DATA/FAX: 2nd response only - Data/Fax call connected CONNECT or CONNECT <text> result code (<text>: speed of connection, depends on ATX value).</p>



The following table shows the DL parameters.

Table 4-6: 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), a NO CARRIER will be returned to the DTE.
- ATDL dials the last number saved in the DC Phone book (ME Dialed calls).

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
```

4.2.2.4. H, Hang-up Call

This command hangs up a call. The H24 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 H24 causes the Data/Fax call termination, and NO CARRIER is sent from the H24 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”.

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



CARRIER
OK

4.2.2.5. 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 H24 sends a OK/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 while a call is in progress) 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 ATA command, which will put the active call on hold and will connect the waiting call, making it the active call. This ATA action is the same action as AT+CHLD=2.

Example

Example - Answering a voice call: AT+CRC=1
+CRING: VOICE
+CRING: VOICE
ata
OK //VOICE call connected -
device 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 - device
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).

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



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This command controls whether or not to present the extended format of an incoming call indication. The RING/+CRING indication is sent from the device to the terminal when the device 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.

Command Type	Syntax	Response/Action	Remarks
Set	+CRC=[<n>]	OK or: CME ERROR: <error>	The Set command enables/disables the extended format of an incoming call indication.
Execute	AT+CRC	OK	The Execute command selects the default settings (the extended format of an incoming call is disabled).
Read	+CRC?	+CRC: <n> OK	The Read command queries the current settings for the cellular result code.
Test	+CRC=?	+CRC: (list of supported <n>s)	The Test command returns the possible types of supported settings.

RING/+CRING Indication

+CRING: <type>
or:
RING

The following table shows the +CRC parameters.

Table 4-7: +CRC Parameters

<Parameter>	Description
<n>	0 Extended format disabled 1 Extended format enabled The default value is 0.
<type> ASYNC REL ASYNC FAX VOICE ALT	Type of incoming call: asynchronous transparent asynchronous non-transparent Fax class 1 Normal voice 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



4.2.2.7. +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 device.

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

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

Command Type	Syntax	Response/Action	Remarks
Set	AT+CLIP=<n>	OK Or: +CME ERROR: <err>	The Set command enables or disables the presentation of the CLI indication from the device to the terminal. Note: The Set command does not address the network.
Execute	AT+CLIP	OK	The Execute command set default +CLIP state (disable).
Read	AT+CLIP?	+CLIP: <n>, <m> OK	The Read command returns the +CLIP enable/disable state in the device as well as in the network provisioning state of the CLI presentation.
Test	AT+CLIP=?	+CLIP: (list of supported <n>s) OK	The Test command returns the Set command options (0,1).

+CLIP Indication

When the CLI presentation indication is enabled by the H24 (<n>=1), this unsolicited indication is sent to the terminal after the RING indication.

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



The following table shows the +CLIP parameters.

Table 4-8: +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
<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
<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: (0-1)

OK //CLI presentation is disabled
by the H24 (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
    
```

4.2.2.8. +CCWA, Call Waiting Command

This command controls the Call Waiting supplementary service, including the settings and the queries of the H24 and the network. When the Call Waiting indication is enabled by the H24 and there is a waiting call, a +CCWA: indication is sent from the H24 to the terminal.

Note: The H24 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.

Action	Syntax	Response	Remarks
Set	+CCWA=[<n>[,<mode>[,<class>]]]	OK If <mode>=2 and the command succeeds: +CCWA: <status>,<class1> [<CR><LF>+CCWA: <status>,<class2> [...]] OK	The Set command enables/disables the Call-Waiting indication in the H24 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 action is performed while querying the network.
Read	+CCWA?	+CCWA: <n> OK	The Read command returns the enable/disable status of the call waiting indication in the H24 (<n>).
Test	+CCWA=?	+CCWA: (list of supported <n>s)	The Test command returns <n> values supported by the H24 as a compound value.

+CCWA Indication

When a call-waiting indication is enabled by the H24 (<n>=1), the following unsolicited indication is sent to the terminal from the H24:

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



The following table shows the +CCWA parameters.

Table 4-9: +CCWA Parameters

<Parameter>	Description
<n>	Enables/disables the call waiting indication to the terminal by the H24. 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
<class>	Sum of integers each representing a class of information. 1 - Voice 2 - Data - refers to all bearer services 4 - Fax 16 - Data circuit sync 32 - Data circuit async The default value is 255.
<"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 H24 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 H24
OK AT+CCWA=?
+CCWA: (0,1) OK
```



```

AT+CCWA?
+CCWA: 1
OK
Examples of +CCWA set command - network interrogation
AT+CCWA=0,2           // query when all class CW
feature is disabled
+CCWA: 0,255          // query report - all classes are
disabled
OK
AT+CCWA=1,2,2         //Class parameter is 2 - set call
wait for all bearer services
OK
AT+CCWA=0,2           // query all classes
+CCWA: 1,16           // Data circuit sync enabled
+CCWA: 1,32           // Data circuit async enabled
OK AT+CCWA=1,1
OK                     //Enable the call waiting feature
in the network, and in the H24
Example +CCWA indication
atd9311234567;        //Originate a voice call
OK
OK                     //Voice call connected
(...conversation...)
(... call waiting indication received by the H24 ...)
+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

```



4.2.2.9. +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 H24, 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 H24 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 device is in control of one active call and one call on hold. In this situation, the device 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 a MTPY call with one call index numbered as 1.

Execute Command

The Execute command works like `at+chld=2`.

Read Command

The Read command is not supported.

Test Command

The Test command returns possible options for the Set command.



The following table shows the +CHLD parameters.

Command Type	Syntax	Response/Action	Remarks
Set	AT+CHLD=<n>	<p>If the call is terminated: OK (approve request was submitted) NO CARRIER</p> <p>If the call state is changed (link, split, from active to hold, and so on): OK (approve request was done)</p> <p>If the call is terminated and another call is answered: OK (approve request was submitted) NO CARRIER OK (call answered and is now connected)</p>	
Execute	AT+CHLD	OK	
Read	AT+CHLD?	CME ERROR: operation not supported	
Test	AT+CHLD=?	+CHLD: (list of supported <n>s) OK	

Table 4-10: +CHLD Parameters

<Parameter>	Description
<n>	<p>Call hold operation:</p> <ul style="list-style-type: none"> 0 - Releases all held calls <p>OR</p> <p>Sets User Determined User Busy for a waiting call</p> <ul style="list-style-type: none"> 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 <p>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.</p>



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

Table 4-11: +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/Held 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.	Accepts waiting call.	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	Accepts waiting call.	Error 3	Accepts waiting call.	Accepts waiting call.	Error 3
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

+CHLD Actions According to Call State and Operation(Cont).

Call State	CHLD <operation>					
	0 - Release Held Call	1- Release Active Call, Accept Held Call	1x - Release Active/Held 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
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, accepts waiting call.	Split. If x does not exist, then error 22.	Error 3
Single Held Call	Releases held call.	Accepts held call.	Releases held call.	Accepts held call.	Error 3	Error 3



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MTPY Held Call	Releases held call.	Accepts held call.	Releases specific active call x. If x does not exist, then error 22.	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.
<p>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".</p>						

Example

```

AT+CHLD=?
+CHLD: (0,1,1x,2,2x,3)
OK
AT+CCWA=1           //Enable call waiting
OK

RING                // MT voice call
AT+CHLD=0

NO CARRIER         // BUSY appears on other
device
OK
RING                // MT voice call
AT+CHLD=1
OK                  // accept the MT call
AT+CHLD=1          //Release the active call NO
CARRIER
OK
RING                // MT voice call
    
```



```

AT+CHLD=11
+CME ERROR: operation not allowed
RING AT+CHLD=2
OK // accept the MT call
AT+CHLD=1 //Release the active call NO
CARRIER
OK
RING // MT voice call
AT+CHLD=21
OK // accept the MT call ATH
//Release the active call NO

CARRIER
OK RING AT+CHLD =22
+CME ERROR: operation not allowed
RING AT+CHLD =3
+CME ERROR: operation not allowed
RING
AT+CHLD=1 // accept the MT call
OK
ATH //Release the active call
NO CARRIER 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



4.2.2.10. +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.

Command Type	Syntax	Response/Action	Remarks
Set	+CCFC=<reason>,<mode> [,<number>,<type>,<class> [,<subaddr>,<satype>,<time>]]]]]]	<p>If the command succeeds: +CCFC: <status>,<class1>[,<number>,<type> [,<subaddr>,<satype>,<time>]]][<CR> <LF> +CCFC: <status>,<class2>[,<number>,<type> [,<subaddr>,<satype>,<time>]]][...]</p>	<p>Remarks The Set command instructs the H24 which call forwarding settings to request from network. The Set command, in query mode, interrogates the network about the subscriber current call forwarding status.</p>
Test	+CCFC=?	+CCFC: (list of supported <reason>s) OK	The Test command returns <reason> values supported by the H24 to the terminal.



The following table shows the +CCFC parameters.

Table 4-12: +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>.
<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.
<classx>	The sum of integers each represents a class of information. 1 - Voice 2 - Data - refers to all bearer services. 4 - Fax 8 - short message service 16 - data circuit sync 32 - data circuit async 64 - dedicated packet access 128 - dedicated PAD access Default value is 5. Note: If classx value 7 is selected, the result will still be voice and fax only (as in value of 5).
<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.
<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 <classx>. This means that there can be a different <number> for the same <reason> because of a different <classx>.
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  
//Register UC forward-to of all voice call  
AT+CCFC=0,3,"01256316830",129,1  
OK
```

```
AT+CCFC=1,2 //Interrogate reason not-  
reachable of all classes.  
+CCFC: 1,1,"+97254151200",145,, OK
```

```
//Register C forward-to data circuit sync after 15 sec.  
AT+CCFC=1,3,"0541234567",129,16,,15  
OK
```

```
//Register C forward-to data circuit async - default 20 sec.  
AT+CCFC=1,3,"0541234567",129,32  
OK
```

```
AT+CCFC=1,2 //Interrogate reason not-  
reachable of all classes.  
+CCFC: 1,16,"+972541234567",145,,  
+CCFC: 1,32,"+972541234567",145,, OK
```

```
AT+CCFC=0,0 //Deactivate UC forward-to of  
all classes. OK
```

```
AT+CCFC=0,2 // Interrogate UC forward -  
forward calls are disabled  
+CCFC: 0,255  
OK
```

```
AT+CCFC=0,1 //Activate UC forward-to of all  
classes. OK
```

```
AT+CCFC=0,2 // Interrogate UC forward -  
forward calls are enabled  
+CCFC: 1,1,"+ 972541234567",145,, OK
```

```
AT+CCFC=4,2  
+CME ERROR: retry operation
```



4.2.2.11. +CLIR, Calling Line Identification Restriction

This command instructs the H24 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 H24 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 H24 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.

Command Type	Syntax	Response/Action	Remarks
Set	+CLIR=<n>	OK	The Set command instructs the H24 to enable/disable CLI restriction for all MO calls.
Read	+CLIR?	+CLIR:<n>,<m> OK	The Read command returns the current setting of CLIR on the network <m> and on the H24 <n>.
Test	+CLIR=?	+CLIR: (list of supported <n>s)	The Test command returns <n> values supported by the H24.



The following table shows the +CLIR parameters.

Table 4-13: +CLIR Parameters

<Parameter>	Description
<n>	Adjustment for outgoing calls 0 - Presentation indicator is used according to the subscription of the CLIR service 1 - CLIR invocation 2 - CLIR suppression The default is 2.
<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=1
OK
atd054565195; //MO voice call
OK
(... calling ...)
(... a H24 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 H24 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
    
```



4.2.2.12. +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.

Command Type	Syntax	Response/Action	Remarks
Set	+MDC=<mode>	OK or: ERROR	The Set command selects which of the supported messages will be displayed upon connection of a voice call.
Execute	AT+MDC	OK	The Execute command selects the default (OK) message.
Read	+MDC?	+MDC: <mode> OK	The Read command returns the current selection of the supported messages.
Test	+MDC=?	+MDC: (list of supported <mode>s) OK	The Test command returns the possible types of supported messages.

The following table shows the +MDC parameters.

Table 4-14: +MDC Parameters

<Parameter>	Description
<mode>	0 - Displays OK upon voice call connection. 1 - Displays CONNECT upon voice call connection. <u>Default Values:</u> Power Up - As previously saved in NVM FLEX bit. 0 - Before Set command is first used.

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
    
```



4.2.2.13. +MFIC, Filtering Incoming Calls

This command instructs the H24 to query or set Filtering Incoming Calls parameters. The command will not work if SIM card is not present or if SIM card is not in READY state.

MFIC parameters are saved after power cycle.

This feature is not active by default.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MFIC=[<state>[,<pb>]]	OK or: +CME ERROR: <err>	
Read	AT+MFIC?	+MFIC=<state>,<pb>, OK	
Test	AT+MFIC=?	+MFIC: (list of supported <state>s),(list of supported <pb>s) OK or: +CME ERROR: <err>	

The following table shows the +MFIC parameters.

Table 4-15: +MFIC Parameters

<Parameter>	Description
<state>	This parameter hold the state of the feature: 0 - Filtering is disabled (default value). 1 - Filtering Calls is enabled.
<pb>	Sets the phonebook to be searched when there is an incoming call: SM - Search will be done on SIM phonebook only. (Default value). ME - Search will be done on modem internal phone book only.

Example

```
AT+MFIC=?
+MFIC: (0-1),("SM","ME") OK
```

```
AT+MFIC=1,"SM" //Enable filtering SIM phone
book. OK
```

```
AT+MFIC?
```



```

+MFIC: 1,"SM"           //Read MFIC parameters
OK

AT+MFIC=0               //Disable the MFIC feature. OK

AT+MFIC=0,"ME"         //Disable filtering of ME phone
book entries.
+CME ERROR: operation not allowed

AT+MFIC?
+MFIC: 0,"SM"          //Read MFIC parameters. OK

AT+MFIC=1               //Enable the MFIC Voice Call
feature. OK

AT+MFIC?
+MFIC: 1,"SM"          //Read MFIC parameters. OK

AT+CPBS="ME"            //Change the phone book
storage to ME storage. OK

AT+CPBW=1,"+972545658279" //Save the sending phone
number in the phone book. OK

//Call from +972545658279

RING                    //Call is accepted
RING

//Call from +97254555555.

//Call from +97254555555 is dropped.

```

4.2.2.14. +CBST, Select Bearer Service Type

This command sets the 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.



Note: For Circuit Switched Data calls, baud rate must be set higher than the network's rate.

Command Type	Syntax	Response/Action	Remarks
Set	AT+CBST=[<speed>[,<name> [,<ce>]]]	OK +CME ERROR: <err>	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. Note: For incoming calls, the bearer service will be taken automatically from incoming parameters and not according to the CBST Set command.
Read	AT+CBST?	+CBST: <speed>,<name>,<ce> OK	
Test	AT+CBST=?	+CBST: (list of supported <speed>s),(list of supported <name>s),(list of supported <ce>s) OK	The Test command returns values supported by the MA as compound values.

The following table shows the +CBST parameters.

Table 4-16: +CBST Parameters

<Parameter>	Description
<speed>	Data rate value Note: When AT+CBST=0 and ATX>0, data rate is not returned after 'CONNECT' unless it's an MT call in GSM. The data rate returned in MT side is the network's and not the ME's.
<name>	0 - Data circuit asynchronous (default) 1 - Data circuit synchronous
<ce>	0 - Transparent 1 - Non-transparent (default)

H24 supports the following settings in GSM mode:

Table 4-17: +CBST Settings in GSM Mode

+CBST Command	Protocol	* WAIUR Air bit rate [Kbps]	** FNUR Air bit rate [Kbps]	Attributes	Comments



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AT+CBST=0,0,1		9.6	Undef	Nontransparent asynchronous	Auto-bauding (automatic selection of the speed; this setting is possible in case of 3.1 kHz modem and non-transparent service).
AT+CBST=7,0,1	V.32	Undef	Undef	Nontransparent asynchronous	
AT+CBST=12,0,1	V.34	9.6	9.6	Nontransparent asynchronous	
AT+CBST=14,0,1	V.34	14.4	14.4	Nontransparent asynchronous	Default setting.
AT+CBST=39,0,1	V.120	Undef	Undef	Nontransparent asynchronous	
AT+CBST=43,0,1	V.120	14.4	14.4	Nontransparent asynchronous	
AT+CBST=71,0,1	V.110	Undef	Undef	Nontransparent asynchronous	
AT+CBST=75,0,1	V.110	14.4	14.4	Nontransparent asynchronous	
AT+CBST=7,1,0		Undef	Undef	Transparent synchronous	FAX Group3 Class1



H24 supports the following settings in WCDMA mode:

Table 4-18: +CBST Settings in WCDMA Mode

+CBST Command	Protocol	* WAIUR Air bit rate [Kbps]	** FNUR Air bit rate [Kbps]	Attributes	Comments
AT+CBST=0,0,1		57.6	NA	Nontransparent asynchronous	Auto-bauding (automatic selection of the speed; this setting is possible in case of 3.1 kHz modem and non-transparent service).
AT+CBST=14,0,1	V.34	14.4	14.4	Nontransparent asynchronous	Default setting.
AT+CBST=16,0,1	V.34	28.8	28.8	Nontransparent asynchronous	
AT+CBST=17,0,1	V.34	57.6	33.6	Nontransparent asynchronous	
AT+CBST=43,0,1	V.120	14.4	14.4	Nontransparent asynchronous	
AT+CBST=48,0,1	V.120	28.8	28.8	Nontransparent asynchronous	
AT+CBST=51,0,1	V.120	57.6	56	Nontransparent asynchronous	
AT+CBST=75,0,1	V.110	14.4	14.4	Nontransparent asynchronous	
AT+CBST=80,0,1	V.110	28.8	28.8	Nontransparent asynchronous	
AT+CBST=81,0,1	V.110	57.6	38.4	Nontransparent asynchronous	
AT+CBST=83,x,1	X.31 FS	57.6	56	Nontransparent asynchronous	Frame Tunneling mode x:0=UDI, 4=RDI.
AT+CBST=84,0,1	X.31 FS	57.6	64		Frame Tunneling mode.
AT+CBST=116,1,0		Undef	64	Transparent synchronous	***UDI
AT+CBST=134,1,0	H.223/H.245	Undef	64	Transparent synchronous	Multimedia UDI

Note: * WAIUR - Wanted Air Interface User Rate.

At the call setup the mobile station sends a set of parameters describing the characteristics to the network.

** FNUR - Fixed Network User Rate.



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One of WAIUR parameters and represents the Fixed Network User Rate. It is the user rate between IWF (InterWorking Function) and the fixed network.

*** UDI - Unified Display Interface.

Example

AT+CBST=?

+CBST:

(0,7,12,14,16,17,39,43,48,51,71,75,80,81,83,84,116,134),(0,1,4),(0,1
)

OK AT+CBST?

+CBST: 14,0,1

OK AT+CBST=17

OK AT+CBST?

+CBST: 17,0,1

OK



4.2.2.15. O, Return to Online Data State

This command returns the H24 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 consecutive escape characters is configured using the S12-register.

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

Example

```

ATD035684072 //Calling a remote modem - data
call
CONNECT //H24 is in Data mode
//Escaping back to Command mode using the +++ sequence
OK
AT //H24 is in Command mode
OK
ATO //Returning to Data mode
CONNECT
    
```



4.2.2.16. +CR, Service Reporting Control

This command controls whether or not the extended format of an outgoing or incoming data call is displayed or not. The +CR indication is sent from the H24 to the terminal whenever a data call is established.

Command Type	Syntax	Response/Action	Remarks
Set	+CR=<mode>	OK OR +CME ERROR: <err>	The Set command enables/disables the extended format of a data call. When enabled, the 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.
Read	+CR?	+CR:<mode> OK	The Read command displays the current service reporting control setting.
Test	+CR=?	+CR:<mode range> OK	The Test command displays the list of supported CR modes.
Execute	+CR	OK	The execute command sets the default value of <mode>.

The following table shows the +CR parameters.

Table 4-19: +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.

Example

```
AT+CR=1 //Enable reporting
OK ATD1234567890
+CR: REL ASYNC
AT+CR=?
+CR: (0,1)

OK
```

4.2.2.17. +MVC, Motorola Vocoders Configuration

This AT command is used to choose and configure the priority order of the supported voice codecs (vocoders).

The phone will not need to restart after setting parameters.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MVC=<n>[,<p1>[,<p2>[,<p3>[,<p4>[,<p5>]]]]	OK or: +CME ERROR: <err>	The command will save new vocoders configuration or restore the default configuration.
Read	AT+MVC?	+MVC: <p1>[,<p2>[,<p3>[,<p4>[,<p5>]]]] OK or: +CME ERROR: <err>	The command will read the current vocoders values.
Test	AT+MVC=?	+MVC: (0-1),(1-5),(1-5),(1-5) ,(1-5),(1-5),(1-5) OK	The command shall return the list of supported <n>,<p1>,<p2>,<p3>,<p4>,<p5>,<p6> values.

The following table shows the +MVC parameters.

Table 4-20: +MVC Parameters

<Parameter>	Description
<n>	0 Restore default vocoder configuration. 1 Set vocoders and their priority order.
<p1>,<p2>,<p3>,<p4>,<p5>,<p6>	1 GSM full rate speech version 1. 2 GSM half rate speech version 1. 3 GSM full rate speech version 2 (EFR). 4 GSM full rate speech version 3 (AMR Full Rate). 5 GSM half rate speech version 3 (AMR Half Rate). 6 UMTS full rate speech (UMTS AMR Full Rate).

Example

```
AT+MVC=0
OK AT+MVC=1,1,3,5
OK AT+MVC?
+MVC: 1,2,3
OK AT+MVC=?
+MVC: (0-1),(1-5), (1-5), (1-5), (1-5), (1-5) OK
```

The meaning of the AT+MVC=1,1,3,5 command is:

The modem is able to support GSM full rate speech version 1, GSM full rate speech version 2 (EFR), GSM half rate speech version 3 (AMR Half Rate) **only**:



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- GSM full rate speech version 1 is the first priority
- GSM full rate speech version 2 (EFR) is the second priority
- GSM half rate speech version 3 (AMR Half Rate) is the third priority

The GSM half rate speech version 1 and GSM full rate speech version 3 (AMR Full Rate) will not be supported by the modem.



4.2.2.18. +MTTY, Motorola TTY Configuration

This AT command selects the TTY (Tele Typewriter) mode. This command only selects the TTY mode. Activation of TTY is done by AT+MAMOD=6 (See +MAMOD for activation or deactivation of TTY).

Note: Tele-typewriter or Teletype, a typewriter with an electronic communication. TTY is an electronic device for text communication via a telephone line, used when one or more of the parties have hearing or speech difficulties.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MTTY=<n>	OK or: +CME ERROR: <err>	The SET command is used for setting the current TTY mode.
Read	AT+MTTY?	+ MTTY : <n> OK or: +CME ERROR: <err>	The READ command returns the current TTY mode <n>.
Test	AT+MTTY=?	+MTTY : (1-3) OK or: +CME ERROR: <err>	The Test command returns the possible value's range.

The following table shows the +MTTY parameters.

Table 4-21: +MTTY Parameters

<Parameter>	Description
<n>	<ul style="list-style-type: none"> 1 Full TTY mode (both uplink and downlink support TTY data; used when both side parties are deaf). 2 VCO mode (Voice Carry Over- uplink is voice active downlink is TTY). 3 HCO mode (Hearing Carry Over-downlink is voice active uplink is TTY). <p>Value is saved in NVM.</p>

Notes:

VCO: Voice Carry Over is intended 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) will type back exactly what is said and it will appear on the screen of your TTY or VCO phone.



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.

Figure 4-1: TTY Hardware Configuration shows the TTY hardware configuration.

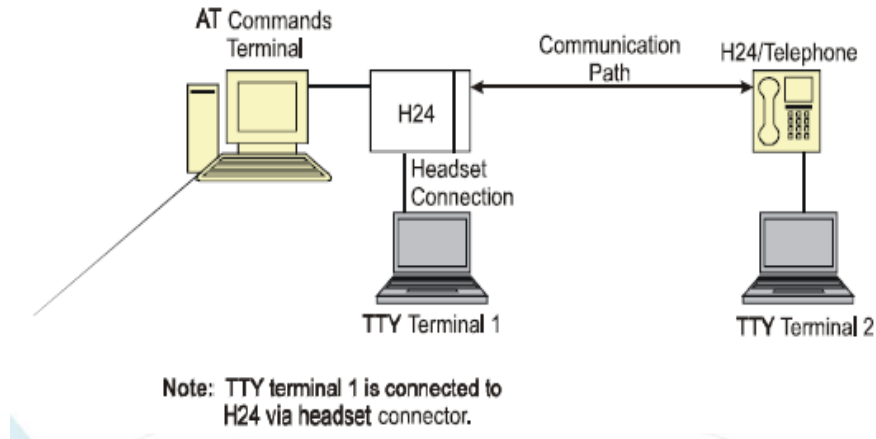


Figure 4-1: TTY Hardware Configuration

Example

```
AT+MTTY=?
+MTTY: (1-3) OK
```

```
AT+MTTY=1
OK
```

```
AT+MTTY?
+MTTY: 1
OK
```

4.2.3. Call Status Messages

4.2.3.1. +CPAS, Phone Activity Status

This command displays the current activity status of the H24, for example, call in progress, or ringing.

Command Type	Syntax	Response/Action	Remarks
Set	AT+CPAS=<mask>	+CPAS: <pas> OK or: +CME ERROR: <err>	The Set command returns the activity status <pas> of the <mask> call type of H24. It can be used to interrogate the H24.
Execute	AT+CPAS	+CPAS: <pas> OK or: +CME ERROR: <err>	The Execute command return the activity status <pas> of the H24. It can be used to interrogate the H24.
Read	AT+CPAS?	+CPAS: <mask> OK or: +CME ERROR:	The read command returns the current value of <mask> parameter.
Test	AT+CPAS=?	+CPAS: (list of supported <pas>s) OK or: +CME ERROR: <err>	The test command displays the values of the possible states that phone can be.

The following table shows the +CPAS parameters.

Table 4-22: +CPAS Parameters

<Parameter>	Description
<mask>	1 – Circuit Switched (voice + data) call. 2 - Packet data call. 3 – Circuit Switched (voice + data) + Packet data call. Default value is 3.



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<pas>	<p>0 - Ready - The H24 allows commands from the terminal</p> <p>3 - Ringing (MT calls) - The H24 is ready for commands from the terminal, but the ringer is active</p> <p>4 - Call in progress - The H24 is ready for commands from the terminal, but a call is in progress</p>
-------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Example:

AT+CPAS

+CPAS: 0

OK

AT+CPAS=2 → Packet data call

+CPAS: 4

OK

AT+CPAS=?

+CPAS: (1-3)

OK

AT+CPAS=1 → Circuit Switched

+CPAS: 4

OK

AT+CPAS?

+CPAS: 2

OK



4.2.3.2. +CLCC, List Current Calls

This command displays a list of all current H24 calls and their statuses, and also enables/disables the unsolicited indication of the call list.

If there are no calls available, no information response is sent to the terminal.

Command Type	Syntax	Response/Action	Remarks
Set	AT+CLCC=<state>	OK or: +CME ERROR: <err>	The Set command enables/disables unsolicited indications.
Execute	AT+CLCC	+CLCC: <idx>,<dir>,<call state>,<mode>,<empty>[,<number>,<type>,<alpha>] [<CR><LF>+ CLCC: <idx>,<dir>,<call state>,<mode>,<empty>[,<number>,<type>,<alpha>] [...] OK	The Execute command displays the CLCC data of all current existing calls in that time.
Read	AT+CLCC?	+CLCC: <state> OK or: +CME ERROR <err>	The read command returns the current state of the unsolicited CLCC indication (disable or enable).
Test	AT+CLCC=?	+CLCC: (List of supported <state>s) OK or: +CME ERROR <err>	List of supported States.



The following table shows the +CLCC parameters.

Table 4-23: +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)
<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
<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 44 characters depending on the character set.
<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) 128 Unknown 129 Local number 145 International number with access character +

Example

```

AT+CLCC?
+CLCC: 1
OK AT+CLCC=1
OK
+CLCC: 1,0,2,0,0,"052123456",129,"office"// mo - voice call dialing
+CLCC: 1,0,3,0,0,"052123456",129,"office"// mo - voice call
alerting
+CLCC: 1,0,0,0,0,"052123456",129,"office"// voice call is active
    
```



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```
AT+CLCC // execution command (query)
+CLCC: 1,0,0,0,0,"052123456",129,"office"// voice call is active
OK
```



4.2.4. Supplementary Services

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

4.2.4.1. +CSSN, Supplementary Service Notifications

Command Type	Syntax	Response/Action	Remarks
Set	+CSSN=[<n>[,<m>]]	OK +CME ERROR: <err>	The Set command enables/disables the display of notification result codes to the TE. 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 notifications 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 (“+CLIP, Calling Line Identification” on). 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	+CSSN?	+CSSN: <n>,<m>	The Read command displays the current supplementary service notification setting.
Test	+CSSN=?	+CSSN: (0-1), (0-1)	The Test command displays the list of supported CSSN values.

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



The following table shows the +CSSN parameters.

Table 4-24: +CSSN Parameters

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



Table 4-25: +CSSI Notification Values

Value	Description	H24 Support
0	Unconditional call forwarding is active	Yes
1	Some conditional call forwarding is active	Yes
2	Call has been forwarded	Yes
3	Call is waiting	Yes (GSM only)
4	CUG call (<index> is present)	Yes
5	Outgoing calls are barred	Yes
6	Incoming calls are barred	Yes
7	CLIR suppression rejected	Yes
8	Call has been deflected	No

Table 4-26: +CSSU Notification Values

Value	Description	H24 Support
0	This is a forwarded call (mobile-terminated call setup).	Yes
1	CUG call (<index> is present; mobile-terminated call setup).	Yes
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
7	Call is being connected with the remote party in an alerted state using an explicit call transfer operation (during a voice call).	Yes
8	Call has been connected with the other remote party using an explicit call transfer operation (during a voice call or during mobile-terminated)	Yes



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	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)	
9	Deflected call (mobile-terminated call setup)	No

Example

```

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
  
```



4.2.4.2. +CSVM, Set Voice Mail Number

This command is used to read the voice mail server number from SIM card.

Command Type	Syntax	Response/Action	Remarks
Read	AT+CSVM?	+CSVM:<mode>,<number>,<type> OK or: +CME ERROR: <err>	

The following table shows the +CSVM parameters.

<Parameter>	Description
<mode>	1 - Enable the voice mail number.
<number>	Voice mail number. String type. Character string 0 1 2 3 4 5 6 7 8 9 * # +.
<type>	The address type of a phone number 129 Use for local call 145 Use + for international access code

Example:
at+csvm?
+CSVM: 1,"+972544151000",145

OK



4.2.4.3. +CUSD, Unstructured Supplementary Service Data

This command allows control of Unstructured Supplementary Service Data (USSD), according to GSM 02.90.

Both network and mobile initiated operations are supported. Parameter <n> is used to disable/enable the presentation of an unsolicited result code (USSD response from the network, or network initiated operation) +CUSD: <m>[,<str>,<dcs>] to the TE. In addition, value <n>=2 is used to cancel an ongoing USSD session. When <str> is given, a mobile initiated USSD-string or a response USSD-string to a network initiated operation is sent to the network. The response USSD-string from the network is returned in a subsequent unsolicited +CUSD result code.

Command Type	Syntax	Response/Action	Remarks
Set	AT+CUSD=[<n>[,<str> >[,<dcs>]]]	OK or: +CME ERROR: <err>	The Set command enables/disables the display of the unsolicited result code.
Unsolicited Report		+CUSD: <m>[,<str>[,<dsc>]]]	The USSD response from the network.
Read	+CUSD?	+CUSD: <n> or: +CME ERROR: <err>	The Read command displays the current value of <n>.
Test	+CUSD=?	+CUSD: (list of supported <n>s) or: +CME ERROR: <err>	The Test command displays the supported values of <n>.



The following table shows the +CUSD parameters.

Table 4-27: +CUSD Parameters

<Parameter>	Description
<n>	0 Disable the result code presentation in the TA. 1 Enable the result code presentation in the TA. 2 Cancel session (not applicable to read command response).
<str>	String type USSD-string (when <str> parameter is not given, network is not interrogated): If <dcS> indicates that GSM 03.38 [25] default alphabet is used: <ul style="list-style-type: none"> • If TE character set other than "HEX" (refer command Select TE Character Set +CSCS): ME/TA converts GSM alphabet into current TE character set according to rules of GSM 27.005 [24] Annex A. • If TE character set is "HEX": ME/TA converts each 7-bit character of GSM alphabet into two IRA character long hexadecimal number (e.g. character? (GSM 23) is presented as 17 (IRA 49 and 55)). If <dcS> indicates that 8-bit data coding scheme is used: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number (e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)).
<dcS>	GSM 03.38 - Cell Broadcast Data Coding Scheme in integer format. The supported value are: 17 - USC2 Language Indicator. (The first character in a USC2 Lang IND has the language ID in it. This situation is not defined by the GSM 7.07 or the 3GPP 27.007 so the assuming that the first character should have the correctly formatted and packed language ID already in it). 72 - USC2 (16 bit). 68 - 8 bit. Each other value except of 96, 80, and 240 are 7 bit. Not supported values are: 96, 80, 240 The default value is 15 (7 bit).
<m>	0 No further user action required (network initiated USSD-Notify, or no further information needed after mobile Initiated operation). 1 Further user action required (network initiated USSD-Request, or further information needed after mobile initiated operation). 2 USSD terminated by network. the reason for the termination is indicated by the index, as described in Table 4-28: CUSD Termination Cause Table Index 3 Other local client has responded. 4 Operation not supported. 5 Network time out.

Example

```
AT+CUSD=1,"*00*0549598743#"
+CUSD: 0,"Connecting...",15
+CUSD: 0,"Connected",15
+CLCC: 1,1,4,0,0,"0545550099",129,"" >Call from USSD server
RING
ATA > answer to the server (when answered, the server call to
```



0549598743) OK
 +CLCC: 1,1,0,0,0,"0545550099",129,"" NO CARRIER
 +CLCC: 1,1,6,0,0,"0545550099",129,""

Table 4-28: 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
NO_ANSWER	22
CALL_REJECTED	23
NUMBER_CHANGED	24
DEST_OUT_OF_ORDER	25
SIGNALING_ERROR	26
NETWORK_ERROR	27



CUSD Termination Cause Table Index (Cont.)

Termination Cause	Index
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
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



CUSD Termination Cause Table Index (Cont.)

Termination Cause	Index
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

4.2.4.4. +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 H24. 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:

+COLP: <number>,<type>[,<subaddr>,<satype>[,<alpha>]].

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

Command Type	Syntax	Response/Action	Remarks
Set	+COLP=<n>	OK +CME ERROR: <err>	The Set command enables/disables the display of the COL at the TE on the H24. 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.
Read	+COLP?	+COLP: <n>,<m> +CME ERROR: <err>	The Read command displays the status of <n>. It also initiates a query of the COLP service provision status and displays <m>.



Test	+COLP=?	+COLP: (list of supported <n>s) +CME ERROR: <err> Example: at+colp=? +COLP: (0-1) OK	The Test command displays the supported values of <n>.
-------------	----------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------

The following table shows the +COLP parameters.

Table 4-29: +COLP Parameters

<Parameter>	Description
<n>	Sets/displays the result code presentation status of the H24. 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").

Example

```
AT+COLP=1 // Enable to display connected
line on TE OK
```

```
ATD035684011; // MO call from H24 to one
phone. OK
OK
```

```
+COLP: 054678903, 129 // Call is forwarded from one
phone to another. Forwarded number and type appears in +COLP
unsolicited report.
```





4.3. 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 H24 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 H24 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).

Note: Dialing a fax call is possible under two conditions, first the correct bearer service has to be set, see +CBST command. The second condition is that the RAT has to be GSM; fax is not supported in WCDMA RAT. In order to manually switch to GSM RAT the +COPS command should be used. MT Fax will not be received if not registered to a GSM RAT.

The following table shows the Fax Class 1 command summary.

Command	Description
+FCLASS	Selects, reads or tests the Service Class
+FTS = <Time>	Stops/Pauses the transmission
+FRS = <Time>	Waits for silence
+FTM = <MOD>	Transmits data with <MOD> carrier
+FRM = <MOD>	Receives data with <MOD> carrier
+FTH = <MOD>	Transmits HDLC data with <MOD> carrier
+FRH = <MOD>	Receives HDLC data with <MOD> carrier



4.3.1. Fax Commands

4.3.1.1. +FCLASS, Select Mode

The H24 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 H24 to Service Class 1 operation prior to answering or originating a call. This is done by setting
+FCLASS = 1.

Command Type	Syntax	Response/Action	Remarks
Set	AT+FCLASS=<n>	OK (Puts the H24 into a particular mode of operation.) +CME ERROR: <err>	The Set command sets the H24 facsimile service class from the available choices.
Execute	AT+FCLASS	OK or: +CME ERROR: <err>	Restores default value.
Read	AT+FCLASS?	+FCLASS: <n> OK +CME ERROR: <err>	The Read command reads the current service class setting of the H24.
Test	AT+FCLASS=?	(list of supported <n>s) OK +CME ERROR: <err>	The Test command returns a list of service classes available from the H24.

The following table shows the +FCLASS parameters.

Table 4-30: +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
```



4.3.1.2. +FTS, Transmit Silence

This command causes the H24 to stop any transmission. The H24 then waits for the specified amount of time, and sends the OK result code to the terminal.

Command Type	Syntax	Response/Action	Remarks
Set	AT+FTS = <Time>	OK or: +CME ERROR: <err>	The Set command causes the terminal to stop any transmission.

The following table shows the +FTS parameters.

Table 4-31: +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
```

4.3.1.3. +FRS, Receive Silence

This command causes the H24 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 H24 a character other than <DC1> (11h) or <DC3> (13h), which is discarded. In either event, the OK result code is returned to the terminal.

Command Type	Syntax	Response/Action	Remarks
Set	+FRS = <Time>	OK or: +CME ERROR: <err>	The Set command specifies the amount of time the line must be silent.

The following table shows the +FRS parameters.



Table 4-32: +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 H24 sends the OK after
silence for 10*50 milliseconds
```

4.3.1.4. +FTM, Transmit Data

This command causes the H24 to transmit data to the remote party using the modulation selected in <MOD>. The H24 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 H24.

- Terminal to H24 streams (Encoding)
 - When the terminal needs to send a <DLE> character in the data stream, it sends two sequential <DLE> characters to the H24.
 - 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.
- H24 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 H24 receives the +FTM command, it immediately returns an OK result code. When the terminal receives the OK from the H24, it can start sending the data stream using the transparent data command encoding. When the H24 decodes the terminating sequence, it returns a CONNECT.



Command Type	Syntax	Response/Action	Remarks
Set	+FTM = <MOD>	OK or: +CME ERROR: <err>	The Set command causes the H24 to transmit data using the modulation selected in <MOD>.
Test	+FTM=?	(list of supported <MOD>s) OK or: +CME ERROR: <err>	

The following table shows the command modulation select codes.

Table 4-33: 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 H24 decodes and packs it into the
HDLC frame and sends it to the remote party)
CONNECT 19200 //H24 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 //H24 detected termination
sequence <DLE><DTX>.

```

4.3.1.5. +FRM, Receive Data



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This command causes the H24 to receive data from the remote party using the modulation specified in <MOD>.

When the H24 receives the +FRM command it immediately returns a CONNECT result code. When the terminal receives the CONNECT from H24, it can start receiving the data stream using the transparent data command decoding. (Refer to Table 4-34: Command Modulation Select Codes -Modulation Parameters)

When the H24 receives the +FRM command, it checks the line for a carrier. If the H24 detects a carrier, it sends a CONNECT to the terminal, and starts receiving the fax page.

Upon data stream termination, the H24 sends the termination sequence to the terminal. Afterwards, if the H24 detects a loss of carrier, it sends a "NO CARRIER", otherwise it sends OK.

Command Type	Syntax	Response/Action	Remarks
Set	+FRM = <MOD>	CONNECT Data stream <DLE><ETX> OK	The Set command causes the H24 to enter the receive mode using the modulation specified in <MOD>
Test	+FRM=?	(list of supported <MOD>s) OK or: +CME ERROR: <err>	

The following table shows the command modulation select codes.

Table 4-34: 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	



4.3.1.6. +FTH, Transmit DATA with HDLC Frame

This command causes the H24 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”.

After the entering active session mode (H24 sent CONNECT to the terminal), the terminal can perform one of the following:

- If the terminal sends additional data, the H24 transmits another frame
- If the terminal sends only <DLE><ETX> (a null frame), the H24 turns off the transmit carrier and sends the CONNECT result code to the terminal
- If five seconds elapses from the time the H24 reports the OK result code without any additional data transmitted from the terminal, the H24 turns off the transmit carrier, returns to command mode, and sends the ERROR result code to the terminal.

Command Type	Syntax	Response/Action	Remarks
Set	FTH = <MOD> (Send data stream <DLE><ETX>)	CONNECT OK or: NO CARRIER	The Set command causes the H24 to transmit data framed in HDLC protocol using the modulation mode selected.

Note: MOD = 3 (Clause 2/V.21) rate 300 bps, is mandatory.

If the H24 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 4-35: 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 H24 detected the terminating sequence
(Terminal sends DCS frame data, as described in ITU-T30 with terminating sequence and drops the carrier)
OK

4.3.1.7. +FRH, Receive DATA with HDLC Frame

This command causes the H24 to receive HDLC framed data using the modulation mode selected in <MOD>, and deliver the next received frame to the terminal.

If the H24 detects the selected carrier with an HDLC flag, the H24 send the CONNECT result code to the terminal, otherwise it sends "NO CARRIER".

The H24 sends the FCS octant to the terminal. The terminal may ignore the FCS.

Upon receipt of the CONNECT from H24, the terminal can start receiving the data stream using the transparent data command decoding. (Refer to “Command Modulation Select Codes - Modulation Parameters”).

After the FCS octets are transferred, the H24 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 H24 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 H24 returns the ERROR result code, and the terminal should discard the frame.

After the status result code, the H24 accepts new commands from the terminal.

Command Type	Syntax	Response/Action	Remarks
Set	+FRH = <MOD>	CONNECT or: NO CARRIER	The Set command causes the H24 to receive HDLC framed data using the modulation mode selected in <MOD>, and deliver the next received frame to the terminal.

Note: MOD = 3 (Clause 2/V.21) rate 300 bps, is mandatory.



4.4. Phonebook and Clock

4.4.1. Directory Access Commands - Phone Book

This set of commands enables read/write access to the phone book contained within the H24, 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 Storage

This command handles the selection of the memory to be used for reading and writing entries in the H24's phone books' memory. (When there is separate storage on the SIM card and in the H24's internal EEPROM).

Command Type	Syntax	Response/Action	Remarks
Set	AT+CPBS=<storage> [,<password>]	OK or: +CME ERROR: <err>	Set command selects phonebook memory storage <storage>, which will be used by other phonebook commands.
Execute	AT+CPBS	OK	Execute command selects the default phonebook memory storage.
Read	+CPBS?	+CPBS: <storage>[,<used>,<total>] OK	Read command returns currently selected memory, number of used locations and total number of locations in the memory.
Test	+CPBS=?	+CPBS: (list of supported <storage>s) OK	

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



The following table shows the +CPBS parameters.

Table 4-36: +CPBS Parameters

<Parameter>	Description
<storage>	List of supported phone books and their storage IDs SM - SIM/UICC phone book. LD - SIM/UICC last dialing phonebook. DC - ME dialed calls list (+CPBW is not applicable for this storage). EN - (*) Emergency numbers (+CPBW is not applicable for this storage). FD - SIM Fixed dialing phone book. MC - H24 missed (unanswered received) calls list (+CPBW is not applicable for this storage). ME - H24 phone book. ON - SIM own numbers (MSISDNs) list (reading this storage is also available through +CNUM). RC - H24 received calls list (+CPBW is not applicable for this storage). SD - Service dialing numbers. The default phone book is ME. Note: Last dialed number is saved in DC and LD phonebooks only after the call is disconnected.
<password>	PIN2 code. Optional while select <storage> is "FD" only.
<used>	Integer type value indicating the number of used locations in selected memory.
<total>	Integer type value indicating the total number of locations in selected memory.

(*) Emergency numbers.

H24 supports - at least - the following emergency numbers: 911, 112, 000, 08, 110, 999, 118, and 119.

Only numbers found in the EN storage are considered as Emergency numbers. Besides the numbers above, H24 can load emergency numbers to EN storage also from:

1. Emergency numbers file in SIM/USIM (set by operator)
2. Additional numbers configured by Motorola (Empty by default). Can be updated per customer at manufacturing time.

Use the phonebook read command to view valid emergency numbers.

Example

```

AT+CPBS="ME" OK
AT+CPBR=?
+CPBR: (1-500,40,255) OK
AT+CPBR=1
OK
AT+CPBR=1,3           //There is nothing written in
entry 1,2,3
OK AT+CPBS="SM"
    
```




```

OK AT+CPBR=?
+CPBR: (1-250,40,24) OK
AT+CPBR=1,3
OK AT+CPBR=1,250
+CPBR: 1,"+97252999080", 145,"Voice Mail" OK
AT+CPBS="FD","<correct pin2>"
OK //+CPBW pin2 unlocked
AT+CPBS="FD","<wrong pin2>"
+CME ERROR: incorrect password
AT+CPBS="SD","<pin2>"
+CME ERROR: operation not allowed
AT+CPBS="FD","<pin2 longer then 8 chars>"
+CME ERROR: text string too long
    
```

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 H24 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 Type	Syntax	Response/Action	Remarks
Set	+CPBR=<index1> [,<index2>]	[+CPBR: <index1>,<number>,<type>,<text> [<CR><LF> +CPBR: <index2>,<number>,<type>,<text>]] OK or: +CME ERROR: <err>	
Test	+CPBR=?	+CPBR: (list of supported <index>s),[<nlength>],[<tlength>] OK	



The following table shows the +CPBR parameters.

Table 4-37: +CPBR Parameters

<Parameter>	Description
<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
<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

Example

```

AT+CPBS="ME" OK
AT+CPBR=?
+CPBR: (1-100,40,255) OK
AT+CPBR=1
OK
AT+CPBR=1,3 //There is nothing written in
entry 1,2,3
OK AT+CPBS="SM" OK
AT+CPBR=?
+CPBR: (1-350,40,24) OK
AT+CPBR=1,3
OK AT+CPBR=1,350
+CPBR: 1,"+97252999080",145,"Voice Mail" OK
    
```



4.4.1.3. +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.

Command Type	Syntax	Response/Action
Set	AT+CPBF=<findtext>	[+CPBF: <index1>,<number>,<type>,<text>[...] <CR><LF> +CBPF: <index2>,<number>,<type>,<text>]] OK or: +CME ERROR: <err>
Test	AT+CPBF=?	+CPBF: [<nlength>],[<tlength>] OK

The following table shows the +CPBF parameters.

Table 4-38: +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
<text>	Text identifier for a phone book entry, according to the character set as AT+CPBS command AT+CPBS command by command +CSCS.

Example

```
AT+CPBS="ME" //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 all entries
 +CPBF: 2,"8475767800",129,"Moto Voicemail"
 +CPBF: 101,"+97252999080",145,"Voice Mail" OK

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

4.4.1.4. +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 Storage”). 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

Note: This command is not applicable for "LD", "DC", "MC", "RC" and "EN" storages.

Command Type	Syntax	Response/Action	Remarks
Set	AT+CPBW=[<index>],[<number>[,<type>[,<text>]]]	OK or: +CME ERROR: <err>	
Test	AT+CPBW=?	+CPBW: (list of supported <index>s),[<nlength>], (list of supported <type>s),[<tlength>] OK	

The following table shows the +CPBW parameters.

Table 4-39: +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



<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. This applies to GSM standard characters only. Non-GSM standard character sets and extended GSM characters require additional space in storage. In some cases, when using such characters the text cannot be stored. In this case, the H24 returns a "text string too long" error.

Example

```

AT+CPBS="ME" OK
AT+CPBW=?
+CPBW: (1-500),40,(129,145),16
OK
AT+CPBW=101,"+97252999080",145,"Voice Mail" OK
AT+CPBW=2,"8475767800",129,"Voice Mail" OK
    
```



4.4.2. System Date and Time Access Commands

4.4.2.1. +CCLK, Read/Set System Date and Time

This command reads and sets the H24 current date, time and time zone.

Command Type	Syntax	Response/Action	Remarks
Set	+CCLK=<time>	OK or: +CME ERROR: <err>	The Set command sets the date, time and time zone of the system clock.
Read	+CCLK?	+CCLK: <time> OK or: +CME ERROR: <err>	The Read command returns the current date, time and time zone setting. By default, <time> will represent the network updated time. If the user has used the Set command once, then <time> will represent the Set command setting.
Test	+CCLK=?	OK or: +CME ERROR: <err>	The Test command returns valid parameters for the +CCLK Set command.
Execute	+CCLK	OK or: +CME ERROR: <err>	The Execute command causes system clock to be overridden by network System Clock value immediately. Note: CCLK Read command will represent the network update time after CCLK Execute command. This value will be represented after power-cycle as well.



The following table shows the +CCLK parameters.

Table 4-40: +CCLK Parameters

<Parameter>	Description
<time>	IRA string of format: yy/MM/dd,hh:mm:ss±zz or yy/MM/dd,hh:mm:ss yy - 2-digit year [2000-2069] 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 be 0.

Example

```
AT+CCLK=?
+CCLK: "88/12/31, 23:59:59, (-47-+48)" OK
```

```
AT+CCLK="01/01/01, 01:01:01-08" OK
```

```
AT+CCLK?
+CCLK: "01/01/01, 01:01:01-08" OK
```

```
AT+CCLK="02/02/02, 02:02:02" OK
Power cycling... AT+CCLK?
+CCLK: "02/02/02, 02:02:02+00"
OK
```

```
AT+CCLK="03/03/03, 03:03:03+50"
+CME ERROR: Numeric parameter out of bounds
```

```
AT+CCLK OK
```

```
AT+CCLK?
+CCLK: "05/10/27,16:52:31+08" OK
```

```
Power cycling... AT+CCLK?
+CCLK:"05/10/27,16:52:50+08"
OK
```



4.5. SMS

4.5.1. SMS Commands

H24 supports SMS PDU and SMS TEXT mode according to ETSI specifications 27.005 & 23.040.

4.5.1.1. +CSCA, Service Center Address

This command enables to write/read SCA to/from SIM.

In SMS text mode, SCA stored in SIM is added to any stored and sent SMS.

In SMS pdu mode, SCA stored in SIM is added to stored SMS and send SMS only when SCA address length coded in PDU equals zero.

Command Type	Syntax	Response/Action	Remarks
Set	+CSCA=<sca>[,<tosca>]	OK or: +CMS ERROR: <err>	Sets service center address stored in SIM (EF-SMSP - Short message service parameters). <tosca> is optional parameter, default value is 129 (local number). When <sca> is prefixed with '+' it indicates that <tosca> is set to 145 (International number).
Read	+CSCA?	+CSCA: <sca>,<tosca> OK	Read command displays <sca> and <tosca> stored in SIM*EF-SMSP).
Test	+CSCA=?	OK	Test command for +CSCA is not defined exactly by ETSI.

The following table shows the +CSCA parameters.

Table 4-41: +CSCA Parameters

<Parameter>	Description
<sca>	Service Center Address. "+" character prefix of <sca> indicates <tosca> of 145. Minimum 1 and up to 20 characters, where each character is represented by semi octets (excluding '+' character). If <sca> contains an odd number of digits, bits 4 to 7 of the last octet shall be filled with an end mark coded as "1111".



<p><tosca></p>	<p>Type of service center address. <tosca> of 129 is mostly use for local number and 145 for International. <tosca> of 129 is default value.</p> <p><tosca> values are in range of 0-255. Valid values are defined according to: GSM03.40 v7.4.0 section 9.1.2.5 as follow: Bit 7 is 1 Bits 6,5,4 - Present Type of number as follow: Bits 6 5 4 0 0 0 Unknown 0 0 1 International number 0 1 0 National number 0 1 1 Network specific number 1 0 0 Subscriber number 1 0 1 Alphanumeric, (coded according to GSM TS 03.38 7-bit default alphabet) 1 1 0 Abbreviated number 1 1 1 Reserved for extension</p> <p>Numbering-plan-identification (applies for Type-of-number = 000,001,010) Bits 3 2 1 0 0 0 0 0 Unknown 0 0 0 1 ISDN/telephone numbering plan (E.164/E.163) 0 0 1 1 Data numbering plan (X.121) 0 1 0 0 Telex numbering plan 1 0 0 0 National numbering plan 1 0 0 1 Private numbering plan 1 0 1 0 ERMES numbering plan (ETSI DE/PS 3 01-3) 1 1 1 1 Reserved for extension. All other values are reserved.</p>
----------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

The following table describes +CSCA <SCA> valid parameters including the conversion when using stored <SCA> in SMS PDU mode (editing SMS via +CMGW or +CMGS without SCA).

This is according to 24.008V031000P Table 10.5.118/GSM 24.008V031000P: Called party BCD number:

Table 4-42: +CSCA <SCA> parameters

<SCA> Character in SMS (Text mode)	Mapped character for SMS PDU mode
Digits: 0-9	Digits: 0-9
"+"	0x91
"*"	"A"
#"	"B"
"A"	"C"
"B"	"D"
"C"	"E"



Example

```
AT+CSCA?
+CSCA: "+972123456",145 // Read SCA address and
TOSCA stored in SIM (EF-smsp) OK
AT+CSCA="972123456" OK
AT+CSCA?
+CSCA: "972123456",129
OK AT+CSCA?
+CSCA: "*ABC#",129
OK AT+CMGW=13
> 0481ABCD1211640A8150224902450000A700 // '*->'A', 'A'->'B',
'B'->'C', '#'->'D'
```

```
+CMGW: 15
OK AT+CMGR=15
+CMGR: 2,,13
0481ABCD1211640A8150224902450000A700 / SCA read as stored
for current SMS
```

OK AT+CSCA?

```
+CSCA: "*ABC#",129 // Read command remained //
SCA settings didn't change
OK AT+CSCA?
+CSCA: "*ABC#",129
OK AT+CMGW=13
> 0011640A8150224902450000A700
```

+CMGW: 16

```
OK AT+CMGR=16
+CMGR: 2,,13
0481CAEDFB11640A8150224902450000A700 // SCA is: ACDEB
in pdu, mapped to *ABC# OK
```

```
AT+CMGW=13
> 0381AB1211640A8150224902450000A700 // Set SCA to BA21
```

+CMGW: 17



```
OK AT+CMGR=17
+CMGR: 2,,13
0381AB1211640A8150224902450000A700 // SCA is set correctly
only for current SMS but +CSCA
setting didn't changed
```

```
OK AT+CSCA?
+CSCA: "*ABC#",129 //SCA didn't change in storage
```

```
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.

Command Type	Syntax	Response/Action	Remarks
Set	+CPMS=<mem1> [,<mem2>[,<mem3>]]	+CPMS: <used1>,<total1>,<used2>,<total2>,<used3>,<total3> OK or: +CMS ERROR: <err>	Set command selects memory storages <mem1>, <mem2> and <mem3> to be used. If chosen storage is not applicable, final result code +CMS ERROR: <err> shall be returned.
Read	+CPMS?	+CPMS: <mem1>,<used1>,<total1>,<mem2>,<used2>,<total2>,<mem3>,<used3>,<total3> OK or: +CMS ERROR: <err>	The Read command displays the selected memory storage type for the three memory areas.
Test	+CPMS=?	+CPMS: (list of supported <mem1>s),(list of supported <mem2>s),(list of supported <mem3>s) OK +CMS ERROR: <err>	The Test command lists the supported memory storage for <mem1>, <mem2> and <mem3>.

The following table shows the +CPMS parameters.



Table 4-43: +CPMS Parameters

<Parameter>	Description
<mem1>	Memory from which messages are read and deleted. Supported values are: "ME","SM". Default value at power-up is "SM".
<mem2>	Memory to which writing operation is made. Supported value is: "ME","SM". Default value at power-up is "ME".
<mem3>	Memory to which received SMS are stored (unless forwarded directly to TE). Supported value is: "ME","SM". Default value at power-up is "SM".
"ME"	ME message storage.
"SM"	EF-SMS file storage in SIM.

Note:

- Incoming Status-Report messages are store at <mem3>.
- Incoming Status-Report messages will be store at EF-smss as SMS-Deliver.
- Messages will not be store when storage is full.
- Sending SMS via +CMSS is always from <mem2> storage.

Example

```
AT+CMGF=1
OK
```

```
AT+CPMS=?
+CPMS: ("ME","SM"),("ME","SM"),("ME","SM") OK
AT+CPMS?
+CPMS: "ME",0,23,"ME",0,23,"SM",0,20
```

```
OK AT+CPMS="SM"
+CPMS: 0,20,0,23,0,20
```

```
OK
AT+CMGW="0547298743" // store outgoing SMS to ME
storage
> MEM2=ME MEM3=SM
```

```
+CMGW: 0
```



```
OK AT+CPMS?
+CPMS: "SM",0,20,"ME",1,23,"SM",0,20
```

OK

```
AT+CMSS=0 // Send the stored message to
my self (H24 number is: "0547298743")
+CMSS: 0
```

```
OK AT+CPMS?
+CPMS: "SM",1,20,"ME",1,23,"SM",1,20 // The received SMS is
stored in MEM3 - SM storage
```

OK

4.5.1.3. +CMGF, Message Format

This command is a basic command. 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 H24 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).

Command Type	Syntax	Response/Action	Remarks
Set	+CMGF=<mode>	OK or: +CMS ERROR: <err>	The Set command sets the message format to use.
Read	+CMGF?	+CMGF:<mode>	The Read command displays the current message format.
Test	+CMGF=?	+CMGF:(list of supported <mode>s)	The Test command lists all the supported message formats.

The following table shows the +CMGF parameters.



Table 4-44: +CMGF Parameters

<Parameter>	Description
<mode>	Message format: 0 PDU mode (default) 1 Text mode

Example

```

AT+CMGF=1
OK AT+CMGF?
+CMGF: 1
OK AT+CMGF=?
+CMGF: (0-1) OK
  
```



4.5.1.4. +CSMP, Set Text Mode Parameters

This command is a basic command and is used to select values for additional parameters needed when SM is sent to the network or placed in storage when TEXT mode is selected.

Command Type	Syntax	Response/Action	Remarks
Set	+CSMP=[<fo>[,<vp>[,<pid>[,<dcs>]]]]	OK or: +CMS ERROR: <err>	The set command selects values for additional parameters needed when SM is sent to the network or placed in storage when text format message mode is selected.
Read	AT+CSMP?	+CSMP: <fo>,<vp>,<pid>,<dcs> OK or: +CMS ERROR: <err>	The read command returns the current parameters value.
Test	AT+ CSMP=?	OK or: +CMS ERROR: <err>	The test command just returns OK.

The following table shows the +CSMP parameters.

Table 4-45: +CSMP Parameters

<Parameter>	Description
<fo>	first octet of GSM 23.040. in integer format. For details see +CMGW definitions. The default value at power-up is 17 (Message type is: SMS-SUBMIT and relative VP format).
<vp>	Validity Period. depending on SMS-SUBMIT <fo>, TP-Validity-Period-Format bits setting. Either in integer format (see Table 4-46: VP Relative Format (In Integer Format)) or in time-string format ("yy/MM/dd,hh:mm:ss±zz"). If there is no correlation between the VPF and the VP value. an error message will be returned.
<pid>	Protocol-Identifier. The one octet information element by which the SM-TL either refers to the higher layer protocol being used, or indicates interworking with a certain type of telematic device. "0 - no interworking, SME-to-SME protocol (default) "Any value between 0-255 will be accepted. The SC may reject messages with a TP-Protocol-Identifier containing a reserved value or one, which is not supported.



<dc>	<p>One octet of Data Coding Scheme, indicates the data coding scheme of the DATA, and may indicate a message class.</p> <p>NOTE: For DCS expanded information, see section “DCS handling”. default alphabet: 00xx00xx, 111100xx, 1101xxxx 8 bit data: 00xx01xx, 111101xx UCS2: 00xx10xx, 1110xxxx reserved: 00xx11xx, 0100xxxx-1011xxxx</p>
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Table 4-46: VP Relative Format (In Integer Format)

<Parameter>	Description
0 to 143	(TP-VP + 1) x 5 minutes (i.e. 5 minutes intervals up to 12 hours)
144 to 167	12 hours + ((TP-VP - 143) x 30 minutes)
168 to 196	(TP-VP - 166) x 1 day
197 to 255	(TP-VP - 192) x 1 week

Example

```

AT+CSMP?
+CSMP: 17,167,0,0 (default values for SMS-SUBMIT) OK
AT+CSMP= 1,256,0,0
+CMS ERROR: numeric parameter out of bounds
AT+CSMP=29,"04/11/04,09:48:36+08" OK
AT+CSMP=? OK AT+CSDH=1
OK AT+CMGF=1
OK AT+CMGW="0544565034"
> ABC (^Z)
+CMGW: 160
OK AT+CMGR=160
+CMGR: "STO
UNSENT","0544565034",,81,29,0,0,"04/11/04,09:48:36+08",,+972
54120032",145,3
ABC OK

```



4.5.1.5. +CSDH, Show Text Mode Parameters

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

Command Type	Syntax	Response/Action	Remarks
Set	+CSDH=[<show>]	OK or: +CMS ERROR: <err>	The set command controls whether detailed header information is shown in text mode result codes.
Read	AT+CSDH?	+CSDH: (list of supported <show>s) OK or: +CMS ERROR: <err>	The read command returns the current <show> parameter value.
Test	AT+CSDH=?	+CSDH: (0-1) OK	The Test command lists all the supported text modes.

Note: The default value is 0.

The following table shows the +CSDH parameters.

Table 4-47: +CSDH Parameters

<Parameter>	Description
<show>	0 - Means do not show header values defined in commands +CSCA and +CSMP (<sca>, <tosca>, <fo>, <vp>, <pid> and <dcs>) nor <length>, <todoa> or <tooa> in +CMT, +CMGL, +CMGR result codes for SMS- DELIVERs and SMS-SUBMITs in text mode. 1 - Means show the values in result codes.

Example

```

AT+CPMS?
+CPMS: "SM",2,20,"ME",0,23,"SM",2,20
OK
AT+CMGR=0
+CMGR: "REC READ","+123456",,"08/11/27,08:06:55+08" TEST
OK
AT+CSDH=1
OK

```



```
AT+CMGR=0
+CMGR: "REC
READ","+123456", "08/11/27,08:06:55+08",145,4,0,0,"+972541200
3
2",145,4
TEST
```

4.5.1.6. +CMGS, Send SM to Network

This command sends an SM from the H24 to the network. The message reference value <mr> is returned to the H24 upon successful delivery of the message.

Valid < toda > will be any value between 128-255.

The header parameters in TEXT mode will be set according to CSMP settings.

Note: Any character sent by the TE to the H24 before H24 has reported a result of AT+CMGS operation, will abort AT+CMGS command execution. However, if SMS was already sent to network and sending operation was successful, the result of operation "+CMGS <mr>" will be reported by H24.

If after aborting AT+CMGS command execution and before result of operation was reported by H24, a second AT+CMGS command is executed, then the result of the second AT+CMGS operation only will be reported by H24.

Command Type	Syntax	Response/Action	Remarks
Set	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 Set command validates the input parameters, sends the SM to network and reports the result of the operation to the H24.

The following table shows the +CMGS parameters.

Table 4-48: +CMGS Parameters

<Parameter>	Description
<da>	Destination address in quoted string. This field contains a single MIN number.
<toda>	Type of DA. Value between 128-255 (according to GSM 23.040, 9.1.2.5). If this field is not given and first character of <da> is '+', <toda> will be 145, otherwise 129.
<length>	Size of message in PDU mode format, in octets, excluding SMSC data.
<mr>	Sent message reference number.
PDU	Message header and contents in PDU mode format. See description in Table 4-49: +CMGW Parameters.

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
>079179521201009511FF0B917962543940F200080014004100420
04300440045 <CTRL+Z>
+CMGS: 128
OK
```

4.5.1.7. +CMGW, Write Message to Memory

This command is used to write and save an SMS-SUBMIT to <mem2> storage and returns index where the message has been stored.

By default, messages are saved with the status of "STO UNSENT", but status "STO SENT" can be applied using the <stat> parameter.

In TEXT mode, the header parameters will be set according to CSMP settings. Message data is saved by ending with <CTRL+Z>.

Command may be abort by ESC character.

Command Type	Syntax	Response/Action	Remarks
Set	If text mode (+CMGF=1): +CMGW[=<da>,<toda>,<stat>]]<CR>te xt 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 Set command writes a message and stores it.

The following table shows the +CMGW parameters.

Table 4-49: +CMGW Parameters

<Parameter>	Description
<da>	Destination address in quoted string. This field contains a single phone number.
<toda>	Type of DA. Value between 128-255 (according to GSM 23.040, 9.1.2.5). If this field is not given and first character of <da> is '+', <toda> will be 145, otherwise 129.
<stat>	Status of new message In text mode: "STO UNSENT" (default) or "STO SENT" In PDU mode: 2 (default) or 3



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<length>	Size of message in PDU mode format, in octets, excluding SMSC data.
<index>	Index in storage of the stored message.
<PDU>	Message header and contents in PDU mode format. See description in “SMS Layout”

Example

```

AT+CPMS="ME"
+CPMS: 0,23,0,23,0,20
OK
AT+CPMS?
+CPMS: "ME",0,23,"ME",0,23,"SM",0,20
OK
AT+CMGF=1
OK
AT+CMGW="1234"
> This is message body<CTRL+Z> //<CTRL+Z> Ends the prompt
text mode and returns to
Regular AT command mode
+CMGW: 0 // SMS-SUBMIT is stored in
ME index 0
OK
AT+CPMS?
+CPMS: "ME",1,23,"ME",1,23,"SM",0,20 // SMS-SUBMIT is
stored in "ME" storage
OK
AT+CSDH=1
OK
AT+CMGR=0 // Read the stored message
+CMGR: "STO
UNSENT","1234",,129,17,0,0,167,"+97254120032",145,20
This is message body
OK
AT+CSMP? // Message values
<FO>,<VP>,<PID>,<DCS>
+CSMP: 17,167,0,0
OK
AT+CMGF=0 // Move to PDU mode
OK
AT+CMGW=10 // Write SMS-Submit message
> 07917952120100951101048121430000A700
+CMGW: 1 // Message index 1 is stored in
ME storage
OK AT+CPMS?
+CPMS: "ME",2,23,"ME",2,23,"SM",0,20
OK
AT+CMGR=1 // Read the stored message
+CMGR: 2,,10
    
```



07917952120100951101048121430000A700
OK



4.5.1.8. +CMSS, Send Message From Storage

This command sends a pre-stored message, written previously using the +CMGW command. The <da>, <toda> parameters are 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). If no DA is found, an error occurs.

Command Type	Syntax	Response/Action	Remarks
Set	+CMSS=<index>[,<da>[,<toda>]]	+CMSS: <mr> or: +CMS ERROR: <err>	The Set command sends a message from storage to the network.

The following table shows the +CMSS parameters.

Table 4-50: +CMSS Parameters

<Parameter>	Description
<index>	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. Value between 128-255 (according to GSM 23.040, 9.1.2.5). If this field is not given and first character of <da> is '+', <toda> will be 145, otherwise 129.
<mr>	Sent message reference number.

Example

```
AT+CMSS=7
+CMSS: 12
OK AT+CMSS=7,"054565132",129
+CMSS: 13
OK
```



4.5.1.9. +CMGC, Send SMS command

Execution command sends a command message from a TE to the network (SMS-COMMAND).

Command Type	Syntax	Response/Action	Remarks
Set	Text mode (+CMGF=1): AT+CMGC=<fo> , <ct>[, <pid>[, <mn>[, <da>[, <toda>]]]]<CR> Text can be entered <CTRL-Z>/<ESC > PDU mode (+CMGF=0): +CMGC=<length ><CR> PDU is given<ctrl-Z/ESC >	If text mode (+CMGF=1) and sending successful: +CMGC: <mr>[,<sects>] if sending fails: +CMS ERROR: <err> If PDU mode (+CMGF=0) and sending successful: +CMGC: <mr>[,<ackpdu>] if sending fails: +CMS ERROR: <err>	
Test	+CMGC=?	OK	

The following table shows the +CMGC parameters.

Table 4-51: +CMGC Parameters

<Parameter>	Description
<fo>	First octet of 3GPP TS 23.040 SMS-COMMAND in integer format.
<ct>	TP-Command-Type in integer format.
<pid>	TP-Protocol-Identifier in integer format.
<mn>	TP-Message-Number in integer format
<da>	TP-Destination-Address-Value field in string format; BCD numbers are converted to characters of the currently selected TE character set.
<toda>	TP-Destination-Address Type-of-Address octet.
<mr>	TP-Message-Reference in integer format.
<sects>	TP-Service-Centre-Time-Stamp in time-string format.
<length>	Length of the actual TP data unit in octets.
<ackpdu>	RP-User-Data element of RP-ACK PDU (When +CSMS <service> value is 1 and network supports).

4.5.1.10. +CSMS, Select Message Service.

This command handles the selection of messaging <service>. It returns the types of messaging services supported by the H24.

Command Type	Syntax	Response/Action	Remarks
Set	+CSMS=<service>	+CSMS: <mt>,<mo>,<bm> or: +CMS ERROR: <err>	The Set command sets the type of service and returns the types of messages supported by the H24.
Read	+CSMS?	+CSMS: <service>,<mt>,<mo>,<bm>	The Read command returns the supported message types along with the current service setting.
Test	+CSMS=?	+CSMS: <service>	The Test command returns a list of all the services supported by the terminal.



The following table shows the +CSMS parameters.

Table 4-52: +CSMS Parameters

<Parameter>	Description
<service>	0 Acknowledge (RP-ACK) for incoming SMS-Deliver and SMS-Status-Report is sent immediately when those messages arrives H24 and +CNMI parameter <mt>=2 or/and <ds>=1. <Service>=0 is default value. 1 <ul style="list-style-type: none"> Acknowledge (RP-ACK) for incoming SMS-Deliver or SMS-Status-Report may be sent via acknowledge command +CNMA when SMS-Deliver or SMS-Status-Report messages arrives H24 and +CNMI parameter <mt>=2 or/and <ds>=1. In case acknowledge command +CNMA is not given within required time an error (RP-ERROR) is sent to network. In case network support & text mode: service center time stamp is added to +CMGC, +CMSS and +CMGS commands report. In case network support & pdu mode: ackpdu (network SUBMIT-Report without SC address) will be added to +CMGC, +CMSS and +CMGS commands report.
<mt>	Mobile terminated messages 0 Not supported by the H24 1 Supported by the H24
<mo>	Mobile originated messages 0 Not supported by the H24 1 Supported by the H24
<bm>	Broadcast type messages 0 Not supported by the H24 1 Supported by the H24

Example

```
AT+CSMS=?  
+CSMS: (0-1)
```

```
OK AT+CSMS?  
+CSMS: 1,1,1,1
```

```
OK  
/* H24 supports the services of: Mobile originated messages, Mobile terminated messages and Broadcast messages*/
```



4.5.1.11. +CNMI, New Message Indications to Terminal

This command selects the procedure of how message reception from the network is being indicated.

Command Type	Syntax	Response/Action	Remarks
Set	+CNMI=[<mode>] [,<mt>[,<bm>] [,<ds>][, <bfr>]	OK or: +CMS ERROR: <err>	Setting +CNMI with no parameters, clears all parameters. Setting <mt>=2 and <ds>=1 is only allowed when <mode>=1
Read	+CNMI?	+CNMI:<mode>,<mt>,<bm>,<ds>,<bfr>	
Test	+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 4-53: +CNMI Parameters

<Parameter>	Description
<mode>	<p>Determines incoming SMS unsolicited result code indication processing:</p> <p>0 Buffer unsolicited result codes in the TA. If TA result code buffer is full, indications can be buffered in some other place or the oldest indications may be discarded and replaced with the new received indications (default).</p> <p>1 Discard indication and reject new received message unsolicited result codes when TA-TE link is reserved. Otherwise forward them directly to the TE.</p> <p>2 Buffer unsolicited result codes in the TA when TA-TE link is reserved and flush them to the TE after reservation. Otherwise forward them directly to the TE.</p>
<mt>	<p>Determines SMS-Deliver indication report:</p> <p>0 No SMS-DELIVER indications are routed to the TE (default)</p> <p>1 If SMS-DELIVER is stored in the H24, the memory location indication is routed to the TE using the following unsolicited result code (see Table 4-55: +CMTI Parameters): +CMTI: <mem>,<index> +CMTI <mem> and <index> parameters are described below.</p> <p>2 SMS-DELIVERs are routed directly to the TE using the following unsolicited result code ((+CMT parameters are described in Table 4-56: +CMT Parameters). PDU Mode: +CMT: [<alpha>],<length><CR><LF><pdu></p> <p>TEXT Mode:</p> <p>When +CSDH=0: +CMT:<da>,<scts> <CR><LF><data></p> <p>When +CSDH=1: +CMT:<da>,<[alpha]>,<scts>,<toda>,<fo>,<pid>,<dcs>,<sca>,<tosca>,<length><CR><LF><data></p>
<bm>	<p>Determines Cell broadcast indication report:</p> <p>0 No CBM indications are routed to the TE (default)</p> <p>2 Received CBMs are routed directly to the TE using unsolicited result code (+CBM parameters are described in Table 4-59: +CBM Parameters).</p> <p>PDU Mode: +CBM: <length><CR><LF><pdu></p> <p>Text Mode: +CBM :<sn>,<mid>,<dcs>,<page>,<pages><CR><LF> <data></p>



+CNMI Parameters (Cont.)

<Parameter>	Description
<ds>	<p>Determines SMS-STATUS-REPORTs indication report:</p> <p>0 No SMS-STATUS-REPORTs indications are routed to the TE (default) 1 SMS-STATUS-REPORTs are routed directly to the TE using the following un-solicited result code (+CDS parameters are described in Table 4-58: +CDS Parameters):</p> <p>PDU Mode: +CDS: <length><CR><LF><PDU></p> <p>Text Mode: +CDS: <fo>,<mr>,[<ra>],[<tora>],<scts>,<dt>,<st></p> <p>2 If SMS-STATUS-REPORT is stored in the ME/TA, indication of the memory location is routed to the TE using unsolicited result code (+CDSI parameters are described in Table 4-57: +CDSI Parameters):</p> <p>+CDSI: <mem>,<index></p>
<bfr>	<p>Handles buffering result codes:</p> <p>0 TA buffer of unsolicited result codes defined within this command is flushed to the TE when <mode> 1,2 is Entered (default). 1 TA buffer of unsolicited result codes defined within this command is cleared when <mode> 1,2 is entered.</p>
<mem>	<p>Memory storage where the new message is stored according to +CPMS <mem3> settings, i.e. "SM" or "ME".</p>
<index>	<p>Index where short message as been stored in <mem>.</p>

Note: Buffer can hold up to 15 SMSs indications.

Example

See +CMT, +CMTI, +CDS and +CDSI examples.



4.5.1.12. +CNMA, New Message Acknowledgment

This command allows acknowledgement of received incoming SMS-DELIVER (+CMT) or SMS-STATUS-REPORT (+CDS) routed directly to TE when +CSMS command <service>=1.

In case acknowledge is not send within required time, an RP-ERROR is send to network, +CNMI parameters <mt> and <ds> are clear and next incoming SMS indication is disable.

In TEXT mode, only positive acknowledgement to the network (RP-ACK) is possible.

In PDU mode, either positive (RP-ACK) or negative (RP-ERROR) acknowledgement to the Network is possible.

Command Type	Syntax	Response/Action	Remarks
Set	AT+CNMA	OK or: +CMS ERROR: <err>	Text Mode: Command enable sending positive acknowledgement to network - RP-ACK PDU Mode: Command enables sending both positive and negative acknowledgement to network (RP-ACK or RP-ERROR) together with PDU message.
Test	AT+CNMA=?	Text Mode: OK PDU Mode: +CNMA: (0-2) OK	

The following table shows the +CNMA parameters.

Table 4-54: +CNMA Parameters

<Parameter>	Description
<n>	Acknowledge type (applicable in PDU mode) 0- RP-ACK is send as in TEXT mode. 1- RP-ACK is send with/without PDU message. 2- send RP-ERROR with/without PDU message.
<length>	Size of message in PDU mode format, in octets, excluding SMSC data.
<PDU>	Message header and contents in PDU mode format.

Example



```
AT+CSMS=0
+CSMS: 1,1,1
```

```
OK AT+CNMI=1,2
OK AT+CMGS="1234"
> TEST SMS DELIVER CMT
+CMGS: 104
OK
// Since +CSMS <service>=0, +CMT report for
Deliver SM don't require +CNMA, acknowledge is sent
Immediately when message received.
+CMT: 1234", "09/03/09,09:40:33+08" TEST SMS DELIVER CMT
```

```
AT+CSMS=1
+CSMS: 1,1,1
OK AT+CMGS="0544565034"
> TEST SMS DELIVER CMT ACK REQ
+CMGS: 108
OK
// Since +CSMS <service>=1, next +CMT report for
Deliver SM require +CNMA, acknowledge is sent
By +CNMA. In case +CNMA is not given +CNMI parameters are
cleared and no additional report for incoming SMS will be routed to
TE.

+CMT: "+972544565034", "09/03/09,09:46:42+08" TEST SMS
DELIVER CMT ACK REQ AT+CNMA
OK
```



4.5.1.13. +CMTI, Stored SMS-DELIVER Indication, Unsolicited Response (New SMS-DELIVER Receipt Indication)

The +CMTI unsolicited response is sent to the TE upon receipt of a new SMS-DELIVER SM, if the +CNMI parameter <mt> is set to 1. Refer to “+CNMI, New Message Indications to Terminal”.

This unsolicited message indicates that a new SMS-DELIVER message was received, and is stored in location <index>:

+CMTI: <mem>,<index>

The following table shows the +CMTI parameters.

Table 4-55: +CMTI Parameters

<Parameter>	Description
<mem>	Memory Storage according to +CPMS <mem3> settings: "SM" or "ME".
<index>	Location of the new message in <mem>.

Example

```
AT+CPMS?
+CPMS: "SM",3,20,"ME",17,23,"SM",3,20 // <MEM3>="SM"
```

```
OK
AT+CNMI=1,1 // Set <mt> to '1' OK
AT+CMGS="0123456"
> TEST
```

```
+CMGS: 81
```

```
OK
```

```
+CMTI: "SM",3 // SMS-Deliver stored in index
3 in "SM" memory
```



4.5.1.14. +CMT, SMS-DELIVER Routed to TE, Unsolicited Response (New SMS-DELIVER Receipt)

The +CMT unsolicited response is sent to the TE upon reception of a new SMS-DELIVER SM if +CNMI parameter <mt> is set to '2'.

This unsolicited message displays the received SMS-DELIVER message.

Acknowledge for the received SMS-DELIVER SM is sent to network immediately when +CSMS <service> is set to '0' or when +CSMS <service> is set to '1', acknowledge is sent via +CNMA command during predefine time-out, an error is sent to network in case timeout expire, Next +CMT response is depend on acknowledge of current received +CMT response in case +CSMS <service> parameter set to '1'.

For more information refer to: +CNMI, +CNMA and +CSMS commands. The following table shows the +CMT parameters.

Table 4-56: +CMT Parameters

<Parameter>	Description
<oa>	Message origination address.
<scts>	Service center time stamp.
<toda>	Type of origination address
<fo>	First octet of the SM
<pid>	Protocol Identifier
<dc>	Data Coding Scheme
<sca>	Service Center Address
<tosca>	Type of Service Center Address
<data>	Message contents.
<alpha>	Alpha ID of message.
<length>	In PDU mode: Size of message, in octets, excluding SMSC data. In TEXT mode: number of characters included in the <data>
<pdu>	Message header and contents in PDU mode format. See description in "+CMGR, +MMGR, Read Message".

Example

```
AT+CMGF=1
OK AT+CSMS=1
+CSMS: 1,1,1
```

```
OK AT+CNMI=1,2
OK
```



```
AT+CMGS="1234" // Send message to myself
> Test
```

```
+CMGS: 87
```

```
OK
```

```
+CMT: "1234",,"09/03/09,08:28:54+08" Test
```

4.5.1.15. +CDSI, Unsolicited Response (New SMS-STATUS-REPORT Indication)

The +CDSI unsolicited response is sent to the TE upon receipt of a new SMS-STATUS-REPORT SM, if the +CNMI parameter <ds> is set to '2'. For further information, refer to “+CNMI, New Message Indications to Terminal”.

This unsolicited message indicates that a new SMS-STATUS-REPORT message was received, and is stored in location <index>.

Unsolicited Response

```
+CDSI: <mem>,<index>
```

The following table shows the +CDSI parameters.

Table 4-57: +CDSI Parameters

<Parameter>	Description
<mem>	Memory Storage according to +CPMS <mem3> settings: "SM" or "ME".
<index>	Location of the new message in <mem>.

Example

```
AT+CNMI=1,,2 // Set <ds> to '2' AT+CPMS?
+CPMS: "SM",10,20,"ME",17,23,"SM",10,20
```

```
OK AT+CSMP=49
OK AT+CMGS="1234"
> TEST CDSI
```

```
+CMGS: 90
OK
```



+CDSI: "SM",10 // SMS-Status-Report stored in index 10 in "SM"
memory

4.5.1.16. +CDS, SMS-STATUS-REPORT Routed to TE, Unsolicited Response (New SMS-STATUS-REPORT Receipt)

The +CDS unsolicited response is sent to the TE upon reception of a new SMS-STATUS-REPORT SM if +CNMI parameter <ds> is set to '1'.

This unsolicited message displays the received SMS-STATUS-REPORT message.

Acknowledge for the received SMS-STATUS-REPORT SM is sent to network immediately when +CSMS <service> is set to '0' or when +CSMS <service> is set to '1', acknowledge is sent via +CNMA command during pre-defined timeout, an error is sent to network in case timeout expire, Next +CDS response is depend on acknowledge of current received +CDS response in case +CSMS <service> parameter set to '1'.

For more info refer to: +CNMI, +CNMA and +CSMS commands. The following table shows the +CDS parameters.

Table 4-58: +CDS Parameters

<Parameter>	Description
<fo>	First octet of the SM
<mr>	Message Reference
<ra>	Message Recipient address
<tora>	Type of Recipient address
<scts>	Service center time stamp
<dt>	Discharge-Time
<st>	Status

Example

```
AT+CSMP=49 //Set MO SMS for Status -
Report
OK AT+CNMI=1,2
OK
AT+CMGS="1234" // Send message to myself
> TEST CDS
```



+CMGS: 89

OK

+CDS: "1234",,"09/03/09,08:50:42+08" TEST CDS

4.5.1.17. +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”.

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>,<pages><CR><LF><data>

In PDU mode: (+CMGF=0):

+CBM: <length><CR><LF><pdu>

The following table shows the +CBM parameters.

Table 4-59: +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.



4.5.1.18. +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.

Command Type	Syntax	Response/Action	Remarks
Set	+CMGR=<index> or +MMGR=<index>	<p>If text mode (+CMGF=1) command execution is successful and SMS-DELIVER: +CMGR: <stat>,<oa>,<[alpha]>,<scts> [,<toa>,<fo>,<pid>,<dcs>,<sca>,<tosca>,<length> <h>]<CR><LF><data></p> <p>If text mode (+CMGF=1) command execution is successful and SMS-SUBMIT: +CMGR: <stat>,<da>,<[alpha]> [,<tda>,<fo>,<pid>,<dcs>,<[vp]>,<sca>,<tosca> <length>]<CR><LF><data></p> <p>If text mode (+CMGF=1) command execution is successful and CBM storage: +CMGR: <stat>,<sn>,<mid>,<dcs>,<page>,<pages><CR> <LF><data></p> <p>If text mode (+CMGF=1) command execution is successful and SMS-STATUS-REPORT: +CMGR: <stat>,<fo>,<mr>,<[ra]>,<[tora]>,<scts>,<dt> <,<s> <t></p> <p>If PDU mode (+CMGF=0) and command execution is successful: +CMGR: <stat>,<[alpha]>,<length><CR><LF><pdu> otherwise: +CMS ERROR: <err></p>	The Set command reads the SM located at <index> in the H24 message storage and displays it



The following table shows the +CMGR parameters.

Table 4-60: +CMGR/+MMGR Parameters

<Parameter>	Description																		
<index>	Index in storage of the message to be retrieved.																		
<stat>	Status of message in memory: <table border="1"> <thead> <tr> <th>PDU mode</th> <th>Text mode</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>“REC UNREAD”</td> <td>Received unread messages (default)</td> </tr> <tr> <td>1</td> <td>“REC READ”</td> <td>Received read messages</td> </tr> <tr> <td>2</td> <td>“STO UNSENT”</td> <td>Stored unsent messages</td> </tr> <tr> <td>3</td> <td>“STO SENT”</td> <td>Stored sent message</td> </tr> <tr> <td>4</td> <td>“ALL”</td> <td>All messages</td> </tr> </tbody> </table>	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
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																	
<alpha>	Alpha ID of message (not present).																		
<length>	In PDU mode: Size of message, 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.																		
<toda/toda>	Type of origination address / destination address																		
<fo>	First octet of the SM																		
<pid>	Protocol Identifier																		
<dcs>	Data Coding Scheme																		
<sca>	Service Center Address																		
<tosca>	Type of Service Center Address																		
<vp>	Validity Period. Either in integer format (see Table 4-45: +CSMP Parameters) or in time-string format																		
<mr>	Message reference																		
<scst>	Service center time stamp																		
<ct>	Command type																		
<sn>	Message serial number																		
<mid>	Message ID																		
<page>	Current page number																		
<pages>	Total number of pages																		
<mr>	Message Reference																		
<ra>	Message Recipient address																		
<tora>	Type of Recipient address																		
<scts>	Service center time stamp																		
<dt>	Discharge-Time																		
<st>	Status																		

Note: Any unused bits will be set to zero and shall be ignored by the receiving entity.

Example

```

AT+CPMS?
+CPMS: "ME",0,23,"ME",0,23,"SM",0,20
OK AT+CMGF=1
OK
AT+CMGW="123456"
    
```



> TEST

```
+CMGW: 0
OK AT+CPMS?
+CPMS: "ME",1,20,"ME",1,23,"SM",0,20
```

OK

```
AT+CMGR=0 // Read SMS index 0 from ME
storage in text mode (SMS type is
SMS-SUBMIT)
```

```
+CMGR: "STO UNSENT","123456", TEST
OK AT+CMGF=0
OK
```

```
AT+CMGR=0 // Read SMS index 0 from ME
storage in PDU mode (SMS type is
SMS-SUBMIT)
```

```
+CMGR: 2,,15
07917952140230F2116406812143650000A704D4E2940A OK
AT+CPMS?
+CPMS: "ME",1,23,"ME",1,23,"SM",1,20
```

```
OK
AT+CPMS="SM" // Set <mem1> to SM storage to
read incoming SMS
+CPMS: 1,20,2,23,1,20
OK AT+CPMS?
+CPMS: "SM",1,20,"ME",1,23,"SM",1,20
```

OK

```
AT+CMGF=1
OK
```



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```
AT+CMGR=0 // Read Incoming SMS index 0
in Text mode
+CMGR: "REC UNREAD","+9721234",,"08/11/27,08:06:55+08"
TEST
```

OK

```
AT+CMGR=0 // Message status change after
first read
+CMGR: "REC READ","+972544565034",,"08/11/27,08:06:55+08"
TEST
```

OK

```
AT+CMGF=0 // Set PDU Mode
OK
```

```
AT+CMGR=0 // Read Incoming SMS index 0
in PDU mode
+CMGR: 1,,20
07917952140230F204068121436500008011728060558004D4E294
0A OK
```



4.5.1.19. +CMGL, +MMGL, List Messages

These commands display a list of all SMS with the status value <stat>, from the H24 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 H24 for a list of message headers without attendant message data.

Command Type	Syntax	Response/Action	Remarks
Set	+CMGL [=<stat>] or +MMGL [=<stat>]	<p>If text mode (+CMGF=1) command execution is successful and SMS-SUBMITs and/or SMS-DELIVERs: +CMGL: <index>,<stat>,<oa/da>,,[<scts>] [,<tooa/toda>,<length>]<CR><LF><data><CR><LF> <LF> +CMGL: <index>,<stat>,<da/oa>,,[<scts>] [,<tooa/toda>,<length>]<CR><LF><data>[...]] The parameters <tooa/toda>,<length> refer command shows the Text Mode Parameters +CSDH and will be shown according to +CSDH settings.</p> <p>If text mode (+CMGF=1), command execution is successful and CBM storage: +CMGL: <index>,<stat>,<sn>,<mid>,<page>,<pages><CR><LF><data><CR><LF> +CMGL: <index>,<stat>,<sn>,<mid>,<page>,<pages> <CR><LF><data>[...]]</p> <p>If text mode (+CMGF=1) command execution is successful and SMS-STATUS_REPORTs: +CMGL: <index>,<stat>,<fo>,<mr>,[<ra>],[<tora>],<scts> >,<dt>,<st>[<CR><LF> +CMGL: <index>,<stat>,<fo>,<mr>,[<ra>],[<tora>],<scts> >,<dt>,<st>[...]]</p> <p>In PDU mode (+CMGF=0): +CMGL: <index>,<stat>,[<alpha>],<length><CR><LF>< pdu>[<CR><LF> +CMGL:</p>	



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Test	+CMGL=? +MMGL=?	+CMGL: (list of supported <stat>s) +MMGL: (list of supported <stat>s)	The Test command lists all the supported <stats>
-------------	--------------------	--------------------------------------------------------------------------	--------------------------------------------------



The following table shows the +CMGL/+MMGL parameters.

Table 4-61: +CMGL/+MMGL Parameters

<Parameter>	Description																		
<index>	Index in storage of the message. to be retrieved.																		
<stat>	Status of message in memory:																		
	<table border="1"> <thead> <tr> <th>PDU mode</th> <th>Text mode</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>“REC UNREAD”</td> <td>Received unread messages (default)</td> </tr> <tr> <td>1</td> <td>“REC READ”</td> <td>Received read messages</td> </tr> <tr> <td>2</td> <td>“STO UNSENT”</td> <td>Stored unsent messages</td> </tr> <tr> <td>3</td> <td>“STO SENT”</td> <td>Stored sent message</td> </tr> <tr> <td>4</td> <td>“ALL”</td> <td>All messages</td> </tr> </tbody> </table>	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
	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																	
<oa/da>	Original/destination address.																		
<data>	Message contents in text mode.																		
<length>	In PDU mode: Size of message, in octets, excluding SMSC data. In TEXT mode: Number of characters included in <data>.																		
<pdu>	Message header and contents in PDU mode format. See description in “+CMGR, +MMGR, Read Message”.																		
<toda/toda>	Type of origination address / destination address																		
<fo>	First octet of the SM																		
<mr>	Message reference																		
<ra>	Recipient-Address																		
<tora>	Type Of Recipient-Address																		
<scst>	Service center time stamp																		
<sn>	Message serial number																		
<mid>	Message ID																		
<page>	Current page number																		
<pages>	Total number of pages																		
<dt>	Discharge-Time																		
<st>	Status																		

Example

```
AT+CMGL=?
+CMGL: ("REC UNREAD","REC READ","STO UNSENT","STO SENT","ALL") OK
```

```
AT+CPMS?
+CPMS: "ME",2,23,"ME",2,23,"SM",1,20
```

OK



```
AT+CMGL="STO SENT"  
+CMGL: 1,"STO SENT","123456",, TEST 2
```

```
OK  
AT+CMGL="STO UNSENT"  
+CMGL: 0,"STO UNSENT","123456",, TEST 1
```

```
OK AT+CMGL="ALL"  
+CMGL: 1,"STO SENT","123456",, TEST 2  
+CMGL: 0,"STO UNSENT","123456",, TEST 1
```

```
OK AT+CSDH=1  
OK
```

```
AT+CMGL="ALL"  
+CMGL: 1,"STO SENT","0544565034",,,129,4  
TEST 2  
+CMGL: 0,"STO UNSENT","123456",,,129,4  
TEST 1
```

```
OK
```

```
AT+CPMS="SM" // Change <mem1> to SIM  
+CPMS: 1,20,2,23,1,20
```

```
OK AT+CMGL="ALL"  
+CMGL: 0,"REC READ","123456",,"08/11/27,08:06:55+08",145,4  
TEST OK
```



4.5.1.20. +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.

Command Type	Syntax	Response/Action	Remarks
Set	+CMGD=<index> [,<delflag>]	OK or: +CMS ERROR: <err>	
Read			The Read command for +CMGD is not defined by ETSI, and therefore is not supported by the H24. The H24 returns an error.
Test	+CMGD=?	+CMGD: (list of valid <index>s), (list of valid <delflag>s)	The Test command displays the supported values of <n>.

The following table shows the +CMGD parameters.

Table 4-62: +CMGD Parameters

<Parameter>	Description
<index>	Index in storage of the message. to be retrieved.
<delflag>	<ul style="list-style-type: none"> 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+CMGW="123456"
> TEST 1
+CMGW: 0
OK
AT+CMGW="1234567890"
> TEST 2
```

```
+CMGW: 1
```



OK
AT+CPMS?
+CPMS: "ME",2,23,"ME",2,23,"SM",1,20

OK
AT+CMGR=0

+CMGR: "STO
UNSENT", "123456",,129,17,0,0,167,"+97254120032",145,6
TEST 1
OK
AT+CMGL="ALL"
+CMGL: 1,"STO SENT", "1234567890",,
TEST 2
+CMGL: 0,"STO UNSENT", "123456",, TEST 1

OK

AT+CMGD=,2 // Delete read and sent messages
OK
AT+CPMS?
+CPMS: "ME",1,23,"ME",1,23,"SM",2,20

OK
AT+CMGL="ALL"
+CMGL: 0,"STO UNSENT", "123456",, TEST 1

OK

AT+CMGD=,3 // Delete read, sent and unsent
messages
OK
AT+CPMS?
+CPMS: "ME",0,23,"ME",0,23,"SM",2,20

OK



4.5.1.21. +CGSMS, Select Service for MO SMS Messages

This command handles the selection of the service or service preference used by the H24 to send mobile-originated SMS messages.

Note: This command is network dependent, which means that the network must support SMS over GPRS.

Command Type	Syntax	Response/Action	Remarks
Set	+CGSMS=[<service>]	OK +CME ERROR: <err>	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.
Read	+CGSMS?	+CGSMS: <service> +CME ERROR: <err>	The Read command displays the current SMS service preference setting.
Test	+CGSMS=?	+CGSMS: (list of currently available <service>s) +CME ERROR: <err>	The Test command displays a list of currently available <service>s on the network.

The following table shows the +CGSMS parameters.

Table 4-63: +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



4.5.1.22. +CSCB, Cell Broadcast Messages

This command handles the selection of cell broadcast message types and data coding schemes received by the H24.

Command Type	Syntax	Response/Action	Remarks
Set	+CSCB=[<mode> [,<mids>]]	<p>If mode=0 and <mids> is not specified, then no channels are accepted, and the H24 channel/mid list is cleared.</p> <p>If mode=1 and <mids> is not specified, then the H24 channel list will stay as is.</p> <p>OK or: +CME ERROE:<err></p>	The Set command sets the cell broadcast message type.
Read	+CSCB?	+CSCB: <mode>,<mids>,>,"0-255"	The Read command displays the current MID and DCS settings.
Test	+CSCB=?	+CSCB: (list of supported <mode>s)	The Test command displays the supported values of <mode>.

Note: The Channel list is saved to the SIM card.
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.

The following table shows the AT+CSCB parameters.

Table 4-64: +CSCB Parameters

<Parameter>	Description
<mode>	The current broadcast message mode: 0 MIDs accepted 1 MIDs not accepted
<mids>	Cell broadcast message identifiers 0-65534

Notes:

- A combination of discrete values or intervals can be entered for <mids>, for example, "0,1,5,320-324,922".
- Parameter values must be entered in ascending order.



- The default value for missing <mode> is 0.
- Clear all <mids> might be done by one of the following commands: AT+CSCB=0 or AT+CSCB=
- The string type lists <mids> may include only numbers (0-9), comma and minus (-) characters.
- <mids> = 1-5 is equivalent to five channels.
- When <mode> is 1, and <mids> is a non empty list, <mids> items will be deleted from the H24 list. Nothing will be done with item that does not exist in the H24 list.
- <dcss> is always 0-255, all coding schemes are accepted - this setting cannot be changed.

Example

```
Testing the modes supported: AT+CSCB=?  
+CSCB: (0,1) OK  
Reading the current mid and lists: AT+CSCB?  
+CSCB: 0,"","0-255" OK  
Adding channels 3, 4,5,6,22 to mid list: AT+CSCB=0,"3-6,22"  
OK AT+CSCB?  
+CSCB: 0,"3-6,22","0-255" OK  
Removing channels 4 and 6 from channel list: AT+CSCB=1,"4,6"  
OK AT+CSCB?  
+CSCB: 0,"3,5,22","0-255" OK  
Clear all <mids>  
AT+CSCB=0 / Or AT+CSCB= OK  
AT+CSCB?  
+CSCB: 0,"","0-255" OK
```



4.5.2. SMS Layout

Table 4-65: Layout of SMS-SUBMIT in PDU Mode: (according to GSM23.040)

Reference	Description	Length
<SCA>	Service Center address: 1 BYTE: length (number of followed octets). Mandatory 1 BYTE: <tosca> - value between 128-255	1, 2-12 BYTES
<FO>	First Octet. See Table 4-72: <FO> of SMS-SUBMIT Message.	1 BYTE
<TP-MR>	Message Reference. An integer representation of a reference number of the SM submitted to the SC by the MS. Values between 0-255.	1 BYTE
<TP-DA>	Destination address formatted according to the formatting rules of address fields.	2-12 BYTES TODA valid values are at range of 128-255
<TP-PID>	Protocol-Identifier. Values between 0-255.	1 BYTE
<TP-DCS>	Data Coding Scheme. Values between 0-255.	1 BYTE
<TP-VP>	Validity Period. depending on <fo>, TP-Validity-Period-Format bits setting.	0, 1, 7 BYTE
<TP-UDL>	User data length	1 BYTE
<TP-UD>	User data	0-140 BYTES

Table 4-66: Layout of SMS-DELIVER in PDU Mode (according to GSM23.040)

Reference	Description	Length
<SCA>	Service Center address	1, 2-12 BYTES 1 Byte input is allowed when setting <SCA> length to zero in order to use SCA stored in SIM. TOSCA valid values are at range of 128-255
<FO>	First Octet. See Table 4-70: <FO> of SMS-DELIVER Message.	1 BYTE
<TP-OA>	Originating address formatted according to the formatting rules of address fields.	2-12 BYTES
<TP-PID>	Protocol-Identifier. Values between 0-255.	1 BYTE
<TP-DCS>	Data Coding Scheme. Values between 0-255.	1 BYTE

Layout of SMS-DELIVER in PDU Mode (according to GSM23.040) (Cont.)

Reference	Description	Length
<TP-SCTS>	The TP-Service-Center-Time-Stamp field is given in semi-octet representation, and represents the local time as de-scribed in GSM23.040.	7 BYTEs
<TP-UDL>	User data length	1 BYTE
<TP-UD>	User data	0-140 BYTES

Table 4-67: Layout of SMS-STATUS-REPORT in PDU Mode (according to GSM23.040)

Reference	Description	Length
<SCA>	Mandatory: Service Center address: 1 BYTE: length (number of followed octets) Mandatory: 1 BYTE: <tosca> - value between 128-255	1, 3-12 BYTES (When length is 1, length BYTE = 0)
<FO>	Mandatory: First Octet. See Table 3-71.	1 BYTE
<MR>	Mandatory: Message Reference number, which identifying the previously submitted SMS-SUBMIT or SMS-COMMAND	1 BYTE
<TP-RA>	Mandatory: Recipient address formatted according to the formatting rules of address fields.	2-12 BYTES
<TP-SCTS>	Mandatory: The TP-Service-Center-Time-Stamp field is given in semi-octet representation, and represents the local time as described in GSM03.40	7 BYTE
<TP-DT>	Mandatory: Discharge-Time of <TP-ST>, is given in semioctet representation, and represents the local time as described in GSM23.040	7 BYTES
<TP-ST>	Mandatory: Status of the MO message	1 BYTE
<TP-PI>	Optional: Parameter indicating the presence of any of the optional parameters which follow. See Table 4-73: <TP-PI> of SMS-STATUS-REPORT Message	1 BYTE



Layout of SMS-STATUS-REPORT in PDU Mode (according to GSM23.040) (Cont.)

Reference	Description	Length
<TP-PID>	Optional: Protocol-Identifier. Values between 0-255.	1 BYTE
<TP-DCS>	Optional: Data Coding Scheme. Values between 0-255.	1 BYTE
<TP-UDL>	Optional: User data length	1 BYTE
<TP-UD>	Optional: User data	131 BYTES

- Notes:**
- Any unused bits will be set to zero by the sending entity and will be ignored by the receiving entity.
 - The maximum guaranteed length of TP-UD is 131 octets. In order to achieve the maximum octet of 143, the TP-RA field must have a length of two octets and TP-PID and TP-DCS must not be present.
 - TP-PI is Mandatory if any of the optional parameters following TP-PI is present, otherwise optional.

Table 4-68: Layout of SMS-COMMAND in PDU Mode (according to GSM23.040)

Reference	Description	Length
<SCA>	Service Center address: 1 BYTE: length (number of followed octets). Mandatory 1 BYTE: <tosca> - value between 128-255	1, 3-12 BYTES (When length is 1, length BYTE = 0)
<FO>	First Octet. See Table 4-69: <FO> of SMS COMMAND Message	1 BYTE
<TP-MR>	Message Reference. An integer representation of a reference number of the SM submitted to the SC by the MS. Values between 0-255.	1 BYTE
<TP-PID>	Protocol-Identifier. Values between 0-255.	1 BYTE
<TP-CT>	Command Type	1 BYTE
<TP-MN>	Message Number	1 BYTE
<TP-DA>	Destination address formatted according to the formatting rules of address fields.	2-12 BYTES
<TP-CDL>	Command data length	1 BYTE
<TP-CD>	Command data	0-156 BYTES



Table 4-69: <FO> of SMS-COMMAND Message

Bit/s	Reference	Description
0-1	Message-Type-Indicator	Parameter describing the message type. 1 0 SMS-COMMAND (in the direction MS to SC)
5	TP-Status-Report-Request	Parameter indicating if a status report is requested by the MS 0 A status report is not requested 1 A status report is requested
6	TP-User-Data-Header-Indicator	Parameter indicating whether the beginning of the User Data field contains a Header in addition to the short message or contains only the short message 0 The TP-UD field contains only the short message

Table 4-70: <FO> of SMS-DELIVER Message

Bit/s	Reference	Description
0-1	Message-Type-Indicator	Parameter describing the message type. 0 0 SMS-DELIVER (in the direction SC to MS)
2	TP-More-Message-To-Send	Parameter indicating whether or not more messages are waiting to the MS in the SC. 0 More messages are waiting for the MS in this SC. 1 No more messages are waiting for the MS in this SC.
5	TP-Status-Report-Indication	Parameter indicating if a status report is requested by the MS 0 A status report is not requested 1 A status report is requested
6	TP-User-Data-Header-Indicator	Parameter indicating whether or not a status report will be returned to the SME. 0 A status report will not be returned to the SME. 1 A status report will be returned to the SME.
7	TP-Reply-Path	Parameter indicating that Reply Path is set or not. 0 TP-Reply-Path parameter is not set. 1 TP-Reply-Path parameter is set.

Note: Any unused bits will be set to 0.



Table 4-71: <FO> of SMS-STATUS-REPORT Message

Bit/s	Reference	Description
0-1	Mandatory: Message-Type-Indicator	Parameter describing the message type. 1 0 SMS-STATUS-REPORT (in the direction SC to MS)
2	Mandatory: TP-More-Message-To-Send	Parameter indicating whether or not more messages are waiting to the MS in the SC. 0 More messages are waiting for the MS in this SC 1 No more messages are waiting for the MS in this SC
5	Mandatory: TP-Status-Report-Qualifier	Parameter indicating whether the previously submitted TPDU was an SMS-SUBMIT or an SMS-COMMAND: 0 The SMS-STATUS-REPORT is the result of a SMS-SUBMIT. 1 The SMS-STATUS-REPORT is the result of an SMS-COMMAND
6	Optional: TP-User-Data-Header-Indicator	Parameter indicating whether or not a status report will be returned to the SME. 0 A status report will not be returned to the SME 1 A status report will be returned to the SME

Table 4-72: <FO> of SMS-SUBMIT Message

Bit/s	Reference	Description
0-1	Message-Type-Indicator	Parameter describing the message type. 0 1 SMS-SUBMIT (in the direction MS to SC)
2	TP-Reject-Duplicates	Parameter indicating whether or not the SC shall accept an SMS-SUBMIT for an SM still held in the SC which has the same MR and the same DA as a previously submitted SM from the same OA. 0 Instruct the SC to accept an SMS-SUBMIT as mention above 1 Instruct the SC to reject an SMS-SUBMIT as mention above. In this case an appropriate TP-FCS value will be returned in the SMS-SUBMIT-REPORT.



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3-4	TP-Validity-Period-Format	Parameter indicating whether the TP-VP field is present and in which format. 0 0 TP-VP field not present 1 0 TP-VP field present - relative format 0 1 TP-VP field present - enhanced format - valid only in PDU mode 1 1 TP-VP field present - absolute format
5	TP-Status-Report-Request	Parameter indicating if a status report is requested by the MS 0 A status report is not requested 1 A status report is requested
6	TP-User-Data-Header-Indicator	Parameter indicating whether the beginning of the User Data field contains a Header in addition to the short message or contains only the short message 0 The TP-UD field contains only the short message
7	TP-Reply-Path	Parameter indicating that Reply Path is set or not. 0 TP-Reply-Path parameter is not set 1 TP-Reply-Path parameter is set

Table 4-73: <TP-PI> of SMS-STATUS-REPORT Message

Bit/s	Description
0	0 TP-PID not presence 1 TP-PID not presence
1	0 TP-DCS not presence 1 TP-DCS presence
2	0 TP-UDL not presence 1 TP-UDL presence
3-7	Reserved

Note: Reserved bits are ignored.



4.5.3. DCS handling

4.5.3.1. Sending or Storing SM

When sending or storing SM in TEXT mode, only the specified <dc>s in Table 4-45: +CSMP Parameters, +CSMP command definitions, will be supported. Handling will be as shown in Table 4-74: <dc> field and +CSCS settings conversion when writing SM.

Table 4-74 shows the conversion between the <dc> and +CSCS setting when storing SM to memory or sending SM.

Table 4-74: <dc> field and +CSCS settings conversion when writing SM

CASE	<dc> field	User-Data-Header	Current TE character set (+CSCS)	Action
A	Default alphabet	Not Set	UTF8 or UCS2	Returns an error since conversion from these character sets to default alphabet is impossible.
			GSM	H24 converts each two IRA characters long hexadecimal number to 7-bit septet.
			IRA or 8859	H24 converts each character to 7-bit septet.
B	Default alphabet	Set	All	H24 converts each two IRA characters long hexadecimal number to one 8-bit octet.
C	8-bit or UCS2	All	All	H24 converts each two IRA characters long hexadecimal number to one 8-bit octet.

Note: If SMS, requested to be read in TEXT mode, is a GSM '7' bit Default alphabetical encoded and contains undefined extended characters in User Data (e.g. hex base 1B07), then two septets will be converted, as two separate characters accordingly, to currently selected (+CSCS setting) character set.



4.5.3.2. Reading SM

Any <dc> value is accepted when receiving an SM.

When reading a SM with unsupported <dc> the message header will be passed as usual. The DATA will be output in "HEX" format.

According to the GSM 03.38, Any reserved codings shall be assumed to be the GSM default alphabet (the same as DCS value 0x00) by a receiving entity. Handling will be as shown in Table 4-75: <dc> field and +CSCS settings conversion when reading SM.

Table 4-75: <dc> field and +CSCS settings conversion when reading SM shows the conversion between the <dc> and +CSCS setting when reading SM.

Table 4-75: <dc> field and +CSCS settings conversion when reading SM

CASE	<dc> field	User-Data-Header	Current TE character set	Action
A	Default alphabet	Not Set	All	H24 converts GSM alphabet into current TE character set according to rules of GSM07.05, Annex A
B	Default alphabet	Set	All	H24 converts each 8-bit from TP-UD, encoded in GSM alphabet into two IRA character long hexadecimal number
C	8-bit or UCS2	All	All	H24 converts each 8-bit octet into two IRA character long hexadecimal number

Examples:

```

### Store in TEXT mode SMS encoded in default alphabet with
UDHI set.
### Character set is IRA. AT+CMGF=1
OK AT+CSMP=81,167,0,0
OK AT+CMGW="0544565803"
> 050003090301123456786543
+CMGW: 222
OK AT+CMGR=222
+CMGR: "STO UNSENT","0544565803",
050003090301123456786543
OK AT+CMGF=0
OK AT+CMGR=222
+CMGR: 2,,25
07917952140230F251000A8150446585300000A70D050003090301
123456786543
OK
    
```




```

### Store in TEXT mode SMS encoded in UCS2 alphabet with
UDHI set.
### Character set is IRA. AT+CSMP=81,167,0,10
OK
AT+CMGF
=1
OK
AT+CMGW="054456580
3"
> 050003090301123456786543FE
+CMGW: 223
OK
AT+CMGR=2
23
+CMGR: "STO UNSENT","0544565803",
05000309030112345678654
3FE OK
AT+CMGF=0
OK
AT+CMGR=2
23
+CMGR: 2,,26
07917952140230F251000A81504465853000AA70D050003090301123456786
543FE OK
### Store in TEXT mode SMS 8-bit encoded.
### Character set is
IRA.
AT+CSMP=17,167,0,2
45
OK
AT+CMGF
=1
OK
AT+CMGW="054456580
3"
> 050003090301123456786543
+CMGW: 225
OK
AT+CMGR=2
25
+CMGR: "STO UNSENT","0544565803",
050003090301123456786543
OK
AT+CMGF
=0
OK AT+CMGR=225
+CMGR: 2,,25
07917952140230F211000A81504465853000F5A70C050003090301

```



asserted once for 1.5 sec.

Command Type	Syntax	Response/Action	Remarks
Set	+MRICS=<n>	OK or: +CME ERROR: <err>	The set command sets the RI configuration flag.
Read	+MRICS?	+MRICS: <n> OK	The read command displays the current value of the last selected value for +MRICS set command.
Test	+MRICS=?	+MRICS: (Range of supported <n>'s) OK	The test command displays all supported values for +MRICS set command.

The following table shows the +MRICS parameters.

Table 4-76: +MRICS Parameters

<Parameter>	Description
<n>	Integer defines the RI configuration: 0 - Disable RI (default). 1 - Enable RI for SMS-DELIVER only. 2 - Enable RI for SMS-STATUS-REPORT only. 3 - Enable RI for SMS-DELIVER and SMS-STATUS-REPORT. 4 - Enable RI for CBM only. 5 - Enable RI for SMS-DELIVER and CBM. 6 - Enable RI for CBM and SMS-STATUS-REPORT. 7 - Enable RI for all kind of SMS.

Notes:If SMS storage is full, +MRICS will alert RI, in case of TEXT SMS arrival, just if <mt> value in +CNMI command is equal to '2'.

If SMS storage is full, +MRICS will alert RI, in case of Status Report SMS, just if <ds> value in +CNMI command is equal to '1'. RI indications are available only when UART is active (+MCONN=1 or +MCONN=3).

Example

```
AT+CMGF=1 // switching to text mode
OK AT+MRICS=?
+MRICS: (0-7) OK
AT+MRICS=1// setting to TEXT SMS OK
AT+MRICS?
+MRICS: 1
OK AT+CMGS="0544565199"
>hi <ctr+z>
+CMGS: 11
OK // RI is asserted for 1.5 seconds
```



```
// The next example assumes SMS storage is full AT+CMGF=1 // switching to text mode OK
AT+CPMS?
+CPMS: "MT",20,76,"ME",0,56,"SM",20,20
OK AT+MRICS=1
OK
```

```
AT+CNMI=,2
OK AT+CNMI?
```

```
+CNMI: 0,2,0,0,0 // mt = 2
OK AT+CMGS="0544565199"
>hi <ctr+z>
+CMGS: 12
OK
+CMT: "+972544565199",,"07/04/25,12:34:06+08" hi // RI is asserted for 1.5 seconds
```

```
// The next example show alerting on status report SMS AT+CMGF=1 // text mode
OK AT+CSMP=49
OK
AT+MRICS=2// configure to status report
OK
AT+CMGS="0522123456" // just a phone number
>hi <ctr+z>
+CMGS: 13
OK // after status report has been received, RI is asserted for 1.5 seconds
```

4.6. Network

4.6.1. Network Commands

4.6.1.1. +CSQ, Signal Strength

This command gets signal quality.



Command Type	Syntax	Response/Action	Remarks
Execute	AT+CSQ	+CSQ: <rss>, <ber> OK or: +CME ERROR: <err>	Execution command returns received signal strength indication <rss> and channel bit error rate <ber> from the MT.
Test	AT+CSQ=?	+CSQ: (list of supported <rss>s), (list of supported <ber>s) OK or: +CME ERROR: <err>	Test command returns values supported as compound values.

The following table shows the +CSQ parameters.

Table 4-77: +CSQ Parameters

<Parameter>	Description
<rss>	0 113 dBm or less 1 111 dBm 2...30 109... 53 dBm 31 51 dBm or greater 99 Not known or not detectable
<ber>	Not supported

Example

```
AT+CSQ=?
+CSQ: (0-31,99),(99) OK
AT+CSQ
+CSQ: 25,99
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.

Command Type	Syntax	Response/Action	Remarks
--------------	--------	-----------------	---------



Set	+CRLP= [<iws>[,<mws> [,<T1>[,<N2>,<version> n>]]]]	OK or: +CME ERROR: <err>	
Read	+CRLP?	+CRLP= <iws>,<mws>,<T1>,<N2>,<version> OK or: +CME ERROR: <err>	
Test	+CRLP=?	+CRLP= (list of supported <iws>s), (list of supported <mws>s), (list of supported <T1>s), (list of supported <N2>s, version) OK or: +CME ERROR: <err>	

The following table shows the +CRLP parameters.

Table 4-78: +CRLP Parameters

<Parameter>	Description
<iws>	IWF to MS window size. RLP Versions 0,1 - 0-61 frames. Default value is 61. RLP Version 2 - 0-488 frames. Default value is 240.
<mws>	MS to IWF window size. RLP Versions 0,1 - 0-61 frames. Default value is 61. RLP Version 2 - 0-488 frames. Default value is 240.
<T1>	Acknowledgement timer T1. RLP Versions 0,1 - 38 - 255 x 10 ms. Default value is 48. RLP Version 2 - 42 - 255 x 10 ms. Default value is 52.
<N2>	Retransmission attempts N2 in integer format 1 to 255 retransmits. Default value is 6.
<version>	RLP version. 0, 1 - default versions in GSM mode. 2 - default version in WCDMA mode.

WCDMA and GSM modes support different RLP Versions by default:

- GSM supports RLP Version 0 and 1 by default. Versions 0 and 1 share the same parameter set.
- WCDMA supports RLP Version 2 by default.

Example

```
AT+CRLP=?
+CRLP: (0-61),(0-61),(38-255),(1-255),0
+CRLP: (0-61),(0-61),(38-255),(1-255),1
+CRLP: (0-488),(0-488),(42-255),(1-255),2
```



OK

AT+CRLP?
+CRLP: 61,61,48,6,0
+CRLP: 61,61,48,6,1
+CRLP: 240,240,52,6,2

OK

4.6.1.3. +CREG, Network Registration Status

This command is used to read current network registration status and serving cell information.

Command Type	Syntax	Response/Action	Remarks
Set	AT+CREG=[<n>]	OK or: +CME ERROR: <err>	Set command controls the presentation of an unsolicited result code +CREG: <stat> when <n>=1 and there is a change in the MT network registration status, or code +CREG: <stat>[,<lac>,<ci>] when <n>=2 and there is a change of the network cell.
Read	AT+CREG?	+CREG: <n>,<stat>[,<lac>,<ci>] OK or: +CME ERROR: <err>	Read command returns the status of result code presentation and an integer <stat> which shows whether the network has currently indicated the registration of the MT. Location information elements <lac> and <ci> are returned only when <n>=2 and MT is registered in the network.
Test	AT+CREG=?	+CREG: (list of supported <n>s) OK	

The following table shows the +CREG parameters.

Table 4-79: +CREG Parameters

<Parameter>	Description
<n>	0 Disables the network registration unsolicited result code. 1 Enables the network registration unsolicited result code +CREG: <stat>. 2 Enable network registration and location information unsolicited result code +CREG: <stat>[,<lac>,<ci>]
<stat>	0 Not registered, MT is not currently searching a new operator to register to 1 Registered, home network 2 Not registered, but MT is currently searching a new operator to register to 3 Registration denied 4 Unknown 5 Registered, roaming



<lac>	String type; two byte location area code in hexadecimal format (e.g. "00C3" equals 195 in decimal).
<ci>	String type; two byte cell ID in hexadecimal format.

Example

```
AT+CREG=?
+CREG: (0-2) OK
AT+CREG?
+CREG: 0,1
OK AT+CREG=2
OK
```

```
AT+CREG?
+CREG: 2, 1, A065, 988b
```

OK

4.6.1.4. +CGREG, GPRS Network Registration

This command is used to read current GPRS network registration status and GPRS serving cell information.

Command Type	Syntax	Response/Action	Remarks
--------------	--------	-----------------	---------



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Set	AT+CGREG=[<n>]	OK or: +CME ERROR: <err>	The set command controls the presentation of an unsolicited result code +CGREG: <stat> when <n>=1 and there is a change in the MT's GPRS network registration status, or code +CGREG: <stat>[,<lac>,<ci>] when <n>=2 and there is a change of the network cell. Note: If the GPRS MT also supports circuit mode services, the +CREG command and +CREG: result code apply to the registration status and location information for those
Read	AT+CGREG?	+CGREG: <n>,<stat>[,<lac>,<ci>] OK or: +CME ERROR: <err>	The read command returns the status of result code presentation and an integer <stat> which shows whether the network has currently indicated the registration of the MT. Location information elements <lac> and <ci> are returned only when <n>=2 and MT is registered in the network.
Test	AT+CGREG=?	+CGREG: (list of supported <n>s) OK	

The following table shows the +CGREG parameters.

Table 4-80: +CGREG Parameters

<Parameter>	Description
<n>	0 Disables the network registration unsolicited result code. 1 Enables the network registration unsolicited result code +CGREG: <stat>. 2 Enable network registration and location information unsolicited result code +CGREG: <stat>[,<lac>,<ci>]. The default value is 0.



<stat>	<p>0 Not registered, MT is not currently searching an operator to register to The UE is in GMM state GMM-NULL or GMM-DEREGISTERED-INITIATED. The GPRS service is disabled, the UE is allowed to attach for GPRS if re-requested by the user.</p> <p>1 Registered, home network The UE is in GMM state GMM-REGISTERED or GMM-ROUTING-AREA-UPDATING-INITIATED on the home PLMN.</p> <p>2 Not registered, but MT is currently trying to attach or searching an operator to register to the UE is in GMM state GMM-DEREGISTERED or GMM-REGISTERED-INITIATED. The GPRS service is enabled, but an allowable PLMN is currently not available. The UE will start a GPRS attach as soon as an allowable PLMN is available.</p> <p>3 Registration denied The UE is in GMM state GMM-NULL. The GPRS service is disabled, the UE is not allowed to attach for GPRS if requested by the user.</p> <p>4 Unknown.</p> <p>5 Registered, roaming The UE is in GMM state GMM-REGISTERED or GMM-ROUTING-AREA-UPDATING-INITIATED on a visited PLMN.</p>
<lac>	String type; two byte location area code in hexadecimal format (e.g. "00C3" equals 195 in decimal).
<ci>	String type; two byte cell ID in hexadecimal format.

Example

```

AT+CGREG=?
+CGREG: (0-2) OK
AT+CGREG?
+CGREG: 0,1
OK AT+CGREG=2
OK

AT+CGREG?

+CGREG: 2,1, A065, 988b

OK

```



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/WCDMA network operator.

Command Type	Syntax	Response/Action	Remarks
Set	AT+COPS=[<mode>[,<format>[,<oper>[,<AcT>]]]]	OK or: +CME ERROR: <err>	Set command forces an attempt to select and register the GSM/UMTS network operator. <mode> is used to select whether the selection is done automatically by the MT or is forced by this command to operator <oper> (it shall be given in format <format>) to a certain access technology, indicated in <AcT>. If the selected operator is not available, no other operator shall be selected (except <mode>=4). If the selected access technology is not available, then the same operator shall be selected in other access technology. The selected operator name format shall apply to further read commands (+COPS?) also. <mode>=2 forces an attempt to deregister from the network. The selected mode affects to all further network registration (e.g. after <mode>=2, MT shall be unregistered until <mode>=0 or 1 is selected).
Read	AT+COPS?	+COPS: <mode>[,<format>,<operator>[,< AcT>]] OK or +CME ERROR: <err>	Read command returns the current mode, the currently selected operator and the current Access Technology. If no operator is selected, <format>, <oper> and < AcT> are omitted.
Test	AT+COPS=?	+COPS: [list of supported (<stat>,<long alphanumeric <oper>,<short alphanumeric <oper>,<numeric <oper>[,< AcT>]s) [,(list of supported <mode>s),(list of supported <format>s)] OK or +CME ERROR: <err>	Test command returns a set of five parameters, each representing an operator present in the network. A set consists of an integer indicating the availability of the operator <stat>, long and short alphanumeric format of the name of the operator and access technology. Any of the formats may be unavailable and should then be an empty field. The list of operators shall be in order: home network, networks referenced in SIM or active application in the UICC (GSM or USIM) in the following order: HPLMN selector, User controlled PLMN selector, Operator controlled PLMN selector and PLMN selector (in the SIM or GSM application), and other networks. After the operator list, the H24 returns lists of the supported <mode>s and <format>s. These lists are separated from the operator list by two commas.



Notes:

1. The access technology selected parameters, <AcT>, should only be used in terminals capable to register to more than one access technology. Selection of <AcT> does not limit the capability to cell re selections, even though access technology is selected, the phone may still re-select a cell in other access technology.
2. If MT is unregistered, <stat> parameter of each operator in the available networks list (COPS test command) is 0 (unknown).
3. In order to get current operator's name (COPS read command) in the long or short format, following algorithm is executed:
 - First of all MT tries to retrieve current operator's name from the network's system information message arrives while registration.
 - If current operator's name is absent in the network's system information message, MT tries to retrieve current operator's name from SIM/USIM.
 - If current operator's name is not supported by SIM/USIM, MT retrieves current operator's name from the hard-coded all-operators list, according to current PLMN.

On one hand, COPS set command given with format 0-1(short/long operator's names) accepts only operator's names present in hard-coded all-operators list. On the other hand, operator's name in the long format, retrieved from network's message or SIM/USIM, could be distinguished from operator's name in the long format, retrieved from the hard-coded all-operators list. That is why, it is recommended to give COPS set command with format 2(numeric operator name). If COPS set command is given with format 0, the long operator's name must be present in the hard-coded all-operators list (see AT+COPN – all operators names command).

4. +COPS EONS (<oper>)

Extended Operator Name String (EONS) enabling a Subscriber Identification Module (SIM card) issuer, for example, a network operator, to control the displayed operator name (<oper>) using a set of rules and associated name strings stored on the SIM card. The rules are known as the Operator PLMN List (OPL) and the associated name string is known as the PLMN Network Name (PNN) list. The EONS feature makes it possible for the H24 module to display a particular name other than that of the actual network where the mobile station operating. Some networks operators use the EONS feature to provide "virtual" nationwide coverage by programming the SIM to make the mobile station display the operator's name in all or in particular portions of third party networks. Under these circumstances, the mobile station is said to be in a "virtual" home network. Upon invoking +COPS READ/TEST AT Commands, as far as <oper> parameter, we first verified for PNN within OPL in SIM Card, if one does not exist, <oper> parameter refers to hard coded PLMN Network Name.

The following table shows the +COPS parameters.

Table 4-81: +COPS Parameters

<Parameter>	Description
<mode>	Determines whether what is displayed is defined by <oper>, or is done automatically by the H24. 0 Automatic (<oper> field is ignored) 1 Manual (<oper> field is present, and <AcT> optionally) 2 De-register from network 3 Set only <format> (for read command +COPS?), do not attempt registration/deregistration (<oper> and < AcT> fields are ignored); this value is not applicable in read command response. 4 Manual/automatic (<oper> field shall be present); if manual selection fails, automatic mode (<mode>=0) is entered.



<format>	<p>The operator format type:</p> <ul style="list-style-type: none"> 0 Long format alphanumeric <oper> 1 Short format alphanumeric <oper> 2 Numeric <oper>
<oper>	<p>Operator name displayed. String type; <format> indicates if the format is alphanumeric or numeric; long alphanumeric format can be up to 16 characters long and short format up to 8 characters (refer GSM MoU SE.13 [9]); numeric format is the GSM Location Area Identification number (refer TS 24.008 [8] subclause 10.5.1.3) which consists of a three BCD digit country code coded as in ITU T E.212 Annex A [10], plus a two BCD digit network code, which is administration specific; returned <oper> shall not be in BCD format, but in IRA characters converted from BCD; hence the number has structure: (country code digit 3)(country code digit 2)(country code digit 1)(network code digit 3)(network code digit 2)(network code digit 1).</p>
<stat>	<ul style="list-style-type: none"> 0 Unknown 1 Available 2 Current 3 Forbidden
<AcT>	<p>Access technology selected:</p> <ul style="list-style-type: none"> 0 GSM 1 GSM Compact 2 UTRAN

Example

```
AT+COPS=?
+COPS: (1,"IL Cellcom","Cellcom","42502",2), (1,"IL Cellcom","Cellcom","42502",0),
(3,"IL ORANGE","ORANGE","42501",2), (3,"IL ORANGE","ORANGE","42501",0), (3,"IL
Pelephone","PCL","42503",2), (3,"","","42577",0),,(0,1,2,3,4),(0,1,2)
OK AT+COPS?
+COPS: 0, 0,"IL Cellcom", 0
```

```
OK AT+COPS=3,2
AT+COPS?
```

```
+COPS: 0, 2,"42502", 0 //Specific provider number
```

```
AT+COPS=0
OK
```

```
AT+COPS=1,2,"4250
2" OK
```

```
AT+COPS=1,1,"Cellco
m" OK
```



4.6.1.6. +COPN, Read Operator Names

This command returns the list of operator names from the H24. Each operator code <numeric> that has an alphanumeric equivalent <alphan> in the H24 memory is returned.

Command Type	Syntax	Response/Action	Remarks
Execute	+COPN	+COPN: <numeric1>,<alpha1> [<CR><LF>+COPN: <numeric2>,<alpha2> [...]] OK or: +CME ERROR: <err>	Reads operator names list.
Test	+COPN=?	OK	

The following table shows the +COPN parameters.

Table 4-82: +COPN Parameters

<Parameter>	Description
<numeric>	String type; operator in numeric format
<alphan>	String type; operator in long alphanumeric format

Example

AT+COPN=? OK

AT+COPN

```
+COPN: "744005","PY Personal"
...
+COPN: "74602","SR.TELESUR.GSM"
+COPN: "74602","SR.TELESUR.GSM"
+COPN: "74603","DIGICEL"
+COPN: "74603","DIGICEL"
+COPN: "74603","DIGICEL"
+COPN: "74807","MOVISTAR"
+COPN: "748007","MOVISTAR"
+COPN: "748010","CTI Movil URY"
+COPN: "75001","C&W FLK"
+COPN: "79502","TM CELL"
+COPN: "79502","TM CELL"
+COPN: "90105",""
```



```
+COPN: "90106", ""
+COPN: "90112", "MCP Maritime Com"
+COPN: "90114", "AeroMobile"
+COPN: "90115", "OnAir"
+COPN: "90117", ""
+COPN: "90121", "Seanet" OK
```

4.6.1.7. +CPOL, Preferred Operators

This command is used to edit the list of preferred network operators located in the SIM card.

Command Type	Syntax	Response/Action	Remarks
Set	+CPOL=[<index>][,<format>][,<oper>][,<GSM_Act>,<GSM_Compact_Act>,<UTRAN_Act>]]	OK or: +CME ERROR: <err>	The Set command writes an entry in list of preferred operators.
Read	AT+CPOL?	+CPOL: <index1>,<format>,<oper1> [,<GSM_Act1>,<GSM_Compact_Act1>,<UTRAN_Act1>][<CR><LF>+CPOL: <index2>,<format>,<oper2> [,<GSM_Act2>,<GSM_Compact_Act2>,<UTRAN_Act2>][...] OK or: +CME ERROR: <err>	The Read command displays all the preferred operators that have been entered into the list.
Test	AT+CPOL=?	+CPOL: (list of supported <index>s),(list of supported <format>s) OK or: +CME ERROR: <err> * Index range is SIM dependent	The Test command displays the entire index range supported by the SIM.



The following table shows the +CPOL parameters.

Table 4-83: +CPOL Parameters

<Parameter>	Description
<index>	The order number of operator in the SIM/USIM preferred operator list.
<format>	Operator format type: 0 Long format alphanumeric <oper> 1 Short format alphanumeric <oper> 2 Numeric <oper>
<oper>	Name of the network operator (depends on <format>).
<GSM_AcT>	GSM access technology: 0 Access technology not selected 1 Access technology selected
<GSM_Compact_AcT>	GSM compact access technology: 0 Access technology not selected 1 Access technology selected
<UTRA_AcT>	UTRA access technology: 0 Access technology not selected 1 Access technology selected

This command is used to edit the PLMN selector with Access Technology lists in the SIM card or active application in the UICC (GSM or USIM).

Execute command writes an entry in the SIM/USIM list of preferred PLMNs, previously selected by the command +CPLS. If no list has been previously selected, the User controlled PLMN selector with Access Technology, EFPLMNwAcT, is the one accessed by default. If <index> is given but <oper> is left out, entry is deleted. If <oper> is given but <index> is left out, <oper> is put in the next free location. If only <format> is given, the format of the <oper> in the read command is changed. The Access Technology selection parameters, <GSM_AcT>, <GSM_Compact_AcT> and <UTRAN_AcT>, are required when writing User controlled PLMN selector with Access Technology, EF EFPLMNwAcT, Operator controlled PLMN selector with Access Technology EFOPLMNwAcT and HPLMN selector with Access Technology EFHPLMNwAcT, see TS 31.102. Refer subclause 9.2 for possible <err> values.

Note 1:
 MT may also update the User controlled PLMN selector with Access Technology, EFPLMNwAcT, automatically when new networks are selected.

Note 2:
 The Operator controlled PLMN selector with Access Technology EFOPLMNwAcT, can only be written if the write access condition in the SIM/USIM has been previously verified.

Read command returns all used entries from the SIM/USIM list of preferred PLMNs, previously selected by the command +CPLS, with the Access Technologies for each PLMN in the list. Test command returns the whole index range supported by the SIM.

Example

```
AT+CPOL=?
+CPOL: (1-50),(0-2) OK
```

```
AT+CPOL?
+CPOL: 000,002,"42501",0,0,0
OK
```



AT+CPOL=,0
OK

AT+CPOL?
+CPOL: 000,000,"IL ORANGE",0,0,0 // format changed
OK
AT+CPOL=1,2,"42502",0,0,1
OK

AT+CPOL?
+CPOL: 000,000,"IL ORANGE",0,0,0
+CPOL: 001,000,"IL Cellcom",0,0,1
OK
AT+CPOL=1
OK

AT+CPOL?
+CPOL: 000,000,"IL ORANGE",0,0,0
OK



4.6.1.8. +CPLS, Selection of Preferred PLMN List

This command is used to select one PLMN selector with Access Technology list in the SIM card or active application in the UICC (GSM or USIM), that is used by +CPOL command.

Command Type	Syntax	Response/Action	Remarks
Execute	+CPLS=<list>	OK or: +CME ERROR: <err>	The set command selects a list in the SIM/USIM. Refer subclause 9.2 for possible <err> values.
Read	AT+CPLS?	+CPLS: <list> OK or; +CME ERROR: <err>	The read command returns the selected PLMN selector list from the SIM/USIM.
Test	AT+CPLS=?	+CPLS: (list of supported <list>s) OK	The test command returns the whole index range supported lists by the SIM./USIM.

The following table shows the +CPLS parameters.

Table 4-84: +CPLS Parameters

<Parameter>	Description
<list>	0 - User controlled PLMN selector with Access Technology EF _{PLMNwAcT} , if not found in the SIM/UICC then PLMN preferred list EF _{PLMNsel} (this file is only available in SIM card or GSM application selected in UICC) 1 - Operator controlled PLMN selector with Access Technology EF _{OPLMNwAcT} 2 - HPLMN selector with Access Technology EF _{HPLMNwAcT}

Example

AT+CPLS=0

OK AT+CPLS?
+CPLS: 0



4.6.1.9. +MBAND, RF Band Selection

This command configures the RF bands that the unit will use for communicating with the Network.

For each model of the H24, initial setting will be entered at the RF phasing stage in the factory to determine the unit bands that will be scanned.

+MBAND command enabling the user to select any subset of the factory phased set of bands to scan and to register with them to the network.

The factory phased set of bands is called default bands.

The Motorola Band Selection command (+MBAND) allows controlling of the Bands scan process.

MBAND will provide the user with the capability to select subset bands on which H24 will perform the network scanning.

This may help the user reducing scanning time.

There are 2 parameters for bands selection:

- GSM Bands.
- WCDMA Bands.

+MBAND settings will take affect upon the next power-up.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MBAND=[< GSM Bands >], [< WCDMA Bands >]	OK	Configures the RF bands to be scanned.
Read	AT+MBAND?	+MBAND: < GSM Bands >, < WCDMA Bands > OK	Displays the RF bands configuration.
Test	AT+MBAND=?	+MBAND: (list of supported < GSM Bands >),(list of supported< WCDMA Bands >) OK	
Execute	AT+MBAND	OK	Restores RF bands factory defaults.



The following table shows the +MBAND parameters.

Table 4-85: +MBAND Parameters

<Parameter>	Parameter Value	Description
GSM Bands	1-15	This parameter is a bitmap for selection of the available GSM bands.
WCDMA Bands	0-21	This parameter is a bitmap for selection of the available WCDMA bands.

The following table gives the GSM bands parameters description.

Table 4-86: +GSM Bands Parameters Description

GSM				
1900	1800	900	850	NUM
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	10
1	0	1	1	11
1	1	0	0	12
1	1	0	1	13
1	1	1	0	14
1	1	1	1	15



Table 4-87: +WCDMA Bands Parameters Description

WCDMA					
1700	2100	900	850	1900	NUM
0	0	0	0	0	0
0	0	0	0	1	1
0	0	0	1	0	2
0	0	0	1	1	3
0	0	1	0	0	4
0	0	1	0	1	5
X	X	X	X	X	6
X	X	X	X	X	7
0	1	0	0	0	8
0	1	0	0	1	9
0	1	0	1	0	10
0	1	0	1	1	11
0	1	1	0	0	12
0	1	1	0	1	13
X	X	X	X	X	14
X	X	X	X	X	15
1	0	0	0	0	16
1	0	0	0	1	17
1	0	0	1	0	18
1	0	0	1	1	19
1	0	1	0	0	20
1	0	1	0	1	21

Example
 //Setting GSM bands and WCDMA bands: AT+MBAND= 4,8
 OK
 //Test commands
 AT+MBAND=?
 +MBAND: (1-15), (0-21) OK
 //Read command
 AT+MBAND?
 +MBAND: 4, 8
 OK
 //exec command AT+MBAND OK



4.6.1.10. +MCI, Motorola Cell Information

This command reports to TE information of a current serving cell and neighbor cells. The information to be reported for GSM/GPRS cell in order of appearance:

<RAT>, <ARFCN>, <BSIC>, <Cell ID>, <SS>, <SQ>, <C1>, <C2>, <C31>, <C32>, <TA>
<\n><\r>

The information to be reported for WCDMA cell in order of appearance:

<RAT>, <UARFCN>, <Cell ID>, <PSC>, <RSCP>, <Ec/No> <\n><\r>

Command Type	Syntax	Response/Action	Remarks
Set	AT+MCI=[<mask_GSM>],[<mask_WCDMA>]	+MCI: <servicing cell information parameters>\n\r [<neighbor 1 information parameters>\n\r [,<neighbor 2 information parameters>\n\r ... [,<neighbor N information parameters>\n\r]]...] OK or: +CME ERROR: <err>	Requests a serving cell and neighbor cells information. Only parameters enabled in cells information masks will be reported. N - maximal number of found neighbor cells. For GSM cells in GSM registration, N = 32 For WCDMA cells in WCDMA registration, N = 37.
Read	AT+MCI?	+MCI: <mask_GSM, mask_WCDMA> OK	Outputs current requested GSM and WCDMA cells information masks.
Test	AT+MCI=?	+ MCI: (0-1023), (0-31) OK	Outputs range of available cells information masks for request.



The following table shows the +MCI parameters.

Table 4-88: +MCI Parameters

<Parameter>	Description
<mask_GSM>	<p>The requested parameters mask to report for GSM: Word bit mask reflects GSM cell parameters, selected by user to be reported:</p> <p>LSB bit 0: ARFCN bit 1: BSIC bit 2: Cell ID bit 3: SS bit 4: SQ bit 5: C1 bit 6: C2 bit 7: C31 bit 8: C32 bit 9: TA bit 10 - bit 15: Unused MSB</p> <p>Mask is input in decimal format. If this parameter is omitted, all GSM cell parameters are reported in the answer on Set command. Default values (all parameters are requested) - 1023.</p>
<mask_WCDMA>	<p>The requested parameters mask to report for WCDMA: Word bit mask reflects WCDMA cell parameters, selected by user to be reported:</p> <p>LSB bit 0: UARFCN bit 1: Cell ID bit 2: PSC bit 3: RSCP bit 4: Ec/No bit 5 - bit 15: Unused MSB</p> <p>Mask is input in decimal format. If this parameter is omitted, all WCDMA cell parameters are reported in the answer on Set command. Default values (all parameters are requested) - 63.</p>
<RAT>	<p>Radio Access Technology: "2G" - GSM cell parameters report "3G" - WCDMA cell parameters report String parameter.</p>
<ARFCN>	<p>Absolute Radio Frequency Channel Number. Ranges: Band 1900: 512-810 Band 1800: 512-885 Band 850: 128-251 Band 900: 975-1024, 0-124</p>
<BSIC>	<p>Base Station Identity Code Range: [0 - 3F]</p>



+MCI Parameters (Cont.)

<Parameter>	Description
<Cell ID>	Cell Identifier GSM Range: [0 - FFFF], WCDMA Range [0 - FFFFFFFF]
<SS>	Signal Strength. Range: 0 - 63
<SQ>	Signal Quality (%) Range [0 - 7]
<C1>	The path loss criterion parameter. Range: signed int16
<C2>	The C2 criterion is used for cell ranking in the GSM cell-reselection process. Range: signed int16
<C31>	The signal level threshold criterion parameter. Range: signed int16
<C32>	The cell-ranking criterion parameter. Range: signed int16
<TA>	TA (Timing Advance) is defined for serving GSM cell only. This value will be reported only in Dedicated and TBF modes. Valid value range is from 0 to 63.
<UARFCN>	UTRA Absolute Radio Frequency Channel Number (Downlink) Ranges: Band 2100: 10562 - 10838 Band 850: 4357 - 4458 additional 1007, 1012, 1032, 1037, 1062, 1087 Band 900: 2937 - 3088 Band 1700: 3112 - 3388 additional 3412, 3437, 3462, 3487, 3512, 3537, 3562, 3587, 3612, 3637, 3662, 3687 Band 1900: 9662 - 9938 additional 412, 437, 462, 487, 512, 537, 562, 587, 612, 637, 662, 687
<PSC>	Primary Scrambling Code Range: [0 - FFFF]
<RSCP>	Received Signal Code Power, the received power on one code measured on the Primary CPICH. Range: -125 ... -25 dBm
<Ec/No>	Received energy per chip divided by the power density in the band. Range: 0...63.

Note: If MCI output parameter is not defined in GSM/WCDMA mask, it does not appear in report.
If MCI output parameter is not relevant and can't be retrieved it is omitted (comma appears).
If MCICFG command is not set to 1, MCI set command request return error - operation not allowed (see MCICFG command).

Example




```
AT+MCI=?  

+ MCI: (0-1023), (0-31)
```

```
OK AT+MCI?  

+ MCI: 1023, 31
```

```
OK AT+COPS?  

+COPS: 1,0,"IL ORANGE",0 // GSM registration
```

```
OK
```

```
AT+MCI = , // default masks
```

```
// BSIC values for some cells are unknown  

// C1, C2, C31, C32 are calculated only for best cells  

// Signal Quality and TA value are relevant only for serving cell in dedicated mode  

//RAT, ARFCN , BSIC, Cell_ID, SS, SQ, C1, C2, C31, C32, TA "2G",69,2,39051,50,2,50,50,0,0,1 // in  

dedicated mode  

"2G",658,41,39052,33,,17,17,0,0,  

"2G",83,42,39053,28,,29,29,0,0, "2G",75,,22,,,,, "2G",62,9,,22,,21,21,0,0, "2G",80,13,,20,,20,20,0,0,  

"2G",64,12,,20,,20,20,0,0, "2G",77,42,,18,,,,, "2G",636,,18,,,,, "2G",625,47,,18,,,,, "2G",79,,16,,,,,  

"2G",61,,15,,,,, "2G",72,,14,,,,, "2G",78,,14,,,,, "2G",74,,13,,,,, "2G",81,,12,,,,, "2G",650,,9,,,,,  

"2G",661,,6,,,,, "2G",632,,5,,,,, "2G",632,,5,,,,, "2G",87,,12,,,,, "2G",88,,11,,,,, "2G",650,,9,,,,,  

"2G",632,,5,,,,, "2G",87,,12,,,,, "2G",625,47,,18,,,,, "2G",632,,5,,,,, "2G",632,,5,,,,,
```

```
"2G",631,,1,,,,, "2G",627,,1,,,,, "2G",621,,1,,,,, "2G",646,,0,,,,, "2G",655,,1,,,,,
```

```
OK AT+COPS?  

+COPS: 1,0,"IL ORANGE",2  

OK AT+MCI=,
```

```
//RAT, UARFCN , Cell_ID,PSC, RSCP, EC/NO
```

```
"3G",10788,30461,1936,107,19 "3G",10788,,10000,121,49 "3G",10788,,10001,0,0 "3G",10788,,2064,116,34
```

```
OK
```

4.6.1.11. +MCICFG, Configure Motorola Cell Information

This command Enables/Disables Motorola Cell Information process (cell data gathering on background and MCI request). MCI set command returns ERROR if MCICFG mode is 0.



Command Type	Syntax	Response/Action	Remarks
Set	+MCICFG=<mode>	OK or: +CME ERROR: <err>	Sets MCICFG mode (enable/disable MCI process).
Read	+MCICFG?	+MCICFG: <mode> OK	Outputs current MCICFG mode.
Test	+MCICFG=?	+MCICFG: (0-1) OK	Outputs range of available values of MCICFG mode.

The following table shows the +MCICFG parameters.

Table 4-89: +MCICFG Parameters

<Parameter>	Description
<mode>	0 - Disable MCI process (default value). 1 - Enable MCI process.

Example

AT+MCICFG=?

+MCICFG: (0-1) OK AT+MCICFG?
+MCICFG: 0
OK AT+MCI=,
+CME ERROR: operation not allowed

AT+MCICFG=1
OK AT+MCI=,
// Data output...

4.6.1.12. +WS46, Get Wireless Network

This command is used to query the current cellular network (Access Technology selected). Access Technology is selected by +COPS Set command (see parameters of AT+COPS).



Command Type	Syntax	Response/Action	Remarks
Read	AT+WS46?	<n> OK or: +CME ERROR: <err>	
Test	AT+WS46=?	+WS46: (list of supported <n>s) OK or: +CME ERROR: <err>	

The following table shows the +WS46 parameters.

Table 4-90: +WS46 Parameters

<Parameter>	Description
<an>	Selected Access Technology 12 GSM Digital Cellular Systems (GERAN only) 22 UTRAN only 25 3GPP Systems (both GERAN and UTRAN) Note: These 3 values are mutually exclusive. e.g. if value "25" is returned, value "12" and "22" shall not be returned.

Note: AT command WS46 indicates the networks in which H24 can operate. When manual registration was performed with selecting of particular access technology (GERAN/UMTS), +WS46 Read command returns code 12 for GERAN access technology or code 22 for UMTS access technology. When automatic registration or manual registration without selecting of particular access technology was performed, +WS46 Read command returns code 25(both GERAN and UMTS technologies are available). Actually, the return code of +WS46 Read command indicates the user preference for the RAT rather than the mode MT is operating in.

Example

```
AT+COPS?  
+COPS: 0,0,"IL Cellcom",2  
OK AT+WS46?  
25  
OK AT+WS46=?  
+WS46: (12,22,25)
```

4.6.1.13. +MPDS, Type of Packet Data Service

This command indicates current available type of Packet Data Service.



Note: GPRS/EDGE coverage will be detected only when SIM has GPRS ability.

Command Type	Syntax	Response/Action	Remarks
Execute	AT+MPDS	+MPDS: <mode> OK or: +CME ERROR: <err>	The Execute command returns the available type of Packet Data Service.
Read	AT+MPDS?	+MPDS: <mode> OK or: +CME ERROR: <err>	The Read command returns the available type of Packet Data Service.

The following table shows the +MPDS parameters.

Table 4-91: +MPDS Parameters

<Parameter>	Description
<mode>	<p>0 - No Data Packet Service.</p> <p>2G cells:</p> <p>1 - GPRS coverage. 2 - EDGE coverage.</p> <p>3G cells:</p> <p>3 - WCDMA (HSDPA and HSUPA not supported). 4 - WCDMA with HSDPA supported. 5 - WCDMA with HSUPA supported. 6 - WCDMA(HSDPA and HSUPA supported).</p> <p>There is no parameter default value.</p>

Example
SIM with GPRS coverage, 2G cells: AT+MPDS
+MPDS: 1
OK AT+MPDS?
+MPDS: 1
OK
3G cells: AT+MPDS
+MPDS: 4
OK

4.6.1.14. +PACSP, Network Selection Menu Availability

This command shows the Network Selection Menu availability.



Command Type	Syntax	Response/Action	Remarks
Read	+PACSP?	+PACSP: <mode> OK or: +CME ERROR: <err>	Read command returns the current value of the <mode> parameter.
Test	+PACSP=?	OK or: +CME ERROR: <err>	Test command returns OK result code.

The following table shows the +PACSP parameters.

Table 4-92: +PACSP Parameters

<Parameter>	Description
<mode>	PLMN mode bit (in CSP file on the SIM). 0 - Restriction of menu option for manual PLMN selection. 1 - No restriction of menu option for manual PLMN selection.

4.6.1.15. +MLOPS, Motorola Limited Operator Selection

This command enables/disables LOPS (Limited Operator Selection) feature, while USIM/SIM is not inserted.

Operation of this command is flexible dependent. LOPS feature:

- Manual camping on a desired network PLMN
- Desired network's Signal Strength (AT+CSQ query) and Packet Service Type (AT+MPDS query) reporting

Command Type	Syntax	Response/Action	Remarks
--------------	--------	-----------------	---------



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Set	+MLOPS=[<RAT>],[<numeric_PLMN>]	OK or: +CME ERROR: <err>	Set command enables/disables LOPS feature. Enable: Forces an attempt to camp on the cell of a user-defined network, and allows Signal Strength/Packet Service Type reports of a desired network's cell. "OK" is returned if camping was successful. If H24 cannot be camped on a desired network - "ERROR" is returned ("no network service"). Disable: - Camp automatically. - Packet Service Type will be reported as "No Data Packet Service".
Read	+MLOPS?	+MLOPS: <RAT>,<numeric_PLMN> OK	In case LOPS feature is disabled, Read command returns only <RAT> parameter.
Test	+MLOPS=?	+MLOPS: (0-2), "numeric_PLMN" OK	Outputs range or type of given parameters.

The following table shows the +MLOPS parameters.

Table 4-93: +MLOPS Parameters

<Parameter>	Description
<RAT>	Radio Access Technology of desired camping: 1 - Enable LOPS feature on WCDMA 2 - Enable LOPS feature on GSM 0 - Disable LOPS feature. The default RAT value is 0



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<numeric_PLMN>	<p>String type parameter defining the network to camp on in numeric format. This format is the Location Area Identification number (refer TS 24.008 [8] subclause 10.5.1.3) which consists of a three BCD digit country code, coded as in ITU T E.212 Annex A [10], plus a two BCD digit network code, which is administration specific, <numeric_PLMN> will not be in BCD format, but in IRA characters converted from BCD; hence the number has structure: (country code digit 3)(country code digit 2)(country code digit 1)(network code digit 3)(network code digit 2)(network code digit 1).</p> <p>The default (MLOPS feature disabled) is no PLMN.</p>
-----------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Note 1: Feature is disabled in following cases:

- AT+MLOPS Set command with RAT parameter 0 is given.
- Unsuccessful camping.
- USIM/SIM inserting.
- AT+MLOPS aborted.

While LOPS feature is disabled, <RAT> and <numeric_PLMN> parameters return to default.

Note 2: The feature is enabled in the following cases:

- AT+MLOPS Set command with RAT parameter 1 or 2 is given.

Note 3: In case PLMN parameter is not given, H24 will try to camp on the latest given PLMN and if it doesn't exist, H24 responds with a CME ERROR ("invalid characters in text string").

Note 4: When switching to a different SIM/USIM, a power cycle is required.

Example

AT+MLOPS=?

+ MLOPS: (0-2), "numeric_PLMN" OK

AT+MLOPS=1, "42502"// Enable LOPS Feature on IL Cellcom WCDMA network

OK //Camped

AT+CSQ

+CSQ: 15,99

OK AT+MPDS?

+MPDS: 3 // WCDMA only

OK

AT+MLOPS=2, "45555"// Unknown PLMN

+ CME ERROR: "no network service"// Camping failed



AT+MLOPS=0

OK // LOP feature is disabled

AT+MPDS?

+MPDS: 0 // Packet Service Type reports "No Data Packet Service" OK

// SIM is inserted

AT+MLOPS=1, "42502"// Enable LOPS Feature on IL Cellcom WCDMA network

+CME ERROR: "operation not allowed"



4.7. Hardware Information

4.7.1. Hardware Information Commands

4.7.1.1. +CBC, Battery Charger Connection

This command enables a user to query the VCC voltage level.

Command Type	Syntax	Response/Action
Read	+CBC	+CBC:<bc>,<bcl>

The following table shows the +CBC parameters

Table 4-94: +CBC Parameters

<Parameter>	Description														
<bc>	Battery status values 0 Battery powered 1 Externally powered - not implemented in H24 Note: The H24 input power source is connected via the battery pins only, so it is always battery powered.														
<bcl>	Battery charge level: <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>VCC, V</th> <th>Battery Level</th> </tr> </thead> <tbody> <tr> <td>>3.70</td> <td>90</td> </tr> <tr> <td>3.50-3.70</td> <td>60</td> </tr> <tr> <td>3.40-3.50</td> <td>20</td> </tr> <tr> <td>3.35-3.40</td> <td>10</td> </tr> <tr> <td>3.30-3.35</td> <td>5</td> </tr> <tr> <td><3.30</td> <td>0</td> </tr> </tbody> </table>	VCC, V	Battery Level	>3.70	90	3.50-3.70	60	3.40-3.50	20	3.35-3.40	10	3.30-3.35	5	<3.30	0
VCC, V	Battery Level														
>3.70	90														
3.50-3.70	60														
3.40-3.50	20														
3.35-3.40	10														
3.30-3.35	5														
<3.30	0														

Note: The H24 does not allow the detection of battery use. The power supply of the H24 is connected via the battery pins. However, users can use this command to verify the level of the H24 input power source.

Example

AT+CBC



+CBC: 0,60 //This example shows 0 (battery powered) with 60% power. OK

Note: The battery level is an average value, which is updated once in 0.5 minute max, depending on unit state "Idle" or "In-call or searching" accordingly. All values are on the 70 pin connector. Preciseness is (+/-) 50mV.

4.7.1.2. +CBAUD, Baud Rate Regulation

This command sets the baud rate. The baud rate of the H24 is changed/set to the request value <rate> written in the command.

The UART is configured according to the request, or to the specific constant baud rate after output "OK" response to the terminal. For example, AT+CBAUD=8 is equivalent to AT+CBAUD=57600.

Note: This command can only be issued over UART.

For Circuit Switched Data calls, baud rate must be set higher than the network's rate.

Command Type	Syntax	Response/Action
Set	AT+CBAUD=<n> AT+CBAUD=<rate>	OK or: ERROR
Read	AT+CBAUD?	+CBAUD: <rate>
Test	AT+CBAUD=?	+CBAUD: (list of supported <n>s, list of supported <rate>s)

The following table shows the +CBAUD parameters.

Table 4-95: +CBAUD Parameters

<Parameter>	Description
<n> <rate>	0 Auto baud rate - Not supported
	1 600
	2 1200
	3 2400
	4 4800
	5 9600
	6 19200
	7 38400
	8 57600
	9 Auto baud rate - Not supported
	10 115200
	11 300
	12 230400
	13 460800
	14 921600
	15 2900000 - Not supported
	16 3200000
	17 3686400
	18 4000000
The default value is 115200.	



Note: Auto baud rate (options 0 and 9) will return error or command not supported result.

Example

```
AT+CBAUD=57600 or
AT+CBAUD=8 //These commands have the same effect
OK AT+CBAUD?
+CBAUD: 57600
OK AT+CBAUD=?
+CBAUD:
(1-8,10-14,16-18,300,600,1200,2400,4800,9600,19200,38400,57600,115200,230400,460800,921600,3200000,
3686400) OK
```

4.7.1.3. +IPR, Local Terminal/H24 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 H24 accepts commands.

The <rate> value specified is the rate in bits per second at which the terminal-H24 interface operates, for example, 19200 or 115200. The rates supported by the H24 are

manufacturer-specific. However, the +IPR parameter permits setting any rate supported by the H24 during online operation.

Note: +IPR is similar to +CBAUD, but with the ability to save.

This command can only be issued over UART.

For Circuit Switched Data calls, baud rate must be set higher than the network's rate

Command Type	Syntax	Response/Action
Set	AT+IPR=<n> AT+IPR=<rate>	OK or: ERROR
Read	AT+IPR?	+IPR: <rate>
Test	AT+IPR=?	+IPR: (list of supported <rate>s)



The following table shows the +IPR parameters.

Table 4-96: +IPR Parameters

<Parameter>	Description
<n> <rate>	0 Auto baud rate - Not supported
	1 600
	2 1200
	3 2400
	4 4800
	5 9600
	6 19200
	7 38400
	8 57600
	9 Auto baud rate - Not supported
	10 115200
	11 300
	12 230400
	13 460800
	14 921600
	15 2900000 - Not supported
	16 3200000
	17 3686400
	18 4000000
	The default value is 115200.

Note: Auto baud rate (options 0 and 9) will return error or command not supported result.

Example

```
AT+IPR=6
OK AT+IPR?
+IPR: 19200
OK AT+IPR=?
```

```
+IPR:
(1-8,10-14,16-18,300,600,1200,2400,4800,9600,19200,38400,57600,115200,230400,460800,921600,3200000,
3686400) OK
```

4.7.1.4. &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 H24 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 H24.

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 H24 devices. When the terminal is ready and able to receive data, it puts the RTS line in an active (low) condition to indicate this to the H24. If the terminal is not able to receive data (typically because its receive buffer is almost full), it puts the RTS line in an inactive (high) condition as a signal to the H24 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



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active condition. The RTS line complements the CTS line. The H24 puts the CTS line in an active condition to tell the terminal that it is ready to receive the data. Likewise, if the H24 is unable to receive data, it places the CTS line in an inactive condition.

Note: This command can only be issued over UART.

Command Type	Syntax	Response/Action
Set	AT&K<param>	OK
Read	AT&K?	&K: <param>
Test	AT&K=?	&K: (list of supported <param>s)

The following table shows the &K parameters.

Table 4-97: &K Parameters

<Parameter>	Description
<param>	0 Disable all terminal/H24 flow control 3 Enable CTS/RTS terminal/H24 flow control 6 Enable CTS/RTS terminal/H24 flow control The default value is 3.

Example

```
AT&K?
&K: 3
OK AT&K4
OK
```



4.7.1.5. &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 H24 (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.
- In Local Link mode, the DCD line indicates the Local Link data status. When AT&C is set to 0, the DCD signal is always ON.

When AT&C is set to 1:

- DCD signal is set to ON when +MDLC command has been launched.
- DCD signal is set to OFF when Local link has been stopped.

When AT&C is set to 2, the DCD signal is always 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).

Command Type	Syntax	Response/Action
Set	AT&C[<param>]	OK
Read	AT&C?	&C:<param>
Test	AT&C=?	&C:(list of supported <param>s)

The following table shows the &C parameters.

Table 4-98: &C Parameters

<Parameter>	Description
-------------	-------------



<param>	<p>DCD signal ON</p> <p>0 DCD is forced ON at all times.</p> <p>1 DCD is set to ON when:</p> <ul style="list-style-type: none"> a A CSD carrier is detected. b A GPRS external session is being established: H24 enters PPP mode TE is about to send an LCP configure-request to the H24 (GPRS connection is not yet established). c Local link starts (+MDLC command launched). <p>DCD is set to OFF when:</p> <ul style="list-style-type: none"> a No CSD carrier is detected. This can happen when a CSD call has been disconnected or when H24 enters CSD online command mode (switch operation). b The H24 has lost its GPRS connection with the network (PDP context was deactivated and the IP address is cancelled). c Local link has been stopped. <p>2 DCD is set to ON when H24 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 H24 has lost its GPRS connection with the network (PDP context was deactivated and the IP address is cancelled). The default value is 1.</p>
---------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Note: If &C is set to 2 when a CSD call is set, DCD will always remain OFF.

Example

```

AT&C?
&C: 2
OK
AT&C
OK
at&c?
&C: 1
OKOK AT&C0
OK

```



4.7.1.6. &D, Circuit 108 Behavior

This command determines how the H24 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 H24 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).

In case of local link during initial PPP retries, DTR change will be ignored.

Command Type	Syntax	Response/Action
Set	AT&D<param>	OK
Read	AT&D?	&D:<param>
Test	AT&D=?	&D:(list of supported <param>s)

The following table shows the &D parameters.

Table 4-99: &D Parameters

<Parameter>	Description
<param>	<p>The H24's reaction when the DTR status is changed from ON to OFF.</p> <p>In CSD calls:</p> <ul style="list-style-type: none"> 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 <p>In GPRS calls:</p> <ul style="list-style-type: none"> 0,4 Ignores DTR changes 1 Switches the GPRS session to asynchronous command mode (the session remains connected) <p>In GPRS FTP calls:</p> <ul style="list-style-type: none"> 0,1,4 Ignores DTR changes 2,3 Deactivates the GPRS and returns to command mode <p>In Local link:</p> <ul style="list-style-type: none"> 0,3,4 Ignores DTR changes 1,2 Stop Local link. Return H24 to command mode. <p>The default value is 2.</p>

Example

```
AT&D?
&D: 2
OK
AT&D1
OK
```



4.7.1.7. +MCWAKE, GPRS Coverage

The Motorola Coverage wake-up command (+MCWAKE) will control network coverage reporting.

There are 2 different kinds of reports:

GPIO (Pin 49) - Change the GPIO line's state

between high and low, Unsolicited report - An unsolicited report sent to the TE,

+MCWAKE:STATE: 1 (high)

+MCWAKE:STATE: 0 (low)

Command Type	Syntax	Response/Action
Set	AT+MCWAKE=[< Report type >], [< Service type >], [< Unsolicited Report >]	OK
Read	AT+MCWAKE?	+MCWAKE: < Report type>, < Service type >, < Unsolicited Report > OK
Test	AT+MCWAKE=?	+MCWAKE: (list of supported < Report type >),(list of supported< Service type >), (list of supported < Unsolicited Report >) OK

The following table shows the +MCWAKE parameters.

Table 4-100: +MCWAKE Parameters

<Parameter>	Description
< Report type >	0 - No indication, GPIO HIGH. 1 - Gpio indication when coverage change to: <ul style="list-style-type: none"> • "No coverage": gpio LOW. • "Coverage": gpio HIGH. 2 - Gpio indication when coverage change to: <ul style="list-style-type: none"> • "No coverage": gpio HIGH. • "Coverage": gpio LOW.



< Service type >	<p>Coverage setting:</p> <p>0 - ANY packet data: UMTS, GPRS OR EGPRS packet. 1 - 2.XG packet data: GPRS, EGPRS. 2 - GSM. 3 - UMTS. 4 - Any coverage: UMTS, GPRS, EGPRS, or GSM.</p>
< Unsolicited Report >	<p>Unsolicited Report to TE setting:</p> <p>0 - DISABLE Unsolicited report. 1 - ENABLE Unsolicited Report.</p> <p>Note: If Report type = 0 no unsolicited Report. Setting it to on when the Report type = 0 will cause an error.</p>

Note: Default values of report type, service type & unsolicited report are available from factory and their values are 2, 0, 0.

Example

//Setting report type to mode coverage change and set it for report type ON and service type ANY and no unsolicited report:

```
AT+MCWAKE=1,4,0
OK AT+MCWAKE?
+MCWAKE: 1,4,0
OK
AT+MCWAKE=1,4,1 // Set command with Unsolicited Report
MCWAKE_STATE: 1
OK AT+MCWAKE=?
+MCWAKE: (0-2),(0-4),(0-1) OK
```

Set command Use Cases example:

Setting report type to mode coverage change and set it for report type ON and service type ANY and no unsolicited report:

```
AT+MCWAKE=1, 4,0
```

OK



4.7.1.8. +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.

Command Type	Syntax	Response/Action	Remarks
Set	AT+CFUN=[<fun> [<i>,<rst></i>]]	OK +CME ERROR: <err>	The Set command selects the level of functionality <fun> in the smart phone or PDA incorporating the H24.
Read	AT+CFUN?	+CFUN: <fun> OK	The Read command displays the current level of functionality.
Test	AT+CFUN=?	+CFUN: (list of supported <fun>s), (list of supported <rst>s) OK	The Test command displays the list of supported functionality settings.

The following table shows the +CFUN parameters.

Table 4-101: +CFUN Parameters

<Parameter>	Description
<fun>	Functionality levels: 0 Minimum functionality - Disables SIM card, disables phone transmit & receive RF circuits. 1 Full functionality (default) 4 Disables phone transmit & receive RF circuits (SIM card is enabled)
<rst>	0 Sets functionality to <fun> without resetting the device (default) 1 Resets the device before setting functionality to <fun>

- Note:**
- 1. When required functionality cannot be realized,** restart will not be performed even if required.
 - 2. Default functionality** is a full, without restart i.e. RF operation and SIM card are allowed.
When functionality is not specified, the default values shall be used.
So, AT+CFUN <CR><LF> without parameters causes set the full functionality without restart.
 - 3. Functionality on unit initialization**
Initialization can take place in two relevant modes, regarding functionality.
 1. After the unit powered up from ON_N line or IGNITION,
 2. Any kind of restarting - SW reset (AT+MRST or CFUN=<fun,1>).
 In case of initialization by ON_N or ignition (init mode 1) unit will always be up with the



default functionality.

In case of initialization mode 2, the unit will start with the same functionality as it was set before restarting.

Examples

AT+CFUN=?

+CFUN: (0-1, 4), (0-1) OK

AT+CFUN?

+CFUN: 1

OK

AT+CFUN=4 //Disable phone transmit and receive RF circuits

Ok

AT+CFUN?

+CFUN: 4

Power cycling (By using Power cut, ON_N or IGN)

AT+CFUN?

+CFUN: 1

// Phone up with default (full) functionality.

AT+CFUN=4,1

//Disable phone transmit and receive RF circuits. Reset required

Ok

Phone restarted

AT+CFUN?

// Phone "remembers" previous functionality

+CFUN: 4

AT+CFUN=0 // Disable RF operation. Disable SIM OK

AT+CFUN?

+CFUN: 0

Power cycling (By using Power cut, ON_N or IGN)

AT+CFUN?

// returns to full functionality.

+CFUN: 1



4.7.1.9. +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.

Command Type	Syntax	Response/Action	Remarks
Set	+ICF=[<format>[,<parity>]]	OK +CME ERROR: <err>	The Set command determines the local serial port start/stop character framing.
Read	+ICF?	+ICF: <format>,<parity> +CME ERROR: <err>	The Read command displays the currently selected character framing.
Test	+ICF=?	:+ICF:(list of supported <format> values),(list of supported <parity> values) +CME ERROR: <err>	The Test command displays a list of supported <format> and <parity> values.

The following table shows the +ICF parameters.

Table 4-102: +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 - can be set only with <parity> 4 2 8 Data, 1 Parity, 1 Stop - can be set with <parity> of 0 or 1 3 8 Data, 1 Stop (default) - can be set only with <parity> 4 4 7 Data, 2 Stop - can be set only with <parity> 4 5 7 Data, 1 Parity, 1 Stop - can be set with <parity> of 0 or 1 6 7 Data, 1 Stop - can be set only with <parity> 4 7 8 Data, 1 Parity, 2 Stop - can be set with <parity> of 0 or 1 8 7 Data, 1 Parity, 2 Stop - can be set with <parity> of 0 or 1
<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
```



4.7.1.10. +IFC, Terminal-H24 Local Flow Control

This parameter controls the operation of the local flow control between the terminal and the H24 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 H24.
- <DTE_by_DCE>: Specifies the method to be used by the H24 to control the flow of transmitted data from the terminal.

Command Type	Syntax	Response/Action	Remarks
Set	AT+IFC=[[<DCE_by_DTE>],[<DTE_by_DCE>]]	OK +CME ERROR: <err>	
Read	AT+IFC?	+IFC: <DCE_by_DTE>,<DTE_by_DCE>	
Test	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.

Note: <DCE_by_DTE> and <DTE_by_DCE> of the same value only are supported.

Table 4-103: <DCE by DTE> and <DTE by DCE> Parameters

<Parameter>	Description
<DCE_by_DTE>	0 None 2 Hardware
<DTE_by_DCE>	0 None 2 Hardware

Note: The only supported combinations are: +IFC=0,0 and +IFC=2,2.

Example

```
AT+IFC=?
+IFC: (0-2),(0-2) OK
AT+IFC?
+IFC: 2,2
OK
AT+IFC=2,2
OK
```



4.7.1.11. +MIOC, Motorola I/O Configure

This command defines the H24 8 GPIO pins data value. This feature's availability is flex dependent. It's available by default.

Note: Supporting GPIO pins means standard keypad lines will not be supported.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MIOC=<Pin selection>,<Data vector>	OK or: +CME ERROR: <err>	The set command defines the logic value of selected pins to high or low when pin is configured as output. The H24 saves the new setting in flex. Only selected pins are affected.
Read	+ MIOC?	+MIOC: <Data vector> OK	The read command returns the actual logical value of the 8 GPIO pins.
Test	+ MIOC=?	+MIOC: (list of supported <Pin selection>s),(list of supported <Data vector>s) OK or: +CME ERROR: <err>	The test command returns the possible ranges of <Pin selection>s and <Data vector>s.

Error using MIOC commands: REQ MIOD - 0001

- Set action is allowed only for pins configured as output. In case <Data vector> includes values of input pins, those values will be ignored. In case <pin selection> includes input pins, an error will be issued a +CME ERROR: "operation not allowed". No action will take place.
- When missing one of the mandatory Parameters the following error will be returned: +CME ERROR:" Invalid number of Parameters".
- If **data vector** contain digits different from "0" or "1" an error will be returned +CME ERROR:" numeric parameter out of bounds"

The following table shows the +MIOC parameters.

Table 4-104: +MIOC Parameters

<Parameter>	Description
<pin selection>	Selected pins for the action invoked. This is a binary vector in which each bit points to pin number. Vector size is 8. 0 Not selected 1 Selected pin (default)



<data vector>	<p>This is a binary vector in which each bit show the physical value of pin. Data vector size is 8.</p> <p>0 Physical low signal. 1 Physical high signal.</p> <p>The default value: On Power Up - as previously saved in FLEX bytes. Before set command first used with <Data vector> and <Mode>=0, or after +MIOC without <Data vector> and before +MIOC command used - 1.</p>
----------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Note: GPIO data will not be saved in case of a power cut.

Example

AT+ MIOC=?

+ MIOC: (00000000-11111111),(00000000-11111111) OK
AT+ MIOC?

+ MIOC: 1,1,0,0,0,0,0,0 // actual logical value of the 8 GPIO pins. OK

4.7.1.12. +MIOD, Motorola I/O Define

This command defines the H24 8 GPIO pins configuration. Factory default values are: all pins are defined as an input.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MIOD=<Pin selection>,<Mode> [,<Data vector>]	OK or: +CME ERROR: <err>	The set command defines the behavior mode of each selected IO pin. The H24 saves the new setting in flex. The selected pins are affected. Validity check of all parameters will be done and appropriate standard error will be issued. In case of legal parameters the new configuration is set. If <Data vector> is omitted and the new <Mode> is output, the pin will hold a physical low signal. In case <Data vector> is supplied and includes values of input pins, those values will be ignored.
Read	+ MIOD?	+MIOD: <Mode vector> OK	The read command returns the current behavior mode of the 8 GPIO pins.



Test	+ MIOD=?	+MIOD: (list of supported <Pin selection>s),(list of supported <Mode>s),(list of supported <Data vector>s) OK or: +CME ERROR: <err>	The test command returns the possible ranges of <Pin selection>s, <Mode>s and <Data vector>s.
------	----------	----------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------

<mode vector>:

This is a binary vector in which each bit shows the operation mode of the pins.

0 = pin is defined as an output pin.

1= pin is defined as an input pin.

This vector will be receive when MIOD read command is executed

The following table shows the GPIOs pins.

Table 4-105: GPIOs Pins

GPIO Name	70 PIN connector, PIN#
GPIO1	28
GPIO2	30
GPIO3	32
GPIO4	34
GPIO5	36
GPIO6	38
GPIO7	40
GPIO8	42

The following table shows the +MIOD parameters.

Table 4-106: +MIOD Parameters

<Parameter>	Description
<pin selection>	Selected pins for the action invoked. This is a binary vector in which each bit points to pin number. Vector size is 8. 0 Not selected 1 Selected pin
<mode>	GPIO pin operation mode. 0 Pin will be defined as Output (default value HIGH) 1 Pin will be defined as Input



<data vector>	<p>This is a binary vector in which each bit shows the physical value of pin. Data vector size is 8.</p> <p>0 Physical low signal. 1 Physical high signal.</p> <p>The default value: On Power Up - as previously saved in FLEX bytes. Before set command first used with <Data vector> and <Mode>=0, or after +MIOD without <Data vector> and before +MIOD command used - 1.</p>
----------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Note: GPIO mode will not be saved in case of a power cut.

Error using MIOD commands

1. In case <Mode> is input and <Data vector> is supplied, a +CME ERROR: "operation not allowed" error will be issued and no action will be taken.
2. When missing one of the mandatory Parameters the following error will be returned: +CME ERROR:" Invalid number of Parameters".
3. If **pin selection** or **data vector** contain digits different from "0" or "1" an error will be returned.
+CME ERROR:" numeric parameter out of bounds".

Example

AT+MIOD=?

```
+MIOD: (1-11111111),(0-1),(0-11111111) OK
AT+MIOD=00001000,0,00001000// Set IO pin #4 to be output high (on). OK
AT+ MIOD =1000,0,1000 // Set IO pin #4 to be output high (on). OK
AT+ MIOD ?
```

```
+MIOD: 00001000
```

OK

```
AT+ MIOD =1000,0 // Set IO pin #4 to be output low (off). OK
AT+ MIOD =11,1 //Set IO pins 1,2 to be input level mode
```

```
OK AT+MIOD?
+MIOD: 00000011 // Pins 1-2 input pins. OK
AT+ MIOD =11,1,1 // data vector shouldn't be enter when pin sets as
Input. ERROR
```



4.7.1.13. +MIOI, Motorola GPIO Interrupt configuration

This command supports the H24 8 GPIO pins configuration as interrupt lines.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MIOI=<Pin selection>,[<debounce_time>], [< active_state>]	OK or: +CME ERROR: <err>	The set command enables/disables the selected IO pin to react as an interrupt. Note: +MIOI setting overrides +MIOD configuration. i.e. A line previously configured as output by +MIOD, will be reconfigured to input upon setting it as an interrupt line by +MIOI. The change will be reflected in +MIOD read command.
Read	+MIOI?	+MIOI: < pin selection >, < debounce_time > < notification_type > OK	
Test	+MIOI=?	+MIOI: (list of supported <Pin selection>s),(list of supported < debounce_time>s),(list of supported < active_state >s) OK	The test command returns the possible ranges of: <Pin selection>s, <debounce_time>s, and < active_state >s.

The following table shows the +MIOI parameters.

Table 4-107: +MIOI Parameters

<Parameter>	Description
<pin selection>	Selected pins for the action invoked. This is a binary vector in which each bit points to pin number. Vector size is 8. 0 Not selected 1 Selected pin.
<debounce_time>	Configures debounce: Range 0-1 0- DEBOUNCE_NORMAL (MAX 100MS -> 10HZ) 1- DEBOUNCE_FAST (MAX 25MS-> 40HZ)
<notification_type>	Configures notification type: Range 0-2: 0- NOTIFICATION_TYPE_HIGH_TO_LOW 1- NOTIFICATION_TYPE_LOW_TO_HIGH 2- NOTIFICATION_TYPE_BOTH_EDGES Default is 0.



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Note: Interrupt configuration is NOT saved through power cycle. After power cycle the pins previously configured as interrupt will be reconfigured as input (not interrupt). It is the user's responsibility to reconfigure them upon his specific initial setup.

Error using MIOI commands:

When missing one of the mandatory Parameters the following error will returned:

+CME ERROR:"Invalid number of Parameters"

Example

```
AT+MIOI=?
+MIOI: (1-11111111),(0-1),(0-2) OK
AT+MIOI=1,1,2 // GPIO 1 is set as interrupt with fast debounce and both-edges notification.
OK AT+MIOI?
+MIOI:
00000001,00000001,00000002 //matching the setting above
```

OK

...

// interrupt rise occurred

+MIOI:1,1 //unsolicited message: GPIO 1 rise to state HIGH



4.7.1.14. +MJDC, Jamming Detection Control

This command is used to enables/disable the Jamming Detection feature.
When the Jamming detector is enabled, an unsolicited report with the current jamming detection state will be sent to the DTE. Then, an update report will be sent to the DTE each time a change in the jamming state is detected.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MJDC=<mjdc_mode>	OK +MJDC:<jamming_detection> Or: +CME ERROR: <err>	The set command configures the jamming mode. NOTE: <jamming_detection> will be displayed only when jamming detector is enabled (i.e. <mjdc_mode>=1).
Read	AT+MJDC?	+MJDC: <mjdc_mode>,[jamming_detection] OK	The read command returns the current settings. NOTE: [jamming_detection] will be displayed only when jamming detector is enabling (i.e. <mjdc_mode>=1).
Test	+MIPSETS=?	+MJDC:(range <mjdc_mode>) OK	The test command returns the possible ranges of <mjdc_mode>s.
Unsolicited Report		+MJDC:<jamming_detection>	Indicates the jamming state.



The following table shows the +MJDC parameters.

Table 4-108: +MJDC Parameters

<Parameter>	Description
<mjdc_mode>	0 - Disable jamming detection. 1 - Enable jamming detection.
<jamming_detection>	5 - WCDMA jamming suspicious 4 - WCDMA jammed. 3- Reserved 2 - Reserved 1 - WCDMA and GSM jamming or GSM jamming (in case of GSM coverage only or 2G SIM) detected. 0 - jamming not detected.

Each change of MJDC value follows by 2sec RI pulse.

Example

```

AT+MJDC = 1 // enable the jamming detector
+MJDC:0 // no jamming is currently detected.
OK
AT+MJDC?
+MJDC: 1,0 // jamming detector is enabled but no jamming is currently detect.
OK
AT+MJDC = 0 // disable the jamming detector
OK

AT+MJDC?
+MJDC: 0 // jamming detector is disable
OK

AT+MJDC=?
+MJDC: (0,1) // ranges of <mjdc_mode>s.
OK

AT+MJDC = 1 // enable the jamming detector
+MJDC:0 // no jamming is currently detected.
OK

// Use a jamming device to jam ME's bends.

+MJDC:5 // unsolicited report: jamming is now detected

+MJDC:4 // unsolicited report: jamming is now detected

+MJDC:1 // unsolicited report: jamming is now detected

```



4.7.1.15. +MPCMC, Continuous PCM Clock

This command defines whether the PCM clock is generated continuously or not, when phone is in digital audio mode (configured by AT+MAMOD command). The change takes effect after the next audio operation.

Note:

1. This command prevents the unit from entering sleep mode.
2. +MPCMC takes effect only in PCM master mode (see +MPCMM command).

Command Type	Syntax	Response/Action	Remarks
Set	+MPCMC=<flag>	OK or: +CME ERROR: <err>	The Set command is used for setting the PCM clock configuration.
Read	+MPCMC?	+MPCMC: <flag> OK or: +CME ERROR: <err>	The Read command returns the current PCM clock <flag> value.
Test	+MPCMC=?	+MPCMC: (list of supported <flag>s) OK	The Test command returns the possible <flag> values.

The following table shows the +MPCMC parameters.

Table 4-109: +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=1
OK AT+MPCMC?
+MPCMC: 1
OK
    
```



4.7.1.16. +MPCMM, Master/Slave Mode

This command defines whether the H24 is in Master or Slave mode. The command is available only in digital audio mode (configured by AT+MAMOD command).

Note: In Slave mode the PCM clock (see “+MPCMC, Continuous PCM Clock”) is always disabled.

Value is saved in NVM.

Command Type	Syntax	Response/Action	Remarks
Set	+MPCMM =<flag>	OK or: +CME ERROR: <err>	The set command is used for setting the PCM Mode configuration.
Read	+MPCMM?	+MPCMM:<flag> OK or: +CME ERROR: <err>	The read command returns the current PCM Mode <flag> value.
Test	+MPCMM =?	+MPCMM: (list of supported <flag>) OK	The test command returns the possible <flag> values.

The following table shows the +MPCMM parameters.

Table 4-110: +MPCMM Parameters

<Parameter>	Description
<flag>	0 Master Mode 1 Slave Mode Before AT+MPCMM command is set for the first time, this value is '0'. Power-up is according to flex.

Example

```
AT+MPCMM=?
+MPCMM: (0-1) OK
```

```
AT+MPCMM=1
OK
```

```
AT+MPCMM?
+MPCMM: 1
OK
```



4.7.1.17. +MVREF, Motorola Voltage Reference

This command defines the Vref regulator's configuration. Pin 27 is used as indicator signal that reflects the configuration of Vref regulator. This command is a basic command.

Command Type	Syntax	Response/Action	Remarks
Set	+MVREF=<control>	OK or: +CME ERROR: <err>	The Set command is used for setting the behavior of Vref regulator.
Read	+MVREF?	+MVREF: <control> OK or: +CME ERROR: <err>	The Read command returns the current behavior <control> value.
Test	+MVREF=?	+MVREF: (0-1) OK	The Test command returns the possible values' range.

The following table shows the +MVREF parameters.

Table 4-111: +MVREF Parameters

<Parameter>	Description
<control>	0 OFF mode. 1 ON mode (default).

Table 4-112: +MVREF Signals Values

Mode	Voltage	Current
0	0V	0A
1	2.6V	0mA

Example

```
AT+MVREF=?
+MVREF:(0-1) OK AT+MVREF=1
OK AT+MVREF?
+MVREF: 1
OK
```



4.7.1.18. +MFTM, Factory Test Mode

This command is used to enter and exit FTM mode.

FTM (Factory Test Mode), is a mode where the unit's RF is limited (no camping or searching).

When exiting FTM mode, the unit returns to its normal operation and regains camping.

Command Type	Syntax	Response/Action	Remarks
Set	+MFTM=<mode>	OK	Set the unit's mode.
Read	AT+MFTM?	+MFTM:<mode> OK	Read the current mode.
Test	AT+MFTM=?	+MFTM: (range of supported <mode>) OK	

The following table shows the +MFTM parameters.

Table 4-113: +MFTM Parameters

<Parameter>	Description
<mode>	0- FTM mode OFF (normal operation). 1- FTM mode ON. Set FTM mode ON or OFF.

Note: Once +MFTM is issued, one cannot abort the command and AT commands are suspended until +MFTM is returned.

Example

Set command: AT+MFTM=1
+MFTM:FTM_MODE OK
AT+MFTM=0
+MFTM:FTM_MODE_OFF OK
Test command: AT+MFTM=?

+MFTM: (0-1)

OK
Read command: AT+MFTM?
+MFTM: 0
OK



4.7.1.19. +TGFCC, GSM Test FCC

This command defines RF parameters for signal transmission. Once the command is executed, the H24 will configure the RF parameters and start a continuous transmission of a GSM or EDGE signal.

- Note:**
1. In order to use this command the H24 must be in FTM mode (via +MFTM command).
 2. The H24 must be connected to an RF Simulator during execution.
 3. Execution of Test FCC commands will suspend usage of any other AT command until the command returns 'OK'. AT commands issued in-between will be processed as soon as this 'OK' returns.
 4. Using Test FCC set commands while not in FTM mode will return the following error:
+CME ERROR: "Invalid TFCC mode".
 5. If the specified <band> doesn't match the specified <channel> the following error will be returned: +CME ERROR: "operation not supported".
 6. When a mandatory parameter is omitted the following error will be returned: +CME ERROR: "Invalid number of Parameters".

Command Type	Syntax	Response/Action	Remarks
Set	+TGFCC=<power_level>,<band>,<channel>,<tx_time>],[<protocol>],[<gsm_slot>],[<training_seq>]	OK or: +CME ERROR:<err>	Sets RF parameters and starts a continuous transmission. If the optional parameters are omitted then the previous set of values is used.
Read	AT+ TGFCC?	+ TGFCC =<power_level>,<band>,<channel>,<tx_time>],[<protocol>],[<gsm_slot>],[<training_seq>] OK	Displays the parameters of the last issued set command. Can be issued either during or after transmission time.
Test	AT+ TGFCC =?	+TGFCC: (range of supported <power_level>s),(range of supported <band>s),(range of supported <channel>s),(range of supported <tx_time>s),(range of supported <protocol>s) , (range of supported <gsm_slot >s), (range of supported <training_seq>s). OK	



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The following table shows the +TGFCC parameters.

Table 4-114: +TGFCC Parameters

<Parameter>	Value	Description
<power_level >	1-33	Output Power Level [dBm] Value is according to Table 4-115.
<band>	0-3	0: 850 MHz 1: 900 MHz 2: 1800 MHz 3: 1900 MHz
<channel>	0- 1023	The used channel according to the used band (see Table4-115)
[<tx_time>]	1-30	The transmit time in minutes. 0- infinity loop Default 1 min.
[<protocol>]	0-1	0 - GSM/GPRS transmits (MCS1). 1 - EDGE transmits (MCS8). Default 0.
[<gsm_slot>]	1-4	Number of slot up (out of 4) the rest are down. 1: 1- slot up 2: 2- slots up 3: 3- slots up 4: 4- slots up Default 1.
[<training_seq>]	0-7	0 - CARRIER_MIDAMBLE_0 1 - CARRIER_MIDAMBLE_1 2 - CARRIER_MIDAMBLE_2 3 - CARRIER_MIDAMBLE_3 4 - CARRIER_MIDAMBLE_4 5 - CARRIER_MIDAMBLE_5 6 - CARRIER_MIDAMBLE_6 7 - CARRIER_MIDAMBLE_7 Default 0.

The following table shows power levels.

Table 4-115: Power Level Table [dBm] (MAX power level to set)

GSMK Modulation-->Protocol=0		
	BANDS	
Slots	850/900	1800/1900
4	28	25
3	29	26
2	31	28



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1	33	30
8PSK Modulation -->Protocol=1		
BANDS		
Slots	850/900	1800/1900
4	22	21
3	23	22
2	25	24
1	27	26

The following table shows the conversion from power level to dBm and watt.

Table 4-116: Convert Power Level to dBm and Watt

Pcl	dBm	mWatt	Watt
5	33	1995.262	1.995
6	31	1258.925	1.259
0	30	1000	1
7	29	794.328	0.794
1	28	630.9	0.631
8	27	501.187	0.501
2	26	398.1	0.398
9	25	316.228	0.316
3	24	251.2	0.251
10	23	199.526	0.199
4	22	158.5	0.158
11	21	125.892	0.126
5	20	100	0.1
12	19	79.433	0.079
6	18	63.1	0.063
13	17	50.118	0.05
7	16	39.8	0.04
14	15	31.623	0.032
8	14	25.1	0.025
15	13	19.953	0.02
9	12	15.8	0.016
16	11	12.589	0.012
10	10	10	0.01
17	9	7.943	0.008
11	8	6.3	0.006
18	7	5.012	0.005
12	6	3.9	0.004
19	5	3.162	0.003
13	4	2.5	0.003
14	2	1.6	0.002



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15	0	1	0.001
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The following table shows Valid Channels for each Band in the GSM protocol.

Table 4-117: Valid Channels for each Band in the GSM protocol

Band	Channel
850	128-251
900	0-124,975-1023
1800	512-885
1900	512-810

Example

Set command:

AT+TGFCC = 1,0,162,1,0,1 -> GSM transmit

OK

AT+TGFCC = 1,0,162,1,1,1 -> EDGE transmit

OK

AT+TGFCC=1,0,124,1,1,1 -> wrong channel to the selected band

ERROR

Test command: AT+TGFCC=?

+TGFCC: (1-33),(0-3),(0-1023),(1-30),(0-1),(1-4)

OK

Read command: AT+TGFCC?

+TGFCC: 1,0,162,1,0,1

OK



4.7.1.20. +TWFCF, WCDMA Test FCC

This command defines RF parameters for signal transmission. Once the command is executed, the H24 will configure the RF parameters and start a continuous transmission of a WCDMA signal.

- Note:**
1. In order to use this command the H24 must be in FTM mode (via +MFTM command).
 2. The H24 must be connected to an RF Simulator during execution.
 3. Execution of Test FCC commands will suspend usage of any other AT command until the command returns 'OK'. AT commands issued in-between will be processed as soon as this 'OK' returns.
 4. Using Test FCC set commands while not in FTM mode will return the following error:
+CME ERROR: "Invalid TFCC mode".
 5. If the specified <band> doesn't match the specified <channel> the following error will be returned: +CME ERROR: "operation not supported".
 6. When a mandatory parameter is omitted the following error will be returned:
+CME ERROR: "Invalid number of Parameters".

Command Type	Syntax	Response/Action	Remarks
Set	+TWFCF=<power level>,<band>,<channel>,[<tx time>]	OK or: +CME ERROR:<err>	Sets RF parameters and starts a continuous transmission. If the optional parameters are omitted then the previous set values is used.
Read	AT+ TWFCF?	+TWFCF =<power level>,<band>,<channel>,[<tx time>]. OK	Displays the parameters of the last issued set command. Can be issued either during or after transmission time.
Test	AT+ TWFCF =?	+TWFCF: (list of supported <power level>s),(list of supported <band>s),(list of supported <channel>s),(list of supported <tx time>s) OK	



The following table shows the +TWFC parameters.

Table 4-118: +TWFC Parameters

<Parameter>	Value	Description
<power_level >	50-205	Output Power Level [dBm] Value is according to Table4-115.
<band>	0-4	0: 2100 MHz 1: 1900 MHz 2: 1700 MHz 3: 850 MHz 4: 900 MHz
<channel>	0- 9888	The used channel according to the used band (see Table4-115)
[<tx_time>]	1-30	The transmit time in minutes. Default 1 min.

The following table shows Valid Channels for each Band in the WCDMA protocol.

Table 4-119: Valid Channels for each Band in the WCDMA protocol

Band	Channel
2100	9612-9888
1900	9262-9538,12,37,62,87,112,137, 162,187,212,237,262,287
1700	1312-1513,1662,1687,1712,1737, ,1762,1787,1812,1837,1862
850	4132-4233,782,787,807,812,837, 862
900	2712-2863

The following table shows power levels.

Table 4-120: Power Level Table [dBm] (MAX power level to set)

TX PDM	Pout [dBm]			
	B1 - 2100	B2 - 1900	B5 - 850	B4 - 1700
50	-----	-----	-57	-----
70	-52	-56	-40.5	-54.5
90	-41.5	-45	-27.5	-43.5
110	-29	-32	-14.5	-30
130	-14	-17	-1.5	-15.5
150	-1	-4	9.5	2.5



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170	10	8	18	9
187	19	17	24.5	17.5
190	20	18.5	-----	18.5
200	24.5	22.5	-----	23
205	-----	24.5	-----	24.5

Example

Set command: AT+TWFC = 50,0,9620,1
OK

AT+TWFC=50,0,9600,1-> wrong channel to the selected band

ERROR

Test command: AT+TWFC=?
+TWFC: (50-205),(0-4),(0-9888),(1-30) OK
Read command: AT+TWFC?
+TWFC: 50,0,9620,1

OK



4.7.1.21. +MPWRDN, Perform Power Down

This command enables the customer software to perform a power down to the H24 unit. This command provides a software simulation for power down by ON_N line.

Command Type	Syntax	Response/Action	Remarks
Set	+MPWRDN	OK	The Set command performs a graceful power down to the H24 module. Note: The Read and Test commands are not permitted for the +MPWRDN command.

Example

```
AT+MPWRDN OK
// Result - H24 module performs power down.
```

4.7.1.22. +MRST, Perform Hard Reset

This command enables the customer software to perform a hard reset to the H24 unit.

Command Type	Syntax	Response/Action	Remarks
Set	+MRST	OK	The Set command performs a graceful restart to the H24 module. Note: The Read and Test commands are not permitted for the +MRST command.

Example

```
AT+MRST OK
// Result - H24 module performs restart.
```



4.7.1.23. +MTMP, Motorola Temperature Measurement

This command enables a user to query the temperature level in Celsius degrees.

Command Type	Syntax	Response/Action	Remarks
Read	+MTMP	+MTMP:<temp>	

The following table shows the +MTMP parameters.

Table 4-121: +MTMP Parameters

<Parameter>	Description
<temp>	Average temperature of the chipset in Celsius degrees.

Example

```
AT+MTMP
+MTMP: 37
OK
```

4.7.2. Antenna Physical Connection Detection

This feature allows the user to get the antenna's physical connection status (connected/disconnected/grounded) using the AT+S97 command. The result depends on the type of antenna used. Therefore, in order to get the correct connection status, the antenna type should be determined using the AT+MUANTYPE command. Setting the right antenna type is the user's responsibility. An accessory command is provided to assist the user to identify the type of antenna connected, AT+MUANTYPEDET. Of course, before using this command, the user must verify that the antenna is intact and properly connected.

4.7.2.1. +MUANTYPEDET, Detect User Antenna Type

This command allows recognizing the attached antenna type. This command should only be used when the antenna is connected and intact, otherwise it may result a false answer.

Three recognizable antenna types are available:

- **Type 0:** Infinite Impedance Type - IIT (Active resistance is > 3.1 MOhm).
- **Type 1:** Medium Impedance Type - MIT (6.8 KOhm < Active resistance is < 3.1 MOhm).
- **Type 2:** Zero Impedance Type - ZIT (Active resistance is < 6.8 KOhm).



Command Type	Syntax	Response/Action	Remarks
Execute	AT+MUANTYPEDET	+MUANTYPEDET: <type> OK or: +CME ERROR: <err>	Execute command automatically recognizes antenna type.

The following table shows the +MUANTYPEDET parameters.

Table 4-122: +MUANTYPEDET Parameters

<Parameter>	Description
<type>	0 Type0: Infinite Impedance type 1 Type1: Medium Impedance type 2 Type2: Zero Impedance type

Example

```
AT+MUANTYPEDET
+MUANTYPE: 1
OK
```

4.7.2.2. +MUANTYPE, Set the Type of Antenna Used

This command sets the user antenna type used. The user must set the type of antenna used in order to later use the AT97 command to check the antenna's physical connection status.

Three antenna types are supported:

- **Type 0:** Infinite Impedance Type - IIT (Active resistance is > 3.1 MOhm).
- **Type 1:** Medium Impedance Type - MIT (6.8 KOhm < Active resistance is < 3.1 MOhm).
- **Type 2:** Zero Impedance Type - ZIT (Active resistance is < 6.8 KOhm).

Command Type	Syntax	Response/Action	Remarks
Set	AT+MUANTYPE= <type>	OK or: +CME ERROR: <err>	Value will be saved through power cycle.
Read	AT+MUANTYPE?	+MUANTYPE: <type> OK or: +CME ERROR: <err>	
Test	AT+MUANTYPE=?	+MUANTYPE: (0-2) OK or: +CME ERROR: <err>	Returns the possible values of antenna type used in "Set" command.



The following table shows the +MUANTYPE parameters.

Table 4-123: +MUANTYPE Parameters

<Parameter>	Description
<type>	0 Type0: Infinite Impedance type 1 Type1: Medium Impedance type 2 Type2: Zero Impedance type 255 Unknown antenna type - Factory value. Setting of the antenna type is required.

Example

```
AT+MUANTYPE? //read antenna type
+MUANTYPE: 1
OK
```

```
AT+MUANTYPE =2 //Set zero Impedance type
OK
```

```
AT+MUANTYPE? //read antenna type
```

```
+MUANTYPE: 2
OK
```

4.7.2.3. AT97, Antenna Diagnostic

This command indicates the status of the antenna physical connection to the H24 RF connector. This information is also provided by a dedicated hardware signal, which is output on pin 41 (ANT_DET) of the interface connector.

Note: Before use AT97 command, antenna type shall be determined. (see See “+MUANTYPE, Set the Type of Antenna Used”). Improper antenna type determination may cause wrong antenna status report.

Three antenna types are supported:

- **Type 0:** Infinite Impedance Type - IIT (Active resistance is > 3.1 MOhm).
- **Type 1:** Medium Impedance Type - MIT (6.8 KOhm < Active resistance is < 3.1 MOhm). Medium Impedance type is divided into two subtypes:
 - Medium-Low Impedance antenna - MLI (< 310 Ohm approximately);
 - Medium-High Impedance antenna - MHI (> 310 Ohm approximately);
- **Type 2:** Zero Impedance Type - ZIT (Active resistance is < 6.8 KOhm).

Limitations

1. For Type 0: Only "Grounded" state is recognizable - Other states will be reported as a "Normal".
2. For Type 1: All statuses may be recognized.
3. For Type 2: Only "Disconnected" state is recognizable - Other states will be reported as a "Normal".



These limitations refer to both: ANT_DET pin state and response to ATS97 command (see below).

ANT_DET

Pin 41 on 70 pin connector reflects antenna state.

1. When antenna state is "N" - Normal, ANT_DET pin is HIGH (2.6V).
2. When antenna state is "D" - Disconnected or "G" - Grounded, ANT_DET pin is LOW (0V).

Report delaying

ANT_DET report may be delayed by 4 sec max. Such a delay is relevant only for Medium Impedance Type - MIT (Type 1) and depending on both: antenna sub-type and status

change. The cases of such a delay are signed by "delayed" in the table below.

Antenna Type	Change of State	Delay of ANT_DET Pin
LIA (Low impedance)	N => D or D => N	Immediate
	N => G or G => N	Delayed
	D => G or G => D	Immediate
HIA (High Impedance)	N => D or D => N	Delayed
	N => G or G => N	Immediate
	D => G or G => D	Immediate

Command Type	Syntax	Response/Action	Remarks
Execute	ATS97	OK	Deprecated; Implemented only for backward compatibility with older Motorola modules.
Read	ATS97?	<info> OK or: +CME ERROR: <err>	The Read command indicates antenna connection status.

Note: When antenna type is unknown (factory default state), an error will be returned to read command.



The following table shows the ATS97 parameters.

Table 4-124: ATS97 Parameters

<Parameter>	Description
<info>	000 The antenna is not connected 001 The antenna is connected 002 The antenna is grounded

Example

```
// Connect the antenna
ATS97?
001
ATS97
OK ATS97=? ERROR
// Disconnect the antenna
ATS97?
000
```



4.8. Audio

4.8.1. General

Audio Mode - You may think of an *Audio Mode* as an audio device (headset, hands-free kit, etc.). As the H24 is a module and therefore supplied without audio devices, but only with the infrastructure for them, we use the term *Audio Mode* for describing this infrastructure. An *Audio Mode* is a predefined audio configuration that defines RX and TX audio paths, gain and volume settings and other features configurations (filters' coefficients, echo cancellation/noise suppression, status and more).

4.8.2. Introduction

The audio control can be Summarized to the following three issues:

- **Path:** Selection of the active audio mode.
- **Volume:** Control of audio volume.
- **Other Calibrations:**
 - Activation and setting of audio algorithms (echo cancellation, noise suppression and sidetone)
 - Gain calibration (RX, TX, Sidetone)
 - Filter calibration (the commands will be supplied upon request from Motorola's customer care team)



4.8.3. Standard Audio Commands

4.8.3.1. +CRSL, Ringer and Other Alerts Volume Level

This command sets the different alerts volume level of the active audio mode. A different volume level is saved in NVM for each audio mode. The new value remains after power cycle.

Command Type	Syntax	Response/Action	Remarks
Set	+CRSL=<level>	OK +CME ERROR: <err>	Sets the alerts volume level for the active audio mode.
Read	+CRSL?	+CRSL: <level> +CME ERROR: <err>	Reads the active audio mode alerts volume level.
Test	+CRSL=?	+CRSL: (list of supported <level>s) +CME ERROR: <err>	Displays the range of alerts volume levels.

The following table shows the +CRSL parameters.

Table 4-125: +CRSL Parameters

<Parameter>	Description
<level>	0-<n> Tone volume level. 0 is mute; <n> is the maximum volume level. The default level is <n>

Example

```
AT+CRSL?
+CRSL: 5
OK AT+CRSL=?
+CRSL: (0-<n>) OK
AT+CRSL=5
OK
```



4.8.3.2. +CLVL, Voice Volume Level

This command sets the voice volume level of the active audio mode. A different volume level is saved in NVM for each audio mode. The new value remains after power cycle.

Command Type	Syntax	Response/Action	Remarks
Set	+CLVL=<level>	OK +CME ERROR: <err>	Sets the voice volume level.
Read	+CLVL?	+CLVL: <level> +CME ERROR: <err>	Reads the current voice volume level.
Test	+CLVL=	+CLVL: (list of supported <level>s) +CME ERROR: <err>	Displays the range of volume levels.

The following table shows the +CLVL parameters.

Table 4-126: +CLVL Parameters

<Parameter>	Description
<level>	Voice volume level. 0 is mute; <n> is the maximum volume level. The default level is <n>.

Example

AT+CLVL?

+CLVL: 5
OK AT+CLVL=?
+CLVL: (0-5) OK AT+CLVL=3
OK



4.8.3.3. +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.

Command Type	Syntax	Response/Action	Remarks
Set	+CMUT=<state>	OK or: +CME ERROR: <err>	The Set command enables/disables uplink voice muting during a voice call.
Read	+CMUT?	+CMUT: <state> OK	The Read command returns the current uplink voice mute/unmute state.
Test	+CMUT=?	+CMUT: (list of supported <state>s) OK	The Test command returns the possible <state> values.

The following table shows the +CMUT parameters.

Table 4-127: +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>
```



4.8.3.4. +CALM, Alert Sound Mode

This command handles the selection of the alert sound mode. The value of the command is saved after a power cycle.

Command Type	Syntax	Response/Action	Remarks
Set	+CALM=<mode>	OK +CME ERROR: <err>	The Set command sets the alert sound mode.
Read	+CALM?	+CALM: <mode> +CME ERROR: <err>	The Read command displays the current alert sound mode setting.
Test	+CALM=?	+CALM: (list of supported <mode>s) +CME ERROR: <err>	The Test command displays the list of supported modes.

The following table shows the +CALM parameters.

Table 4-128: +CALM Parameters

<Parameter>	Description
<mode>	Alert sound mode of the H24. 0 Ring (default) 1 Silent mode (ring prevented)

Note: Selecting the ring mode with this command retrieves the current alert volume level setting.

Example

```
AT+CALM=?
+CALM: (0,1) OK AT+CALM?
+CALM: 0
OK AT+CALM=1
OK
```



4.8.3.5. +CRTT, Ring Type Selection

This command sets the current ringtone to use for incoming call. It can also play and stop a sample one-cycle ringtone.

Command Type	Syntax	Response/Action	Remarks
Set	AT+CRTT= <RingTypeNumber>, <operation>	OK or: +CME ERROR: <err>	The Set command sets the ring type and operation.
Read	AT+CRTT?	+CRTT: <RingTypeNumber> OK or: +CME ERROR: <err>	The Read command returns the ring type number.
Test	AT+CRTT=?	+CRTT: (list of supported <RingTypeNumber>s), (list of supported <operation>s) OK or: +CME ERROR: <err>	The Test command returns the list of supported tone type numbers and operations.

The following table shows the +CRTT parameters.

Table 4-129: +CRTT Parameters

<Parameter>	Description
<RingTypeNumber>	Ring tone styles
<operation>	Play or set a tone 0 Play (play one cycle) 1 Set 2 Stop



The following table categorizes the different type of alerts:

Table 4-130: Alert Types

CRTT=X	Ring Tone Style
0, 4, 12, 14, 16, 18-26, 28, 30-38, 40, 42-50, 61, 68-76, 87-88	Ringtones (Periodically played ringtones).
1, 8-10, 15, 52-60, 62-67, 77-79, 82-86	Network & UI alerts (Played once).
2-3, 5-7, 11, 13, 17, 27, 29, 39, 41, 51, 80-81, 89	Network & UI alerts (Played continuously).

```

Example
AT+CRTT=6,0          //Ring type number 6, operation 0 (play)
OK                  //When 6 is in the supported <RingTypeNumber> range
AT+CRTT=6,2        //Ring type number=6, operation 2 (stop) OK
AT+CRTT=?
+CRTT: (0-89),(0-2) OK
AT+CRTT?
+CRTT: 6           //Ring type number 6
AT+CRTT=5,4       //Invalid operation
+CME ERROR: <err>
    
```

4.8.3.6. +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”)

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.

Command Type	Syntax	Response/Action	Remarks
Set	+VTD=<n>	OK. +CME ERROR: <err>	The Set command sets the tone duration.
Read	+VTD?	<n> +CME ERROR: <err>	The Read command displays the current tone duration.
Test	+VTD=?	+VTD: (list of supported <n>s) +CME ERROR: <err>	The Test command displays the list of supported tone durations.



The following table shows the +VTD parameters.

Table 4-131: +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
```

4.8.3.7. +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”).

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: +VTS: "Call termination stopped DTMF tones transmission".

Command Type	Syntax	Response/Action	Remarks
Set	+VTS= <DTMF>,[<duration>]	OK +CME ERROR: <err>	The Set command sets the tone and duration (if entered).
Read	+VTS?	+VTS: <DTMF> +CME ERROR: <err>	The Read command displays the currently transmitted DTMF tone. An error is displayed if no tone is active.
Test	+VTS=?	+VTS: (list of supported <DTMF>, (list of supported <duration>s) +CME ERROR: <err>	The Test command displays the list of supported DTMF tones and tone lengths.

The following table shows the +VTS parameters.



Table 4-132: +VTS Parameters

<Parameter>	Description
<DTMF>	String of IRA characters (0-9, #, *, A-D) String length is up to 32 characters long.
<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 H24 is powered down.
If <duration> is not defined, the +VTD value is used.

Example

```
AT+VTS?
+VTS: "5" OK AT+VTS="2",10
OK
```



4.8.4. Motorola Extended Audio Commands

This group of commands enable accessory devices to control certain audio aspects within the system.

4.8.4.1. +MACRXG, Set CODEC RX Gain

Sets Codec RX gain of the active audio mode. Values are saved in NVM.

Note: Analog audio only.

Command Type	Syntax	Response/Action	Remarks
Set	+MACRXG = <codec rx gain>	OK or: +CME ERROR: <err>	Sets codec rx gain for the specified audio mode.
Read	+MACRXG?	+MACRXG:<codec rx gain OK	Reads codec rx gain for the active audio mode.
Test	+MACRXG=?	+MACRXG: <available modes range>	These values will define the range for the set command.

The following table shows the +MACRXG parameters.

Table 4-133: +MACRXG Parameters

<Parameter>	Description
<codec rx gain>	rx_gain_min (0) - rx_gain_max (65535) the value in decimal

Example

```
AT+MACRXG=?
+MACRXG: (0-65535) AT+MACRXG= 2048
```

4.8.4.2. +MACSTG, Set CODEC ST Gain

Sets Codec ST gain of the active audio mode. Values are saved in NVM.

Note: Analog audio only.



Command Type	Syntax	Response/Action	Remarks
Set	+MACSTG = <codec st gain>	OK or: +CME ERROR: <err>	Sets codec st gain for the specified audio mode.
Read	+MACSTG?	+MACST:<codec tx gain> OK	Reads codec st gain for the active audio mode.
Test	+MACSTG=?	+MACST: <available modes range>	These values will define the range for the set command.

The following table shows the +MACSTG parameters.

Table 4-134: +MACSTG Parameters

<Parameter>	Description
<codec st gain>	st_gain_min (0) - st_gain_max (65535) the value in decimal

Example

```
AT+MACSTG=?
+MACSTG: (0-65535) AT+MACSTG= 2048
```

4.8.4.3. +MACTXG, Set CODEC TX Gain

Sets Codec TX gain of the active audio mode. Values are saved in NVM.

Note: Analog audio only.

Command Type	Syntax	Response/Action	Remarks
Set	+MACTXG = <codec tx gain>	OK or: +CME ERROR: <err>	Sets codec tx gain for the specified audio mode.
Read	+MACTXG?	+MACTXG:<codec tx gain> OK	Reads codec tx gain for the active audio mode.
Test	+MACTXG=?	+MACTXG: <available modes range>	These values will define the range for the set command.

The following table shows the +MACTXG parameters.



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2	Audio gain optimized for Hands free	Voice	√				√
		Alert					√
3	Digital Audio.	Voice	PCM Interface (refer to H24 Module Hardware Description – 6802986C38)				
		Alert					
4	Voice routed to main speaker. Alert routed to high power speaker.	Voice	√		√		
		Alert					√
5	Voice routed to high power speaker. Alert routed to normal speaker.	Voice	√				√
		Alert			√		
6	TTY	Voice		√		√	
		Alert					√

Note: Mode 1 may be referred to as headset in this document.

Example

```
AT+ MAMOD =1 // set audio mode 1
OK
```

```
AT+MAMOD?
+MAMOD: 1 //audio mode 1 is active
OK
```

```
AT+MAMOD=?
+MAMOD: (0-6) OK
```

```
// Scenario - Attempt to set Audio mode while headset detect is enabled and a headset is detected on the headset interrupt pin.
AT+MAHSD=1
OK
```

*** Plug in a headset

```
AT+ MAMOD =2
```

```
+CME ERROR: Operation not allowed
```



4.8.4.5. +MAHSD, Headset/TTY Switch Detect Enable

This command Enables/disables the headset/tty switch detect mechanism ("Headset" refers to audio mode 1, "TTY" refers to audio mode 6).

Headset/TTY switch detect mechanism sets the active audio mode to "Headset"/ "TTY" (see audio modes table in +MAMOD command's section) once a headset is plugged in. It returns to the previous audio mode, once the headset is plugged out. +MAHSD value is saved in NVM.

Note: Upon setting +MAHSD, the audio mode status is explicitly checked and accordingly set.

When +MAHSD=1 and a headset is plugged in, +MAMOD value is automatically set to '1' and its set command is disabled and will return ERROR.

When +MAHSD=2 and a headset is plugged in, +MAMOD value is automatically set to '6' and its set command is disabled and will return ERROR.

Command Type	Syntax	Response/Action	Remarks
Set	+MAHSD =<status>	OK or: +CME ERROR: <err>	Enables/disables headset/tty switch detect.
Read	+MAHSD?	+MAHSD: <status> OK	Reads the headset/tty switch detect status.
Test	+MAHSD=?	+MAHSD: <available states>	

The following table shows the +MAHSD parameters.

Table 4-137: +MAHSD Parameters

<Parameter>	Description
<status>	Headset/TTY switch detection mechanism status 0 - Headset/TTY switch detect disable 1 - Headset switch detect enable 2 - TTY switch detect enable



4.8.4.6. +MAGRST, Restore Default Gain

An action command that restores manufacturer's default RX, TX and ST gain values of the active audio mode.

Command Type	Syntax	Response/Action	Remarks
Execute	+MAGRST	OK or: +CME ERROR: <err>	

4.8.4.7. +MAEC, Echo Cancelling Configuration

Selects EC type. Value is saved in NVM.

Command Type	Syntax	Response/Action	Remarks
Set	+MAEC=<type>	OK or: +CME ERROR: <err>	Sets the echo canceller type to be used.
Read	+MAEC?	+MAEC:<type> OK	Reads the echo canceller type currently in use.
Test	+MAEC=?	+MAEC: <available types>	

The following table shows the +MAEC parameters.

Table 4-138: +MAEC Parameters

<Parameter>	Description
<type>	Echo canceller types: 0 - EC Off 1 - ESEC (Ear Seal EC) 2 - HEC (Headset EC) 3 - AEC (Acoustic EC)



4.8.4.8. +MAFRST, Audio Feature Restore Default

An action command to restore manufacturer's audio features defaults for the current audio mode (According to default feature configuration table below).

Table 4-139: Default feature configuration per audio mode

Audio MODE		EC Type	NS on/off	ST on/off
0		ESEC	On	On
1		HEC	On	On
2		AEC	On	Off
3 (Digital audio)		Off	Off	Off
4		ESEC	On	On
5		AEC	On	Off
6 (TTY)	Full	Off	Off	Off
	HCO	Off	Off	Off
	VCO	Off	Off	Off

Audio mode 0 and audio mode 4 use the same codec configuration. Therefore any change in the following commands will influence the other:

+MAEC, +MAST, +MANS, +MATXV, +MACRXG, +MACSTG, +MACTXG, +MARXAVC, +MATXAGC, +MAGRST.

The same issue is relevant to Speakerphone and Speakerphone2.

Command Type	Syntax	Response/Action	Remarks
Execute	+MAGRST	OK or: +CME ERROR: <err>	



4.8.4.9. +MANS, Noise Suppression Control

This command enables/disables NS for the active audio mode. Value is saved in NVM.

Command Type	Syntax	Response/Action	Remarks
Set	+MANS =<type>	OK or: +CME ERROR: <err>	
Read	+MANS?	+ MANS:<type> OK	
Test	+MANS =?	+MANS: <available types>	

The following table shows the +MANS parameters.

Table 4-140: +MANS Parameters

<Parameter>	Description
<type>	0 - NS off 1 - NS on

Note: When EC type is OFF (+MAEC=0), noise will not be suppressed even if +MANS=1, due to H24 limitation.



4.8.4.10. +MAST, Sidetone Control

This command enables/disables sidetone for the active audio mode. Sidetone gain can be configured by +MAGAIN command. Value is saved in NVM.

Command Type	Syntax	Response/Action	Remarks
Set	+MAST =<type>	OK or: +CME ERROR: <err>	
Read	+MAST?	+ MAST:<type> OK	
Test	+MAST =?	+MAST: <available types>	

The following table shows the +MAST parameters.

Table 4-141: +MAST Parameters

<Parameter>	Description
<type>	0 - ST off 1 - ST on

4.8.4.11. +MATXV, Set TX Voice

Sets uplink (microphone) voice volume gain for the active audio mode. Value is saved in NVM.

Command Type	Syntax	Response/Action	Remarks
Set	+MATXV =<tx voice volume gain>	OK or: +CME ERROR: <err>	Sets TX voice volume level.
Read	+MATXV?	+MATXV:<voice vol> OK	Reads TX current voice volume level.
Test	+MATXV=?	+MATXV: <tx voice vol range>	Returns the TX voice volume level range.

The following table shows the +MATXV parameters.



Table 4-142: +MATXV Parameters

<Parameter>	Description
<codec tx voice volume gain>	txv_gain_min (0) - txv_gain_max (65535) the value in decimal.

Example

```
AT+MATXV=?
+MATXV: (0-65535) AT+ MATXV = 2048
```

4.8.4.12. Extended DSP Filters Control Commands

Extended AT commands control for the H24 filter Calibration is available. Please, contact M2M customer care for filter calibration documentation and assistance; see “Contact Us”. H24 allows control of the following filters:

- FIR Filter
- Automatic Gain Control
- Automatic Volume Control



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). 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.

Command Type	Syntax	Response/Action
Execute	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.

Command Type	Syntax	Response/Action
Execute	AT	OK

Example

```
AT OK
```



4.9.1.3. +CPIN, Enter PIN for Unlocking SIM Card or Enter PUK for Unlocking SIM Card

This command locks the SIM card. 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 password (determined by the error code returned from the requested operation or the Read command) is SIM PUK or SIM PUK2, the <new 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 that if PIN password fails 3 times (10 times in case of a personalization PIN) it enters "BLOCKED" state and then it is required to enter PUK password. If PUK application fails a number of times defined by SIM card manufacturer, the SIM card is permanently blocked and it will be useless.

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 4-143: SIM Card Errors

Error	Description
6 PH-FSIM PIN required	ME is waiting for SIM PERSONALIZATION PIN to be entered.
7 PH-FSIM PUK required	SIM PERSONALIZATION PIN is blocked, ME is waiting for SIM PERSONALIZATION PUK to be entered.
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.
40 network personalization PIN required	ME is waiting for PN PERSONALIZATION PIN to be entered.
41 network personalization PUK required	PN PERSONALIZATION PIN is blocked, ME is waiting for PN PERSONALIZATION PUK to be entered.
42 network subset personalization PIN required	ME is waiting for PU PERSONALIZATION PIN to be entered.
43 network subset personalization PUK required	PU PERSONALIZATION PIN is blocked, ME is waiting for PU PERSONALIZATION PUK to be entered.
44 service provider personalization PIN required	ME is waiting for PP PERSONALIZATION PIN to be entered.



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45 service provider personalization PUK required	PP PERSONALIZATION PIN is blocked, ME is waiting for PP PERSONALIZATION PUK to be entered.
46 corporate personalization PIN required	ME is waiting for PC PERSONALIZATION PIN to be entered.
47 corporate personalization PUK required	PC PERSONALIZATION PIN is blocked, ME is waiting for PC PERSONALIZATION PUK to be entered.

Command Type	Syntax	Response/Action	Remarks
Set	AT+CPIN=<puk> or <pin>, [<newpin>]	OK or: +CME ERROR: <err>	The Set command sends the password to the H24 that is necessary before it can be operated (SIM PIN or SIM PUK). The Set command supplies to MS 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 locked, the error code 11 or "SIM PIN required" is returned. The user must then issue the Set command with the SIM PIN.
Read	AT+CPIN?	+CPIN: <code> OK or: +CME ERROR: <err>	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.
Test	AT+CPIN=?	OK or: +CME ERROR: <err>	

The following table shows the +CPIN parameters

Table 4-144: +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 Note: This parameter is irrelevant for personalization since personalization PIN



<p><code></p>	<p>READY - Not waiting for a password SIM PIN - Waiting for SIM PIN SIM PUK - Waiting for SIM PUK SIM PUK2 - Waiting for SIM PUK2, this response is given when the last executed command resulted in PUK2 authentication failure</p> <p>Personalization codes:</p> <p>PH-FSIM PIN – waiting for SIM PERSONALIZATION PIN password PH-FSIM PUK – waiting for SIM PERSONALIZATION PUK password PH-NET PIN – waiting for PN PERSONALIZATION PIN password PH-NET PUK - waiting for PN PERSONALIZATION PUK password PH-NETSUB PIN – waiting for PU PERSONALIZATION PIN password. PH-NETSUB PUK – waiting for PU PERSONALIZATION PUK password. PH-SP PIN - waiting for PP PERSONALIZATION PIN password. PH-SP PUK - waiting for PP PERSONALIZATION PUK password. PH-CORP PIN – waiting for PC PERSONALIZATION password. PH-CORP PUK – waiting for PC PERSONALIZATION PUK password.</p>
<p>SIM PIN SIM PUK SIM PUK2 PH-FSIM PIN PH-FSIM PUK PH-NET PIN PH-NET PUK PH-NETSUB PIN PH-NETSUB PUK PH-SP PIN PH-SP PUK PH-CORP PIN PH-CORP</p>	<p>AT+CPIN=<pin> AT+CPIN=<puk>,<newpin> AT+CPIN=<puk2>,<newpin2> AT+CPIN=<pin> AT+CPIN=<puk> AT+CPIN=<pin> AT+CPIN=<puk> AT+CPIN=<pin> AT+CPIN=<puk> AT+CPIN=<pin> AT+CPIN=<puk> AT+CPIN=<pin> AT+CPIN=<puk></p>

Example

```

AT+CPIN=? OK
AT+CLCK="SC",1,"<correct PIN>" OK
//The facility is enabled by the +CLCK command (Refer to "+CLCK, Facility Lock" on page 3-221)
//After power cycle
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. +EPIN, Enter SIM PIN2 to Verify PIN2 Indicator

This AT command will be used to verify the PIN2 when the proper SIM PIN2 password has been provided. The code presented by the ME PIN2 password will be compared with the relevant one stored in the SIM. The execution of this command is possible only if the SIM is in READY state or waiting for PIN2 state. If the PIN2 presented is correct, the number of remaining PIN2 attempts will be reset to its initial value allowed by the service provider. If the PIN2 presented is false, the number of remaining PIN2 attempts will be decremented. If an incorrect password is entered for maximum attempts allowed by provider, the SIM will be blocked, and the user will have to unblock it. To unblock the SIM card, the user can use the AT+CPIN command.

Command Type	Syntax	Response/Action	Remarks
Set	AT+EPIN=<type>,<passwd>	OK or: +CME ERROR: <err>	
Test	AT+EPIN=?	+EPIN: possible list of <tupe> OK	

The following table shows the +EPIN parameters.

Table 4-145: +EPIN Parameters

<Parameter>	Description
<type>	Digit type value, that indicate what action need to be executed. 2 - Verify PIN2 indicator.
<passwd>	String type. PIN2 password 4 - 8 digits.

Example

```

AT+EPIN=?
+EPIN: 2
    
```



OK

AT+EPIN=2, "<wrong_passwd>"
+CME ERROR: incorrect password

AT+EPIN=1, "<passwd>"
+CME ERROR: not supported

AT+EPIN=2, "<correct_passwd>" OK

4.9.1.5. +TPIN, Query Number of Remaining SIM PIN/PUK Entering Attempts

This command returns the number of remaining attempts of entering the PIN and PUK for the SIM card and the personalization feature in use.

The command returns the number of remaining attempts for:

- PIN1 (CHV1)
- PIN2 (CHV2)
- PUK1 (unlock CHV1)
- PUK2 (unlock CHV2)

And also for personalization facilities:

- SIM personalization pin (PF PIN)
- Network personalization pin (PN PIN)
- Network subset personalization pin (PU PIN)
- Service provider personalization pin (PP PIN)
- Corporate personalization pin (PC PIN)
- SIM personalization puk (PF PUK)
- Network personalization puk (PN PUK)
- Network subset personalization puk (PU PUK)
- Service provider personalization puk (PP PUK)
- Corporate personalization puk (PC PUK)

The number of available attempts is provider dependant. Typically it is:

- 3 attempts for SIM PIN
- 10 attempts for SIM PUK And

for personalization facilities:

- 10 attempts for PERSONALIZATION PIN
- 32 attempts for PERSONALIZATION PUK it is PF, PN, PU, PP and PC.

- Notes:**
1. When SIM is not inserted, the command will respond with an error.
 2. When PIN1 is locked, only PIN1 (CHV1), PIN2 (CHV2), PUK1 (unlock CHV1), PUK2 (unlock CHV2) will be returned.

Command Type	Syntax	Response/Action
--------------	--------	-----------------



Read	+TPIN?	+TPIN:<chv1>, <unb1_chv1>,<chv2>, <unb1_chv2>,<pn pin>,<pn puk>,<pu pin>,<pu puk>,<pp pin>,<pp puk>,<pc pin>,<pc puk>,<pf pin>,<pf puk> Ok // or when PIN1 is locked +TPIN:<chv1>,<unb1 chv1>,<chv2>,<unb2_chv2> OK // or: +CME ERROR: <err>
------	--------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

The following table shows the +TPIN parameters.

Table 4-146: +TPIN Parameters

<Parameter>	Description
<chv1>	Number of remaining PIN attempts
<chv2>	Number of remaining PIN2 attempts
<unbl_chv1>	Number of remaining PUK attempts
<unbl_chv2>	Number of remaining PUK2 attempts
<pn pin>	Number of remaining NETWORK PERSONALIZATION PIN attempts
<pn puk>	Number of remaining NETWORK PERSONALIZATION PUK attempts
<pu pin>	Number of remaining NETWORK SUBSET PERSONALIZATION PIN attempts
<pu puk>	Number of remaining NETWORK SUBSET PERSONALIZATION PUK attempts
<pp pin>	Number of remaining SERVICE PROVIDER PERSONALIZATION PIN attempts
<pp puk>	Number of remaining SERVICE PROVIDER PERSONALIZATION PUK attempts
<pc pin>	Number of remaining CORPORATE PERSONALIZATION PIN attempts
<pc puk>	Number of remaining CORPORATE PERSONALIZATION PUK attempts
<pf pin>	Number of remaining SIM PERSONALIZATION PIN attempts
<pf puk>	Number of remaining SIM PERSONALIZATION PUK attempts

Example

```
AT+TPIN?
+TPIN: 3,10,3,10,10,32,10,32,10,32,10,32,10,32
OK AT+CPIN="7777"
+CME ERROR: incorrect password
```

```
AT+TPIN?
+TPIN: 2,10,3,10,10,32,10,32,10,32,10,32,10,32
```



OK

```
// Power up while PIN1 is locked  
AT+TPIN?  
+TPIN: 2,10,3,10
```

OK



4.9.1.6. +CPWD, Change Password

This command sets a new password for the facility lock.

A password can be changed only if the provided password <oldpwd> has been verified. The entered password <newpwd> must also comply with the password rules. The facility value <fac> is not case-sensitive. In the pass-word value, letters are not allowed.

Note: Changing of SIM facility requires that the facility will be enabled (Refer to “+CLCK, Facility Lock”).

Command Type	Syntax	Response/Action	Remarks
Set	AT+CPWD=<fac>,<oldpwd>,<newpwd>	OK or: +CME ERROR: <err>	The Set command sets a new password for the facility lock function, defined by the +CLCK command. (Refer to “+CLCK, Facility Lock”).
Read	+CPWD?	+CME ERROR: <err>	
Test	+CPWD=?	+CPWD:list of supported (<fac>,<pwdlength>)s OK or: +CME ERROR: <err>	The Test command returns a list of pairs which represent the available facilities, and the maximum length of their passwords.

The following table shows the +CPWD parameters.

Table 4-147: +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 H24 power-up and when this command is issued. AB All Barring services. Facility messages of barring services are sent to the network. P2 SIM PIN2.
<oldpwd>	String type, 4-8 character password specified for the facility from the H24 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: ("AB",4),("AC",4),("AG",4),("AI",4),("AO",4),("IR",4),("OI",4),("OX",4),("SC",8),("P2",8)
```



OK

AT+CPWD?
+CME ERROR: operation not supported

AT+CLCK: "sc",1,"correct pin1 password" // Locking Sim Card
OK

AT+CPWD="sc","incorrect old password","new password"
+CME ERROR: incorrect password

AT+CLCK: "sc",0,"correct pin1 password"// Unlock Sim Card
OK

AT+CLCK="sc",2
+CLCK: 0
OK

AT+CPWD="sc","old password","new password"
+CME ERROR: operation not allowed

AT+CPWD="p2","old password","new password" OK

AT+CLCK="ai",2
+CLCK: 0,255
OK
AT+CPWD="ab","old password","new password" AT+CLCK="ai",1," new password "
OK

AT+CLCK="ai",2
+CLCK: 1,1
+CLCK: 1,4
+CLCK: 1,16
+CLCK: 1,32
OK



4.9.1.7. +CLCK, Facility Lock

This command locks, unlocks or interrogates an H24 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. Facilities locking/unlocking takes effect after the next power cycle, except for the personalization facilities (PN, PU, PP, PC, PF) which take effect immediately. When querying the status of a single call barring program <mode>=2, the <status> for each call type will be returned.

Note: To unlock a personalization facility when using a foreign SIM card, one should unlock the H24 using +CPIN command with the Network PIN.

Command Type	Syntax	Response/Action	Remarks
Set	+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	The Set command performs the specified <mode> action on the specified <fac>.
Test	+CLCK=?	+CLCK: (list of supported <fac>s)	The Test command returns the list of supported facilities.




```
AT+CLCK=?  
+CLCK: ("AB","AC","AG","AI","AO","IR","OI","OX","SC","FD","PN","PU","PP","PC","PF") 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 on 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: 0,255  
OK
```

```
AT+CLCK="IR",1,"correct password" //<classx> is defaulted to 7 when not specified  
OK
```

```
AT+CLCK="IR",2  
+CLCK: 1,1  
+CLCK: 1,4  
+CLCK: 1,32  
+CLCK: 1,16  
OK
```

```
AT+CLCK="OI",2  
+CLCK: 0,255  
OK
```

```
AT+CLCK="OI",1,"correct password",3  
OK  
(International calls are barred for voice and data calls only)
```

```
AT+CLCK="OI",2  
+CLCK: 1,1 // voice and data calls only  
+CLCK: 1,16  
+CLCK: 1,32  
OK
```



4.9.1.8. +MCTYPE, Queries the Card Type Currently Used By H24

This AT command queries the card type currently used by H24 (SIM card or USIM card).

Command Type	Syntax	Response/Action	Remarks
Read	AT+MCTYPE?	+MCTYPE: <mode> OK or: +CME ERROR: <err>	The Read command returns the card type currently used by H24 (SIM card or USIM card).
Test	AT+MCTYPE=?	+MCTYPE: (list of supported <mode>s) OK or: +CME ERROR: <err>	The Test command returns list of supported modes.

The following table shows the +MCTYPE parameters.

Table 4-149: +MCTYPE Parameters

<Parameter>	Description
<mode>	0 - Unrecognized card type. 1 - GSM SIM card. 2 - UMTS USIM card.

Example

```
AT+ MCTYPE =?
+MCTYPE: (0-2) OK
```

```
AT+ MCTYPE?
+MCTYPE =1 //if GSM SIM card is plugged in
OK
```

```
AT+ MCTYPE?
+MCTYPE =2 //if UMTS USIM card is plugged in
OK
```

```
AT+ MCTYPE?
+CME ERROR: SIM not inserted //if no card is plugged in
```



4.9.1.9. +MGSMSIM, Setting SIM Type

This command adjusts the H24 to work with a 2G SIM or a 3G SIM card types.

Note: This command is for testing purposes only.

Command Type	Syntax	Response/Action	Remarks
Set	+MGSMSIM =<mode>	OK or: +CME ERROR: <err>	The Set command sets the desired SIM type to be used.
Read	+MGSMSIM?	+MGSMSIM:<mode> OK or +CME ERROR: <err>	The Read command displays the current setting.
Test	+MGSMSIM =?	+MGSMSIM: (list of supported <mode>s) OK	These values will define the range for the set command.

The following table shows the +MGSMSIM parameters.

Table 4-150: +MGSMSIM Parameters

<Parameter>	Description
<mode>	0 - Starts card as a 2G SIM. 1 - Starts card as a 3G SIM.

Example

```
AT+MGSMSIM?
+MGSMSIM: 1
OK AT+MGSMSIM=?
+MGSMSIM: 0-1
```

```
OK AT+MGSMSIM=0
OK
```



4.9.2. Personalization Commands

This section lists the set of commands that handle the Personalization feature. The commands: +CPIN, +CLCK and +TPIN are common to the personalization as well as to other locking facilities of the H24 and therefore will only be referred from this section to their location in this document. +MPERSO is the only personalization specific command and will be detailed right below.

When the module is personalized, the only accessory operations allowed are Core AT commands (allowed while H24/SIM card is locked). All other AT commands are not executed. For example, accessing phone book entries. However, the module is still capable of sending asynchronous message events via AT responses, for example, incoming call notification.

4.9.2.1. +MRPERSO - Restore Configuration From Backup

This command restores the configuration of personalization from a backup partition and overrides the existing configuration if exists.

Command Type	Syntax	Response/Action	Remarks
Set	+MRPERSO=<param>	OK	

The following table shows the +MRPERSO parameters.

Table 4-151: +MRPERSO Parameters

<Parameter>	Description
<param>	8 is the only valid value.

Example

```
AT+MRPERS<F8
OK
```



4.10. Firmware Update Over the Air (FOTA)

The following paragraphs describe the use of AT commands for updating the H24 firmware over the air.

Note: FOTA is enabled when web session is well configured by +MFOTAWSCFG command, in accordance with your carrier required settings, to allow data connection.

The update process is done by communication between the H24 and the versions server. During the process, the servers sends both SMSs and data over GPRS connection to the H24.

During the process, the data connection will be opened and closed for several times.

4.10.1. +MFOTAWSCFG, Set the Web-Session Default Entry

This command specify a particular PDP context definition to be used when web session need to be initiated.

AT+ MFOTAWSCFG settings will be saved in nvm and the last setting will be available after power up.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MFOTAWSCFG = <Context ID> ,	OK or: +CME ERROR: <err>	The set command configures the Web-Session default entry.
Read	AT+MFOTAWSCFG?	+MFOTAWSCFG: <Context ID> OK	The read command returns the current setting.
Test	AT+MFOTAWSCFG=?	+MFOTAWSCFG:(list of supported < context ID>s OK	Test command returns the supported context ID's.

The following table shows the +MFOTAWSCFG parameters.

Table 4-152: +MFOTAWSCFG Parameters

<Parameter>	Description	Remarks
<context ID>	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). Saved in Flex.



Example

```
AT+MFOTAWSCFG=?
+MFOTAWSCFG: (1-16)
```

```
OK AT+MFOTAWSCFG=15
OK
```

```
AT+MFOTAWSCFG? AT+MFOTAWSCFG: 15
OK
```

4.10.2. +MFOTACNFG, Set the DM Session as Automatic/Non-Automatic

This command enables to set the DM session as Automatic/Non-Automatic (i.e. Transparent/Non-Transparent).

Default value is Automatic DM session.

Upon the receiving of the AT+MFOTACNFG command, the module will perform the following tasks:

1. Validate OMA-status is "idle" and DM-session is not active. If not, the module will abort the command with a CME error "operation not allowed" (code 3).
2. Otherwise - set the appropriate Flex params, return OK to DTE.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MFOTACNFG= <Automatic DM session>	<OK> or: +CME ERROR: <"operation not allowed">	Enable/Disable FOTA feature at the selected DM mode.
Read	AT+MFOTACNFG?	+MFOTACNFG: <Automatic DM session>	Provide FOTA session state.
Test	AT+MFOTACNFG=?	+MFOTACNFG: list of <Automatic_DM_Mode>	



The following table shows the +MFOTACNFG parameters.

Table 4-153: +MFOTACNFG Parameters

<Parameter>	Description	Remarks
<Automatic DM session>	0 - Non automatic DM session 1 - Automatic DM session	"Automatic DM Session" enables the network to contact and establish a secure connection with the modem without direct user interaction.

Example

```
AT+MFOTACNFG? // Get the FOTA DM session mode
```

```
+MFOTACNFG: 0  
OK
```

```
AT+MFOTACNFG=1 // change the FOTA DM session mode to Automatic
```

```
OK
```

```
AT+MFOTACNFG? // Get the FOTA DM session mode  
+MFOTACNFG: 1
```

```
OK
```

```
AT+MFOTACNFG=?  
+MFOTACNFG: (0-1) OK
```



4.10.3. +MFOTAREQ, Sends FOTA Requests Toward DTE

When +MFOTAREQ is operational, reports are enabled during FOTA process (Automatic, i.e. Unsolicited, state was set using +MFOTACNFG command), the module will send confirmation requests toward DTE and the user has to respond using +MFOTARSP.

If case that the user missed the last request indication, he can use this command to show the last request, and respond accordingly. See "Execute" command Type on table below.

Command Type	Syntax	Response/Action	Remarks
Unsolicited Report	+MFOTAREQ: <FOTA-Operation>		
Execute	AT+MFOTAREQ	+MFOTAREQ: <FOTA-Operation>	

The following table shows the +MFOTAREQ parameters.

Table 4-154: +MFOTAREQ Parameters

<Parameter>	Description
<FOTA-Operation>	0 - No request is waiting for respond. Relevant for the "Execute" Command-Type on the table above. 1 - Request to begin DM session 2 - Allow download Update-Package? 3 - Upgrade Phone Software Now?

Example

```
+MFOTAREQ: 1      // Request to begin DM session

AT+MFOTARSP=0    // Confirm DM session beginning
OK

+MFOTAREQ: 2      // Request to start downloading an Update-Package

AT+MFOTARSP=0    // Confirm the download operation
OK

+MFOTAREQ: 3      // Request to Upgrade Phone Software
AT+MFOTAREQ
+MFOTAREQ: 3
AT+MFOTARSP=2    // Postpone the Upgrade operation
OK
```



4.10.4. +MFOTARSP, Respond to +MFOTAREQ Report

This command is used to send a response to +MFOTAREQ reports.

Command Type	Syntax	Response/Action	Remarks
Set	AT+ MFOTARSP = <action>	<OK> or: +CME ERROR:	
Test	AT+ MFOTARSP=?	+ MFOTARSP: (list of < action>s)	

The following table shows the +MFOTARSP parameters.

Table 4-155: +MFOTARSP Parameters

<Parameter>	Description	Remarks
<action>	0 - start 1 - reject	

Example

+MFOTAREQ: 1 // Request to begin DM session

AT+MFOTARSP=0 // Confirm DM session beginning
OK

+MFOTAREQ: 2 // Request to start downloading an Update-Package

AT+MFOTARSP=1 // Reject the download operation
OK

+MFOTAREQ: 3 // Request to Upgrade Phone Software
AT+MFOTARSP=2 // Postpone the Upgrade operation
OK



4.10.5. +MFOTAINSTL, Install the FOTA Updated Package

Install the updated package if the conditions are met:

If update package was downloaded and OMA state is "Ready to update" then the module will start update installation, otherwise, the module will reply with CME error: "operation not allowed".

Command Type	Syntax	Response/Action	Remarks
Execute	AT+MFOTAINSTL	OK or: +CME ERROR<err>	Install the updated package.

4.10.6. +MFOTAABORT, Abort the DM Session

This command allows aborting the DM/DL session. As a result, the FOTA activities above DM session (interaction with the server and download) are stopped.

Note: The DM/DL session is active during the download of descriptor file or download of an update package. In all other cases the command will return ERROR - operation not allowed.

Command Type	Syntax	Response/Action	Remarks
Execute	+MFOTAABORT	OK or: +CME ERROR<err>	The Execute command aborts the DM session. OK is returned.

Example

```
+MFOTAREQ: 2           // Download request AT+MFOTARSP=0           // Confirm the download operation
OK

+MFOTAIND: 10, 4
+MFOTAIND: 10, 5       // DM Session in progress
+MFOTAIND: 10, 7       // DM Session complete
+MFOTAIND: 16, 14      // Download in progress
+MFOTAIND: 16, 13, 0  // Progress bar indication
+MFOTAIND: 16, 13, 5  // Progress bar indication
AT +MFOTAABORT        // Abort download
OK
```



<FOTA-indications>	<p>5 DM Session started. 6 DM session in progress. 7 DM Session completed. 8 xx DM session interrupted, xx (fail reason see Table4-157). 9 Unable to connect to server. 10 Bootstrap completed. 11 Access failed. 12,xx Download failed, xx (fail reason see Table 4-157). 13,xx Software update xx% completed. 14 Download in progress. 15 SW download completed. 16 SW update complete. 17 SW update failed. 18 No update package available. 19 SW installation has started.</p>
---------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

The following table shows the failure reasons.

Table 4-157: Failure Reasons

Failure	Reason
0	Success.
16	Unspecific error.
17	Memory error.
18	Not allowed or bad parameters.
19	Attempt to call TRG_RDM_run with non-resume trigger when suspended.
32	SyncML message Protocol or version error.
8194	Workspace buffer too small.
24576	Buffer overflow.
24577	Badly formatted input.
24578	Tree node already exists.
24579	Tree node is missing.



Failure Reasons (Cont.)

Failure	Reason
24580	Parent node is missing.
24581	Error in leaf node.
24582	Leaf node expected.
24583	Unknown property.
24584	An attempt was made to delete a permanent node.
24585	Not allowed by AccessType.
24586	Client aborted.
24587	Bad program name passed to Tree Access API
24588	Partial write of external data not allowed.
24589	Write of external data not allowed at this time.
24590	May not replace.
24591	Tree read error.
24592	Tree write error.
24593	Authentication failure.
24594	External data access denied.
24595	External data value is not readable.
24596	External data value is not writable.
24597	Node not registered for execute.
24598	Tree open error.
24599	Tree commit error.
24832	No more commands.
24833	Missing start message command.
24834	Missing end message command.
24835	Optional feature not implemented.
24837	Alert options parsing error.
24838	Not enough items with Alert.
24839	Not enough items with Alert.
24840	Not enough items with Alert.
24841	User cancelled or aborted the Alert.
24842	Too many choices passed to implementation.
24843	Server has sent a session-abort alert.
24844	Large object item has been handled.



OK

4.11. Modem Configuration and Profile

4.11.1. Modem Register Commands

The H24 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”. Some registers can also be accessed using dedicated commands, detailed below.

4.11.1.1. V, H24 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 4-158: Effects of Parameter Settings

V0	V1	Information Responses
<ATV0>	<ATV1>	0 - "OK" 1 - "CONNECT" 2 - "RING" 3 - "NO CARRIER" 4 - "ERROR" 5 - "NO DIALTONE" 6 - "BUSY" 7 - "NO ANSWER"
<numeric code>	<verbose code>	

Command Type	Syntax	Response/Action	Remarks
Set	ATV<value>	OK or: +CME ERROR: <err>	The Set command sets the format of information responses and result codes.
Read	ATV?	<current value>	The Read command reads the current setting of response format.
Test			The Test command for V is not defined, and therefore is not supported by the H24. The H24 returns an error.



The following table shows the V parameters.

Table 4-159: 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? V: 1
OK ATV0
0
ATV7
4
ATV1
OK ATV7
ERROR
    
```



4.11.1.3. 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.

Command Type	Syntax	Response/Action	Remarks
Set	ATE[<value>]	OK or: +CME ERROR: <err>	The Set command sets whether or not to echo characters.
Read	ATE?	<current value>	The Read command reads the current setting for command echo.
Test			The Test command for E is not defined by ITU, and therefore is not supported by the H24. The H24 returns an error.

The following table shows the E parameters.

Table 4-161: En Parameters

<Parameter>	Description
<value>	0 Does not echo characters 1 Echoes characters The default value is 0.

Example
ATE?
E: 1
OK

4.11.1.4. X, Result Code Selection and Call Progress Monitoring Control

This command defines the CONNECT result code format. It determines whether or not the H24 transmits particular result codes to the user. It also controls whether the H24 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.

Command Type	Syntax	Response/Action	Remarks
Set	ATX<value>	OK or: +CME ERROR: <err>	The Set command sets the result code and call progress monitoring control.
Read	ATX?	<current value>	
Test			The Test command for X is not defined by ITU, and therefore is not supported by the H24. The H24 returns an error.



Example

```

ATS0=3
OK ATS0?
003
OK
    
```

S0, Set/Get Number of Rings Before Auto Answer

Command Type	Syntax	Response/Action	Remarks
Set	ATS0=<value>	OK or: CME ERROR: <error>	The Set command selects the number of rings before auto answer.
Execute	ATS0	CME ERROR: operation not supported	
Read	ATS0?	<current value of ATS0> or: +CME ERROR: <error>	The Read command should return the current selection of the number of rings.
Test	ATS0=?	CME ERROR: operation not supported	The Test and the Execute commands are not supported for ATS0.

The following table shows the S0 parameters.

Table 4-163: S0 Parameters

<Parameter>	Description
<value>	Min Value: 0 Max Value: 255 Default Value: 0

Example

```

ATS0=3
OK ATS0?
003
OK
    
```

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.



The following table shows the S7 parameters.

Table 4-165: S7 Parameters

<Parameter>	Description
<value>	Min Value: 1 Max Value: 90 Default Value: 30

Example

```
ATS7=3
OK ATS7?
003
OK
```

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.

Command Type	Syntax	Response/Action	Remarks
Set	S12=<guard_time>	OK +CME ERROR: <err>	The Set command sets the CSD escape character guard time value if all parameters are valid.
Read	S12?	<guard_time> OK +CME ERROR: <err>	The Read command displays the current CSD escape character guard time.

The following table shows the S12 parameters.

Table 4-166: 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.



4.11.1.6. \S, Show the Status of the Commands and S-registers in Effect

This command displays the status of selected commands and S-registers.

4.11.1.7. &F, Set to Factory Defined Configuration

This command restores the factory default configuration profile. The H24 supports only one factory default profile, 0.

Command Type	Syntax	Response/Action	Remarks
Set	AT&F<value>	OK or: +CMS ERROR: <err>	
Read	AT&F?	<current profile number>	
Test			The Test command for &F is not defined by ITU, and therefore is not supported by the H24. The H24 returns an error.

The following table shows the &F parameters.

Table 4-167: &F Parameters

<Parameter>	Description
<value>	0 Factory default configuration profile. This is the only value supported.

Note:
AT&F does not act to AT&Y.
AT&F0 changed only the “Active profile”.

Example

```
AT&F?
&F: 0
OK
```



4.11.1.9. &V, View Configuration

This command lists the user's profile configurations.

Command Type	Syntax	Response/Action	Remarks
Execute	&V	ACTIVE PROFILE: ... (profile data) STORED PROFILE 0: ... (profile data) STORED PROFILE1: ... (profile data) OK or +CME ERROR: <err>	The Execute command displays the current active configuration and stored user profiles.

Example

```

AT&V ACTIVE PROFILE:
E1 Q0 V1 X1 &C2 &D2 &K3 &Y0
S000=000 S002=043 S003=013 S004=010 S005=008 S007=030
S008=002 S012=020 S024=003 S100=000 S102=000
STORED PROFILE 0:
E0 Q0 V0 X0 &C0 &D0 &K0
S000=003 S002=048 S003=013 S004=010 S005=030 S007=040
S008=006 S012=036 S024=009 S100=011 S102=050
STORED PROFILE 1:
E1 Q1 V1 X1 &C1 &D1 &K4
S000=001 S002=045 S003=013 S004=010 S005=046 S007=040
S008=012 S012=058 S024=016 S100=022 S102=100
    
```

4.11.1.10. &W, Store User Profile

This command stores the user profile configuration to the NV. The H24 supports 2 user profile values, the default profile is 0.

Command Type	Syntax	Response/Action	Remarks
Set	&W[<n>]	OK or +CME ERROR: <err>	The Set command stores the current active configuration to user profile 0 or 1.



The following table shows the &W parameters.

Table 4-169: &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 4-170: 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, 3-6	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
S4	Line feed character.	0-127	10	7
S5	Backspace character.	0-32	8	6



Profile Parameters (Cont.)

Profile Parameter	Description	Parameter Range	Default Value	Length in Bits
S7	Wait time for a remote data adaptor's carrier signal before hanging up.	1-90	45	8
S8	Timer to send DTMF.	0-255	2	8
S12	Time (in units of 50 ms) for the escape character during CSD connections.	0-255	20	8
S24	Time, in seconds to wait before entering Sleep mode.	1-255	3	8
S100	Value of the delay before sending data to the terminal.	0-255	0	8
S102	Minimum Time for Terminal to Fall into Sleep Mode.	0-255	30	8

Example
AT&W0
OK AT&W1
OK



4.11.1.11. &Y, Default User Profile

This command sets the user profile to the power up configuration. The H24 supports 2 user profile values, the default profile is 0.

Command Type	Syntax	Response/Action	Remarks
Set	&Y[<n>]	OK or +CME ERROR: <err>	The Set command stores the current active configuration to user profile 0 or 1.

The following table shows the &Y parameters.

Table 4-171: &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
```

4.11.2. Sleep Mode Commands

In order to improve the power consumption, the H24 supports a low-power consumption mode, called "Sleep mode". The H24 has internal decision conditions for entering and exiting sleep mode. As the terminal and the H24 operate in a combined system, and as the communication between the H24 and the terminal must be reliable, there should be a mechanism agreed upon by both the H24 and the terminal to co-ordinate their separate sleep mode entering and exiting sequences. The H24 will not enter sleep mode unless the terminal enables the H24 sleep mode and signals its readiness for sleep. For this purpose, a set of AT commands and dedicated HW lines are defined.

Notes:

- H24 USB supports resume/suspend mechanism according to USB2.0 specification, which handles signaling (resume/suspend, remote wakeup) and data integrity.
- If the following conditions become true:
 - Sleep mode enabled
 - HW flow control enabled
 - Airplane mode enabled (AT+CFUN=0 or AT+CFUN=4).

The user will be able to wake H24 through RX activity only if the terminal switches to flow control NONE first!



4.11.2.1. Enable/Disable Sleep Mode

Enabling/Disabling sleep mode is controlled via +MSLEEP command.

Issue AT+MSLEEP=1 for enabling sleep mode or AT+MSLEEP=0 for disabling.

4.11.2.2. Sleep Mode AT Commands

The following are the Sleep mode AT commands:

- AT`S102`: Defines the period to wait between sending the wake-up signal, and sending data to the terminal.
- AT`S100`: The minimum time that takes the Terminal to enter sleep mode. Only if this time period passes, the H24 will wait AT`S102` time between wake-up out line and data transmission.

The following are applicable for UART only:

- AT`S24`: Number of Seconds Delay for UART to enter sleep.
- AT+MSCTS: Defines the behavior of the CTS line when H24 is in Sleep mode. It enables or disables activation of the CTS line after wakeup.



4.11.2.3. Sleep Mode H/W Signals

Two HW lines are used:

- One for waking the H24 (Wakeup-In).
- One for waking the terminal (Wakeup-Out).

Terminal Does Not Wake the H24 (If the Terminal Uses Hardware Flow Control Only)

When the H24 is in Sleep mode, the CTS line is also inactive. The terminal does not send any characters to the H24 if the CTS is inactive, otherwise the character may be lost (Hardware Flow Control).

Terminal Wakes the H24 Using the Wakeup-In Line

The terminal uses the Wakeup-In line (pin #16) to wake up the H24 when it wants to send data. When the Wakeup-In line is low, the H24 will not enter the Sleep mode. If the terminal has data to send while the H24 is sleeping, it activates the line (brings it to active low), then waits 30 ms (the time required to wake the H24). Only then can the terminal start sending data.

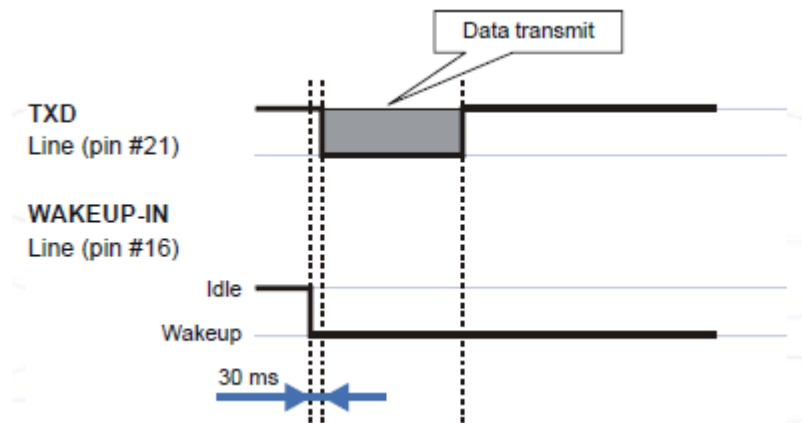


Figure 4-2: Wakeup-In Line

Two modes exist:

- Idle Mode: The terminal has no data to send. If the terminal enables sleep mode (using `ats24`), the H24 activates its Sleep mode module.
- Wakeup Mode: The H24 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 H24 (using the RS232 protocol).

H24 Wakes the Terminal

- The H24 follows these steps in order to wake up the terminal:
- The H24 indicates to the terminal that it has data and that it must wake up. The H24 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 H24 gets the output wakeup line to high.

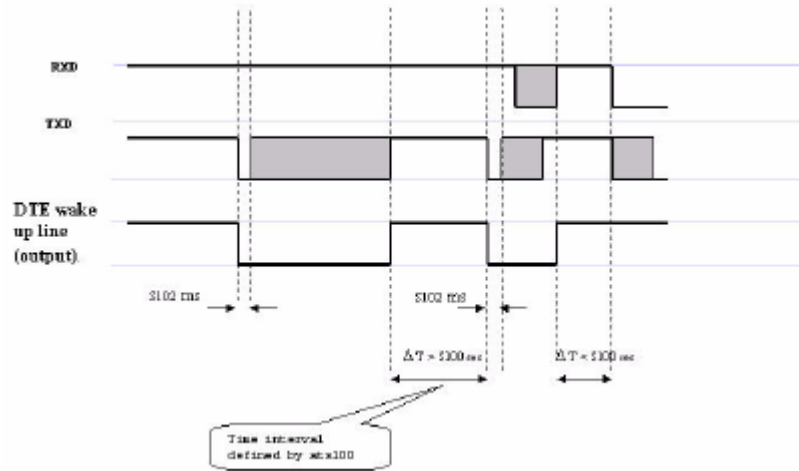


Figure 4-3: Wakeup Outline

Two modes exist:

- Idle mode: The H24 has no data to send.
- Wakeup mode: The H24 has data to send to the terminal.

After the H24 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).

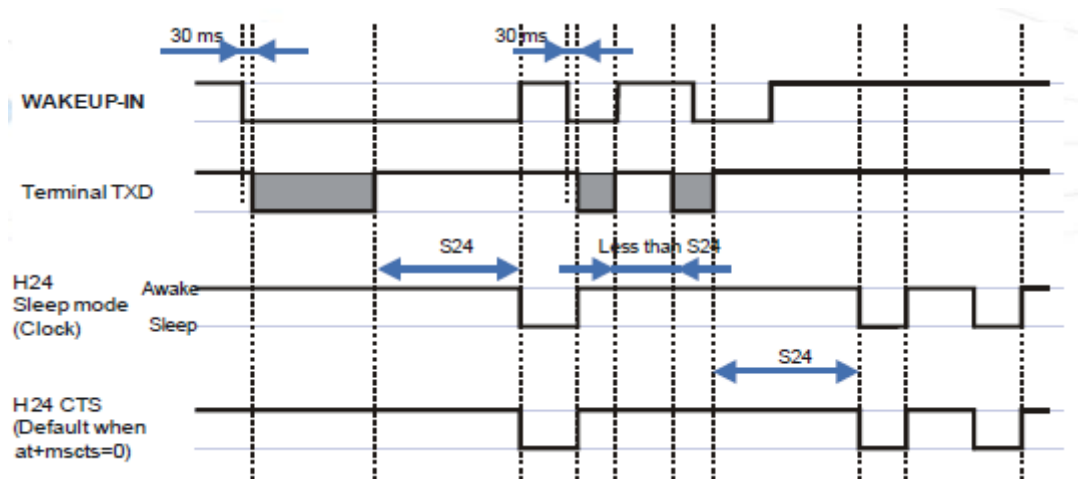


Figure 4-4: Sleep Mode when $S24 > 0$



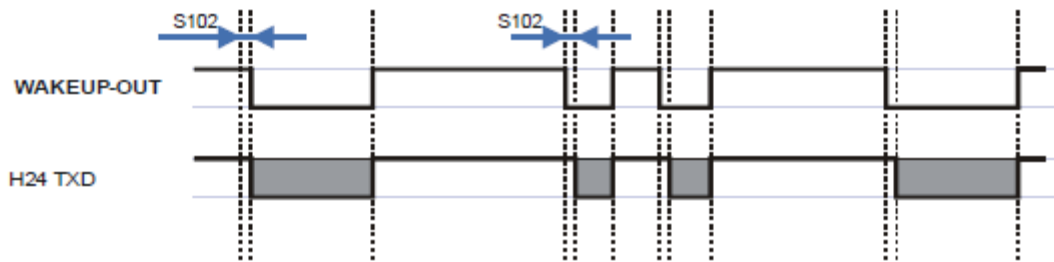


Figure 4-5: H24 Lines when S24 > 0

4.11.2.4. Sleep Commands Description

4.11.2.4.1. +MSLEEP, Enable/Disable Sleep Mode

This command enables or disables the H24 to enter Sleep Mode. The value at power up is H24 Sleep Mode disabled.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MSLEEP=<value> ¹	OK ERROR or: +CME ERROR:<err>	
Read	AT+MSLEEP?	<value> ² OK	
Test	AT+MSLEEP=?	+MSLEEP: (0-1) OK	

Note: ¹) The set command sets the status of the Sleep Mode [enabled/disabled].

²) The read command returns the current status of the Sleep Mode.

The following table shows the +MSLEEP parameters.



Table 4-172: +MSLEEP Parameters

<Parameter>	Description
<value>	This parameter enables/disables the Sleep Mode. 0 Disabled (H24 does not enter Sleep Mode, the H24 stay active all time). 1 Enable the H24 to enter to Sleep Mode. The default value is 0. The value does not save in NV, means that after power up it will be always 0 (disable).

Example

```
AT+MSLEEP=?
+MSLEEP: (0-1) OK
```

```
AT+MSLEEP?
+MSLEEP: 0
OK
```

```
AT+MSLEEP=1
OK
```

4.11.2.4.2. S24, Set Number of Seconds Delay Before H24 Enters Sleep Mode

The terminal sends AT+S24=5, AT+MSLEEP=1 and if there are no radio and UART activities, the H24 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 upon entering/existing sleep mode.
- If +MSCTS=1, the line is switched off at the moment of entering Sleep mode and stays off even if H24 is awakened.

(For more information refer to “+MSCTS, Enable/Disable CTS During Wakeup Period” .)

Command Type	Syntax	Response/Action	Remarks
Set	AT+S24=<value>	OK	The Set command sets the amount of time, in seconds, the H24 should wait before entering Sleep mode.
Read	AT+S24?	<value> OK	The Read command returns the current value.



The following table shows the S24 parameters.

Table 4-173: 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 H24 will enter sleep mode in 5 seconds)
    
```

4.11.2.4.3. 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 H24 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).

Command Type	Syntax	Response/Action	Remarks
Set	ATS102 = <value>	OK	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.
Read	ATS102?	<value> OK	The Read command returns the current value.



The following table shows the S102 parameters.

Table 4-174: S102 Parameters

<Parameter>	Description
<value>	0 <= value <= 10,000 The default value is 30 ms.

Example

```

ATS102? <enter>
030
OK
ATS102=100 <enter> OK
ATS102? <enter>
100
OK
    
```

Note: This means if there is data for transmission to the terminal, the H24 drops the Wakeup Out line, waits 100 ms. and then sends data to the terminal.

4.11.2.4.4. S100, Set Minimum Time for Terminal to Fall into Sleep Mode

ATS100 is a terminal minimum time limit for entering sleep mode.

In order to limit the number of interrupts on the DTE side and reduce data sending delay time on our side, H24 sends wakeup-out pulse when the interval between one burst of sent/received data to the other is bigger than specified in ATS100.

Command Type	Syntax	Response/Action	Remarks
Set	ATS100=<delta>	OK or: +CME ERROR:<err>	The set command sets the terminal minimum time limit for entering sleep mode.
Read	ATS100?	<delta> OK	The Read command returns the current ATS100 value.



The following table shows the S100 parameters.

Table 4-175: S100 parameters

<Parameter>	Description	Remarks
<delta>	Time interval between one burst of sent/received data to the other before the terminal enters sleep mode. 0: Wakeup out feature isn't active. (default when +S100 set command is never used) 1 - 255: Time in seconds.	This value is saved on power down.

Example

```

ATS100?
001
OK ATS100=0
OK ATS100?
000
OK

```

4.11.2.4.5. +MSCTS, Enable/Disable CTS During Wakeup Period

This command defines the behavior of the CTS line when the H24 is in normal mode (not Sleep mode).

The command configures the H24 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 H24 exits Sleep mode for internal H24 reasons (non-terminal communication related reasons).

Command Type	Syntax	Response/Action	Remarks
Set	AT+MSCTS=<control>	OK	The Set command tells the H24 whether to activate the CTS when the unit is awakening.
Read	AT+MSCTS?	+MSCTS: <current control> OK	The Read command returns the current control value.
Test	AT+MSCTS=?	+MSCTS: (list of supported <control>) OK	The Test command returns the possible control values.



The following table shows the +MSCTS parameters.

Table 4-176: +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 AT+MSCTS?
1
OK
    
```

Note: This means that by waking up, the CTS line will stay OFF and it can be activated by the Wakeup IN Line interrupt only.

4.11.3. Error Handling Commands

4.11.3.1. +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 H24. When enabled, H24-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 H24. When enabled, H24 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 27.005, 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 H24. When enabled, H24-related errors cause a +CMS ERROR: <err> final result code instead of the regular ERROR final result.



Command Type	Syntax	Response/Action	Remarks
Set	AT+CMEE=[<n>]	OK or: +CME ERROR: <err>	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 H24.
Read	AT+CMEE?	+CMEE: <n> OK	The Read command returns the current setting format of the result code.
Test	AT+CMEE=?	+CMEE: (list of supported <n>s) OK	The Test command returns values supported by the terminal as a compound value.

The following table shows the +CMEE parameters.

Table 4-177: +CMEE Parameters

<Parameter>	Description
<n>	0 Disable the +CME ERROR: <err> result code and use ERROR. 1 Enable the +CME ERROR: <err> or +CMS ERROR: <err> result codes and use numeric <err> values. 2 Enable the +CME ERROR: <err> or +CMS ERROR: <err> result codes and use verbose <err> values. The default value is 0.



Table 4-178: +CME Errors

Numeric	Verbose
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"
19	"SIM not allowed"
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"
28	"unknown calling error"
30	"no network service"
31	"network timeout"
32	"network not allowed - emergency calls only"
33	"command aborted"



+CME Errors (Cont.)

Numeric	Verbose
34	"numeric parameter instead of text parameter"
35	"text parameter instead of numeric parameter"
36	"numeric parameter out of bounds"
37	"text string too short"
38	"operation not allowed on channel"
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"
100	"unknown"
103	"Illegal MESSAGE"
106	"Illegal ME"
107	"GPRS services not allowed"
111	"PLMN not allowed"
112	"Location area not allowed"
113	"Roaming not allowed in this location area"
132	"service option not supported"
133	"requested service option not subscribed"
134	"service option temporarily out of order"
148	"unspecified GPRS error"
149	"PDP authentication failure"
150	"invalid mobile class"
257	"call rejected"
258	"retry operation"
259	"invalid deflected to number"
260	"deflected to own number"
261	"unknown subscriber"
262	"service not available"
263	"unknown class specified"



+CME Errors (Cont.)

Numeric	Verbose
264	"unknown network message"
273	"minimum TFTs per PDP address violated"
274	"TFT precedence index not unique"
275	"invalid parameter combination"
276	"Invalid TFCC mode"
277	"Invalid number of Parameters"
278	"Invalid Parameter"
280	"PING msg too long"
281	"PING host not found"
282	"unspecified PING error"
283	"network busy"

Table 4-179: +CMS Errors

Numeric	Verbose
1	"Unassigned number"
8	"Operator determined barring"
10	"Call barred"
11	"Reserved 11"
17	"Network Failure"
21	"Short message transfer rejected"
22	"Congestion"
27	"Destination out of order"
28	"Unidentified subscriber"
29	"Facility rejected"
30	"Unknown subscriber"
33	"Command Aborted"
38	"Network out of order"
41	"Temporary failure"
42	"Congestion high traffic"
47	"Resources unavailable unspecified"
50	"Requested facility not subscribed"



±CMS Errors (Cont.)

Numeric	Verbose
69	"Requested facility not implemented"
81	" Invalid SM Transfer Ref Value Or Transaction Id"
95	"Invalid message unspecified"
96	"Invalid mandatory information"
97	"Message type non-existent or not implemented"
98	" Message Type Not Compatible"
99	"Information element non existent or not implemented"
111	"Protocol error unspecified"
127	"Interworking unspecified"
128	"Telematic interworking not supported"
129	"Short message Type 0 not supported"
130	"Cannot replace short message"
143	"Unspecified PID error"
144	"Data coding scheme (alphabet) not supported"
145	"Message class not supported"
159	"Unspecified DCS error"
160	" Cannot Perform Command"
161	"Command unsupported"
175	"Unspecified command error"
176	"TPDU not supported"
192	"SC busy"
193	"No SC subscription"
194	"SC system failure"
195	"Invalid SME address"
196	"Destination SME barred"
197	"SM Rejected-Duplicate SM"
198	"VPF not supported"
199	"VP not supported"
208	"SIM SMS storage full"
209	"No SMS storage capability in SIM"
210	"Error in MS"
211	"Memory Capacity Exceeded"
212	"SAT Busy"



+CMS Errors (Cont.)

Numeric	Verbose
213	"SIM Data Download Error"
255	"an unspecified error"
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"
330	"SMSC address unknown"
331	"no network service"
332	"network timeout"
340	"no +CNMA acknowledgement expected"
500	"unknown error"
512	"No SM resources"
513	"TR1M timeout"
514	"LL Error"
515	"No response from network"

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
AT+CMEE=?
+CMEE: (0,1,2)
```

4.11.3.2. +CEER, Extended Error Report

Command Type	Syntax	Response/Action	Remarks
Set	AT+CEER=[<n>]	OK	The Set command sets the type of response.
Execute	AT+CEER	+CEER: <verbose report>, <report type> OK +CEER: <number>, <report type> OK	The verbose report contains the literal style of error with follow syntax: <verbose report>, <report type>. The numeric report contain the follow syntax: <number>, <report type>.
Read	AT+CEER?	+CEER: <n> OK	The Read command displays the type of response.
Test	AT+CEER=?	+CEER: (List of supported <n>s) OK	The Test command lists the supported response types (verbose, numeric).



The following table shows the +CEER parameters.

Table 4-180: +CEER Parameters

<Parameter>	Description
<n>	1 Returns numeric response. 2 Returns verbose response. The default value is 2.
<number> and <verbose report>	The total number of characters and line terminators (up to 2041) in the information text. Numeric format(<number>) followed by the matching literal format(<verbose report>): <u>CS internal caused errors</u> -1 "No cause information available" 0 "Phone is offline" 21 "No service available" 25 "Network release no reason given" 27 "Received incoming call" 29 "Client ended call" 34 "UIM not present" 35 "Access attempt already in progress" 36 "Access failure unknown source" 38 "Concur service not supported by network" 39 "No response received from network" 45 "GPS call ended for user call" 46 "SMS call ended for user call" 47 "Data call ended for emergency call" 48 "Rejected during redirect or handoff" 100 "Lower-layer ended call" 101 "Call origination request failed" 102 "Client rejected incoming call" 103 "Client rejected setup indication" 104 "Network ended call" 105 "No funds available" 106 "No service available"



+CEER Parameters (Cont.)

<Parameter>	Description	
<number> and <verbose report>	108 "Full service not available"	
	109 "Maximum packet calls exceeded"	
	301 "Video connection lost"	
	302 "Video call setup failure"	
	303 "Video protocol closed after setup"	
	304 "Video protocol setup failure"	
	305 "Internal error"	
	CS network caused errors	
	1 "Unassigned/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/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 available"	
	63 "Service/option not available"	
	65 "Bearer service not implemented"	
	68 "ACM >= ACMmax"	
	69 "Requested facility not implemented"	
	70 "Only RDI bearer is available"	
	79 "Service/option not implemented"	
	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 non-existent/not implemented"	
	98 "Message type not compatible with state"	
99 "IE non-existent/not implemented"		
100 "Conditional IE error"		



+CEER Parameters (Cont.)

<Parameter>	Description	
<number> and <verbose report>	101 "Message not compatible with state"	
	102 "Recovery on timer expiry"	
	111 "Protocol error unspecified"	
	127 "Interworking unspecified"	
	<u>CS network reject errors:</u>	
	2 "IMSI unknown in HLR"	
	3 "Illegal MS"	
	4 "IMSI unknown in VLR"	
	5 "IMEI not accepted"	
	6 "Illegal ME"	
	7 "GPRS services not allowed"	
	8 "GPRS & non GPRS services not allowed"	
	9 "MS identity cannot be derived"	
	10 "Implicitly detached"	
	11 "PLMN not allowed"	
	12 "Location Area not allowed"	
	13 "Roaming not allowed"	
	14 "GPRS services not allowed in PLMN"	
	15 "No Suitable Cells In Location Area"	
	16 "MSC temporarily not reachable"	
	17 "Network failure"	
	20 "MAC failure"	
	21 "Synch failure"	
	22 "Congestion"	
	23 "GSM authentication unacceptable"	
	32 "Service option not supported"	
	33 "Requested service option not subscribed"	
	34 "Service option temporarily out of order"	
	38 "Call cannot be identified"	
40 "No PDP context activated"		
95 "Semantically incorrect message"		
96 "Invalid mandatory information"		
97 "Message type non-existent"		
98 "Message type not compatible with state"		
99 "Information element non-existent"		
101 "Message not compatible with state"		
161 "RR release indication"		



+CEER Parameters (Cont.)

<Parameter>	Description
<number> and <verbose report>	162 "RR random access failure"
	163 "RRC release indication"
	164 "RRC close session indication"
	165 "RRC open session failure"
	166 "Low level failure"
	167 "Low level failure no redial allowed"
	168 "Invalid SIM"
	169 "No service"
	170 "Timer T3230 expired"
	171 "No cell available"
	172 "Wrong state"
	173 "Access class blocked"
	174 "Abort message received"
	175 "Other cause"
	176 "Timer T303 expired"
	177 "No resources"
	178 "Release pending"
	179 "Invalid user data"
	<u>PS internal caused errors:</u>
	0 "Invalid connection identifier"
	1 "Invalid NSAPI"
	2 "Invalid Primary NSAPI"
	3 "Invalid field"
	4 "SNDTCP failure"
	5 "RAB setup failure"
	6 "No GPRS context"
	7 "PDP establish timeout"
	8 "PDP activate timeout"
	9 "PDP modify timeout"
	10 "PDP inactive max timeout"
	11 "PDP lower layer error"
	12 "PDP duplicate"
	13 "Access technology change"
	14 "PDP unknown reason"
	<u>PS network caused errors:</u>
	25 "LLC or SNDTCP failure"
	26 "Insufficient resources"
	27 "Missing or unknown APN"
	28 "Unknown PDP address or PDP type"
	29 "User Authentication failed"
	30 "Activation rejected by GGSN"
	31 "Activation rejected unspecified"
	32 "Service option not supported"
	33 "Requested service option not subscribed"
34 "Service option temporarily out of order"	
35 "NSAPI already used (not sent)"	
36 "Regular deactivation"	
37 "QoS not accepted"	
38 "Network failure"	
39 "Reactivation required"	
40 "Feature not supported"	



+CEER Parameters (Cont.)

<Parameter>	Description
<number> and <verbose report> (continued)	41 "Semantic error in the TFT operation" 42 "Syntactical error in the TFT operation" 43 "Unknown PDP context" 44 "PDP context without TFT already activated" 45 "Semantic errors in packet filter" 46 "Syntactical errors in packet filter" 81 "Invalid transaction identifier" 95 "Semantically incorrect message" 96 "Invalid mandatory information" 97 "Message non-existent/not implemented" 98 "Message type not compatible with state" 99 "IE non-existent/not implemented" 100 "Conditional IE error" 101 "Message not compatible with state" 111 "Protocol error unspecified"
<report type>	The <report type> appears in "verbose response" and "numeric response" in second parameter. It depends of type of lower-layer report: Network (external) CS/PS cause, Network (external) CS reject or Internal CS/PS cause: 0 CS internal cause errors 1 CS network cause errors 2 CS network reject errors 3 PS internal cause errors 4 PS network cause errors

Example

```

AT+CEER
+CEER: "No cause information available", 0
OK
AT+CEER?
+CEER: 2
OK
AT+CEER=?
+CEER: (1-2) OK AT+CEER=1
OK
AT+CEER?
+CEER: 1
AT+CEER
+CEER: -1, 0
    
```



4.12. UI (User Interface)

4.12.1. +CRSM, Restricted SIM Access

AT+CRSM provides limited access to the Elementary Files on the SIM. Set command transmits to the MT the <command> and its required parameters. H24 handles internally all SIM-MT interface locking and file selection routines. As response to the command, H24 sends the actual SIM information parameters and <response> data.

Error result code "+CME ERROR" may be returned if the command cannot be passed to the SIM, e.g. if the SIM is not inserted, or bad SIM card, or PIN1/PUK authentication required, or required input parameters not present. However, failure in the execution of the command in the SIM is reported in <sw1> and <sw2> parameters.

Some of the AT+CRSM commands require PIN1/PIN2 authentication.

For more detailed information see the following specification documents:

- For 2G SIM: 3GPP TS 51.011
- For 3G USIM: 3G TS 31.101

Command Type	Syntax	Response/Action	Remarks
Set	AT+CRSM=<command>,[<file_id>[,<P1>,<P2>,<P3>[,<data>]]]	+CRSM: <sw1>,<sw2>[,<response>] OK or: +CME ERROR: <err>	Set command transmits to the MT the SIM <command> and its required parameters. MT sends back the actual SIM information parameters and response data.
Read	AT+CRSM?	OK	
Test	AT+CRSM=?	+CRSM: (list of supported <command>s),(range of supported <P1> values),(range of supported <P2> values),, (list of need to be pasted parameters <P1>,<P2>,<P3>), (length of the <data>) (range of supported <P3> values) OK or: +CME ERROR: <err>	The test command displays the possible ranges of selected CRSM parameters.



The following table shows the +CRSM parameters.

Table 4-181: +CRSM Parameters

<Parameter>	Description
<command>	Integer type. Command passed on by the ME to the SIM. 176 READ BINARY 178 READ RECORD 192 GET RESPONSE 214 UPDATE BINARY 220 UPDATE RECORD 242 STATUS
<file_id>	Integer type. This is the identifier of a elementary data file on SIM. Mandatory for every <command> except of STATUS.
<P1>,<P2>,<P3>	Integer type. Parameters passed on by the ME to the SIM. These parameters are mandatory for every command, except GET RESPONSE and STATUS. Valid value range: 0-255.
<data>	Information which shall be written to the SIM (hexadecimal character format). Mandatory for UPDATE BINARY and UPDATE RECORD.
<sw1> <sw2>	Integer character format. Information from the SIM about the execution of the actual command. These parameters are delivered to the TE in both cases, on successful or failed execution of the command. Valid value range: 0-255.
<response>	Response of a successful completion of the command previously issued (hexadecimal character uppercase format). STATUS and GET RESPONSE return data, which gives information about the current elementary data <file_id>. This information includes the type of file and its size (refer TS 51.011 and TS 31.101). After READ BINARY or READ RECORD command the requested data will be returned. <response> is empty string after a UPDATE BINARY or UPDATE RECORD command.

Example

```
AT+CRSM=192,28474 // GET RESPONSE, ADN(6F3A)
+CRSM: 144,0,"621E82054221001EFA83026F3AA5038001318A01058B036F060980021D4C8800"
```

```
OK
AT+CRSM=178,28474,1,4,0 // READ RECORD, ADN(6F3A)
+CRSM: 144,0,"4245545441FFFFFFFFFFFFFFFFFFFFFFFF06913355555555FFFFFFFFFFFFFFF"
```

OK



<Call setup>	0	No active call setup.
	1	MT call is waiting of ringing.
	2	MO call was initiated.
	3	MO call ringing at B-party (alert).
SIM available	0	No SIM available.
	1	SIM is available.
Receive SMS	0	No waiting un-read message.
	1	Un-read message is waiting.
	2	Messages storage is unavailable.

Example

```
AT+CIND=?
+CIND: ("battchg",(0-5)): ("signal",(0-5)): ("service",(0-1)): ("call",(0-1)): (
"roam",(0-1)): ("smsfull",(0-1)): ("Packet Service coverage",(0-1)): ("callsetup",(0-3)): ("sim available",(0-1)):
("msg waiting",(0-2))
OK
```

```
AT+CIND? // No message waiting, no call
+CIND: 5,4,1,0,0,0,1,0,1,0
OK
```

```
atd035681234; OK
```

```
AT+CIND? // voice call in alerting state
+CIND: 5,4,1,1,0,0,1,3,1,0
OK
```

```
AT+CIND? // voice call is connected
+CIND: 5,4,1,1,0,0,1,0,1,0
OK
```

```
AT+CPMS? // Message was received
+CPMS: "SM",1,20,"SM",1,20,"SM",1,20
OK
```

```
AT+CIND?
+CIND: 5,4,1,0,0,0,1,0,1,1
```

OK

```
// Disconnect antenna - no signal strength, no Packet Service service
```

coverage no

```
AT+CIND?
+CIND: 5,0,0,0,0,0,0,0,1,1
OK
```



4.12.4. +MIND, Motorola Indicator Control

This command enables/disables the following user indications to the TE:

- "SIM ready" - All commands interacting with the SIM are ready for use:
 - Access commands: CRSM, CSIM
 - SMS commands: CSCA, CMGW, CMGR ...
 - Phonebook commands: CPBR, CPBS ...
- "Ready" - The unit is now capable of receiving data through the serial connection. This indication is parallel to the DSR event.
- "SMS storage is full" - Incoming short messages storage is full. Indication is related to the storage area set by CPMS.
- "RING" - RING indication

Note:

1. The +MIND values are saved through power cycle only.
2. In case of multichannel configuration (MCONN=1 , MCONN=4 or MCONN=5)
 - a. All reports are directed to the control channel.
 - b. "Ready" indication is available as control channel readiness only (not available for a data channel).

Command Type	Syntax	Response/Action	Remarks
Set	+ MIND =<event >, <configuration>	OK	
Read	AT+ MIND?	+MIND: <event status> OK	The read command returns the current status for the events.
Test	AT+ MIND =?	+MIND: (list of supported <events selection>s),(list of supported< Configuration >s), OK or: +CME ERROR: <err>	The test command returns the possible ranges of <event >s and <Configuration>s.
Execute	AT+MIND	OK or: ERROR	Sets all +MIND events to default.



The following table shows the +MIND parameters.

Table 4-184: +MIND Parameters

<Parameter>	Description
<Event>	0 SIM ready 1 Ready 2 Sms storage is full 3 Ring
<Configuration>	0 Disable event 1 Enable numeric report 2 Enable string report For <event> '3' (RING), although both configuration values (1 & 2) are available, There is only a string indication ("RING")

H24 default value:

+MIND:0,0,0,1 // By default (device out of factory), only ring indication is enabled.

Example

AT+MIND=?

+MIND: (0-3),(0-2)

AT+MIND?

+MIND:0,0,0,1 //Ring numeric indication is enabled

OK

AT+MIND=0,2 //Enable SIM ready Indication

OK

+MIND: Sim ready //Unsolicited indication when SIM is ready

AT+MIND?

+MIND:2,0,0,1 // SIM ready string indication and ring indication are enabled

OK

AT+MIND // Execute command sets all indication to their default value
(only ring indication is 'on')

OK

AT+MIND?

+MIND:0,0,0,1



4.12.5. +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 H24 module should accept the command and act according to received parameters regardless of SIM presence and phone lock state.

In Multi channel mode, this command is allowed on the control channel only.

Command Type	Syntax	Response/Action	Remarks
Set	+MDSI=<mode>	OK or +CME ERROR: <err>	The following is the available mode values for the Set command: <mode> = 1 - enables the sending of the unsolicited result code: +MDSI: <mode>[,<type>, <cause>, <type text>, <cause text>] to the TE. <mode> = 0 - No unsolicited message is sent to the TE.
Read	+MDSI?	+MDSI: <mode>[,<type>, <cause>, <type text>, <cause text>] OK or +CME ERROR: <err>	The Read command queries the current settings for <mode>. If reject cause has been received prev. to the read command <type>, <cause>, <type text>, <cause text> will also be displayed.
Test	+MDSI=?	+MDSI: (list of supported <mode>s) OK or +CME ERROR: <err>	The Test command returns the possible <mode> values.



The following table shows the +MDSI parameters.

Table 4-185: +MDSI Parameters

<Parameter>	Description
<mode>	0 Unsolicited indications off 1 Unsolicited indications on
<type>, <type text>	1 "GSM". Invalidate SIM for GSM/WCDMA services was sent with <cause> 2 "GPRS". Invalidate SIM for GPRS/HSDPA services was sent with <cause> In all other cases <type text>, "unspecified".
<cause>, <cause text>	<cause> and <cause text> related to <type> = 1 and <type> = 2 0 "No reject cause" 2 "IMSI unknown in HLR" 3 "Illegal MS" 4 "IMSI unknown in VLR" 5 "IMEI not accepted" 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" 10 "Implicitly detached" 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" 16 "MSC temporarily not reachable" 17 "Network failure" 22 "Congestion" 32 "Service option not supported" 33 "Requested Service option not subscribed" 34 "Service option temporarily out of order" 38 "Call cannot be identified" 48 "Retry on entry to new cell" 95 "Semantically incorrect message" 96 "Invalid mandatory information" 97 "Message type non existent" 98 "Message type not compatible with call state" 99 "Info element not-existent or not implemented" 100 "Conditional IE error" 101 "Message not compatible with protocol state" 242 "Authentication and ciphering reject" 243 "Authentication reject" In all other cases <cause text>, "unspecified".

Example

```
AT+MDSI?
+MDSI: 0
OK AT+MDSI=?
+MDSI: (0,1) OK
```

//Insert a SIM card that is no longer subscribed



AT+COPS=0
OK AT+MDSI?

+MDSI: 0, 1, 2, "GSM/WCDMA", "IMSI unknown in HLR" 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: 1, 2, 7, "GPRS/HSDPA", "GPRS services not allowed"

//Insert a SIM card that is no longer subscribed

AT+COPS=0

OK

//Unsolicited messages

+MDSI: 1, 1, 2, "GSM/WCDMA", "IMSI unknown in HLR"



4.12.6. Unsolicited Status Messages

By the normal operation of the H24, some indicators states are changed.

For example, a new message (SMS) was arrived, and by that, SIM storage becomes full. This new event can be notified to the user by displaying it on TE.

The following commands describe how to enable the unsolicited display (+CMER), and how to interpret the results (+CIEV).

4.12.6.1. +CMER, Mobile Equipment Event Reporting

Set command enables or disables sending of unsolicited result codes to TE in the case of indicators state changes.

Command Type	Syntax	Response/Action	Remarks
Set	+CMER=[<mode> [,<keyp>[,<disp> [,<ind>[,<bfr>]]]]]	OK or: +CME ERROR: <err>	The Set command enables/disables an external accessory to receive event reports from the H24. In some cases, this is used to track the user activity for redisplay on a vehicle system, or to perform accessory-specific menu operations.
Read	AT+CMER?	+CMER: <mode>,<keyp>,<disp>,<ind>,<bfr> OK or: +CME ERROR: <err>	The Read command queries the current settings for the AT+CMER command.
Test	AT+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 Test command returns the possible <mode>, <keyp>, <disp>, <ind>, and <bfr> values.

The following table shows the +CMER parameters.

Table 4-186: +CMER Parameters

<Parameter>	Description
<mode>	Controls the processing of unsolicited result codes specified within this command. 0 Buffer unsolicited result codes in H24 but not displaying it on TE. 1 Display unsolicited result on TE. If TE is busy, H24 buffers the result.
<keyp>	0 argument degenerated.
<disp>	0 argument degenerated.



<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 the results buffer. 0 Clear buffer. 1 push result to buffer.

Note: H24 does not have keypad nor display and hence doesn't have events related to that accessories. So arguments <keyp> and <disp> can get just value that equal to '0'.

4.12.6.2. +CIEV, Indicator Event Reporting

When an H24 indication is changed and the <ind> parameter of the +CMER command is set to 1, the +CIEV indication is sent to the DTE.

The following table shows the +CIEV parameters.

Table 4-187: +CIEV Parameters

<ind>	Description	<value> Range	Explanation
0	Battery indicator	0-5	
1	Signal bars	0-5	
2	Service availability	0/1	
3	Unread message indication	0/1	
4	Call in progress	0/1	
5	Roaming indicator	0/1	
6	SIM Pin 1 requested	0/1	
7	SIM SMS full	0/1	
8	Packet coverage	0/1	
12	SIM insertion/removal indication	0/1	

Unsolicited Report

+CIEV: <ind>,<value>

The following shows the +CIEV parameters. Examples: AT+CMER=1,0,0,1,1
+CIEV: 0,0 // Those results emerged immediately after setting of cmer command.

+CIEV: 1,2
+CIEV: 2,0
+CIEV: 3,0
+CIEV: 4,0
+CIEV: 5,1
+CIEV: 6,0
+CIEV: 7,0



+CIEV: 8,0
+CIEV: 12,0

OK

+CIEV: 1,3 // This is the first unsolicited indicator report, that was emanate from a change in signal strength indicator

+CIEV: 1,4

+CIEV: 1,5

+CIEV: 1,4

+CIEV: 1,5

+CIEV: 12,1 // sim card was inserted



4.13. GPRS/EDGE/UMTS

4.13.1. GPRS Commands

4.13.1.1. +CGCLASS, GPRS Mobile Station Class

This command is used to set the H24 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.

Command Type	Syntax	Response/Action	Remarks
Read	AT +CGCLASS?	+CGCLASS: <class> OK or: +CME ERROR: <err>	The Read command returns the current GPRS mobile class.
Test	AT +CGCLASS=?	+CGCLASS: (list of supported <class>s) OK or; +CME ERROR: <err>	The Test command is used for requesting information on the supported GPRS mobile classes.

Note: Issuing GPRS actions over a poor-quality connection may cause protocol errors and harm data validity. To prevent these problems, H24 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 4-188: +CGCLASS Parameters

<Parameter>	Description
<class>	String parameter that indicates the GPRS mobile class: A Class A B Class B C Class C

Example

```
AT+CGCLASS=?
+CGCLASS: (A) OK
Note: If a SIM card without GPRS allowance is used:
AT+CGCLASS=?
+CGCLASS: (CC) //Note that CC is a not supported value.
```



4.13.1.2. +CGDCONT, Define PDP Context

This command specifies the PDP (Packet Data Protocol) context.

Command Type	Syntax	Response/Action	Remarks
Set	AT+CGDCONT=[<cid> [,<PDP_type>[,<APN> [,<PDP_addr>[,<d_comp> [,<h_comp>]]]]]]	OK or: +CME ERROR: <err>	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. Note: To delete a context use this parameter without any other parameters or commas. If a context does not exist then OK will be returned. E.g. AT+CGDCONT=3 will delete PDP context number 3.
Read	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>	The Read command returns the current settings for each defined context.
Test	AT+CGDCONT=?	+CGDCONT: (range of supported <cid>s), <PDP_type>, , , (list of supported <d_comp>s), (list of supported <h_comp>s)	The Test command returns the values supported as a compound value. If the ME supports several PDP types, <PDP_type>, the parameter value ranges for each <PDP_type> are returned on a separate line.



The following table shows the +CGDCONT parameters.

Table 4-189: +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).
<"PDP_type"> (Packet data protocol type)	String parameter (in quotation marks) specifying the type of packet data protocol: IP Internet Protocol (IETF STD 5)
<"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 ME 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 (default if value is omitted) 1 - ON (V.42bis, exists for backwards compatibility) 2 - V.42bis The default value is 0.
<h_comp>	Numeric parameter that controls the PDP header compression. 0 - OFF (default if value is omitted) 1 - ON (RFC1144, exists for backwards compatibility) 2 - RFC1144 (applicable for SNDCP only) 3 - RFC2507 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.

Example

```

AT+CGDCONT=?
+CGDCONT: (1-16),"IP",,(0-2),(0-3)
+CGDCONT: (1-16),"PPP",,(0-2),(0-3)
+CGDCONT: (1-16),"IPV6",,(0-2),(0-3) OK
AT+CGDCONT? 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
OK AT+CGDCONT=2,"IP","interpol","0.0.0.0",1,1
OK AT+CGDCONT?
+CGDCONT: 1,"IP","internetg","0.0.0.0",0,0
+CGDCONT: 2,"IP","interpol","0.0.0.0",1,1
Deleting a PDP context entry:

```



```
at+cgdcont?  
+CGDCONT: 1,"IP","", "0.0.0.0",0,0
```

```
OK  
<< create new PDP context 3
```

```
at+cgdcont=3,"IP","sasa" OK  
at+cgdcont?  
+CGDCONT: 1,"IP","", "0.0.0.0",0,0  
+CGDCONT: 3,"IP","sasa", "0.0.0.0",0,0
```

```
OK  
<< delete non existent PDP context 4  
AT+CGDCONT=4  
OK AT+CGDCONT?  
+CGDCONT: 1,"IP","", "0.0.0.0",0,0  
+CGDCONT: 3,"IP","sasa", "0.0.0.0",0,0
```

```
OK  
<< delete PDP context 3  
AT+CGDCONT=3  
OK AT+CGDCONT?  
+CGDCONT: 1,"IP","", "0.0.0.0",0,0
```

```
OK
```



4.13.1.3. +MPPP, Set PPP Configuration Parameters

This command sets configuration parameters for PPP protocol.

Command Type	Syntax	Response/Action
Set	+MPPP=<bitmask>	OK Or ERROR
Read	AT+MPPP?	+MPPP:<bitmask> OK
Test	AT+MPPP=?	+MPPP: (list of supported <bitmask>s) OK

The following table shows the +MPPP parameters.

Table 4-190: +MPPP Parameters

<Parameter>	Description
<bitmask>	PPP configuration parameters, as follows: 1 – LCP mode 2 - IPCP mode 4 – Server dummy IP 7 – All values

Example:

```
AT+MPPP=1
OK
AT+MPPP=2
OK
AT+MPPP=4
OK
```

```
AT+MPPP?
+MPPP: 0
```

OK

```
AT+MPPP=?
+MPPP: (0-7)
```

OK



4.13.1.4. +MPAUTH, Set PDP-IP Authentication Parameters

This command sets authentication parameters for PDP-IP packet data call.

Command Type	Syntax	Response/Action
Set	<p>For auth_type None: AT+MPAUTH=<CID>,<auth_type> [,<password>,<username>]</p> <p>For auth_type PAP: AT+MPAUTH=<CID>,<auth_type>,<password>,<username></p> <p>For auth_type CHAP: AT+MPAUTH=<CID>,<auth_type>,<password> [,<username>]</p>	<p>OK Or ERROR: <ErrorCode></p>
Read	AT+MPAUTH=? ¹	<p>+MPAUTH: <1>,<auth_type>[,<username>]<CR><LF> +MPAUTH: <2>,<auth_type>[,<username>]<CR><LF> +MPAUTH: <3>,<auth_type>[,<username>]<CR><LF> +MPAUTH: <4>,<auth_type>[,<username>]<CR><LF> +MPAUTH: <5>,<auth_type>[,<username>]<CR><LF> +MPAUTH: <6>,<auth_type>[,<username>]<CR><LF> +MPAUTH: <7>,<auth_type>[,<username>]<CR><LF> +MPAUTH: <8>,<auth_type>[,<username>]<CR><LF> +MPAUTH: <9>,<auth_type>[,<username>]<CR><LF> +MPAUTH: <10>,<auth_type>[,<username>]<CR><LF> +MPAUTH: <11>,<auth_type>[,<username>]<CR><LF> +MPAUTH: <12>,<auth_type>[,<username>]<CR><LF> +MPAUTH: <13>,<auth_type>[,<username>]<CR><LF> +MPAUTH: <14>,<auth_type>[,<username>]<CR><LF> +MPAUTH: <15>,<auth_type>[,<username>]<CR><LF> +MPAUTH: <16>,<auth_type>[,<username>]<CR><LF></p> <p>OK</p>
Test	AT+MPAUTH=?	<p>+MPAUTH: (range of supported <CID>s), (list of supported <auth_type>s),,</p> <p>OK</p>

Note: The Read command asynchronous response does not display password values. It only displays username for PAP/CHAP authentication.



The following table shows the +MPAUTH parameters.

Table 4-191: +MPAUTH Parameters

<Parameter>	Description
<cid>	PDP Context Identifier in 1-16 range.
<auth_type>	Authentication type parameter, determines what additional parameters are required, as follows: 0 (None) - Neither username nor password are accepted. 1 (PAP) - Username and password are mandatory. 2 (CHAP) - Password (secret) is mandatory and Username is optional.
<password>	Password string up to 127 characters length.
<username>	Username string up to 127 characters length.

Example

AT+MPAUTH=1,1,"*****","Andy" OK

AT+MPAUTH=2,2,"*****" OK

AT+MPAUTH=3,2,"*****","Cindy" OK

AT+MPAUTH?
+MPAUTH: 1,1,"Andy"
+MPAUTH: 2,0
+MPAUTH: 3,2,"Cindy"
+MPAUTH: 4,0
+MPAUTH: 5,0
+MPAUTH: 6,0
+MPAUTH: 7,0
+MPAUTH: 8,0
+MPAUTH: 9,0
+MPAUTH: 10,0
+MPAUTH: 11,0
+MPAUTH: 12,0
+MPAUTH: 13,0
+MPAUTH: 14,0
+MPAUTH: 15,0
+MPAUTH: 16,0

OK



4.13.1.5. +CGQMIN, Quality of Service Profile (Min Acceptable)

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

Command Type	Syntax	Response/Action	Remarks
Set	AT+CGQMIN=[<cid>[,<precedence>[,<delay>[,<reliability>[,<peak>[,<mean>]]]]]]	OK or: +CME ERROR: <err>	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. A special form of the set command, +CGQMIN= <cid>, causes the requested profile for context number <cid> to become undefined.

Command Type	Syntax	Response/Action	Remarks
Read	AT+CGQMIN?	+CGQMIN: <cid>,<precedence>,<delay>,<reliability>,<peak>,<mean> OK or: +CME ERROR: <err>	Read command returns the current settings for each defined context.



Test	AT+CGQMIN=?	<p>+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></p>	Test command returns values supported as a compound value. If the ME supports several PDP types, the parameter value ranges for each PDP type are returned on a separate line.
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Note: Any omitted parameters in set command will be set to 0.
Set values are stored in NVM and remain in effect across power cycles.
The following table shows the +CGQMIN parameters.

Table 4-192: +CGQMIN Parameters

<Parameter>	Description
<cid>	A numeric parameter that specifies a particular PDP context definition. The supported values are: 1 to 16.
<precedence>	A numeric parameter that specifies the precedence class. The supported values are: 1 to 3.
<delay>	A numeric parameter that specifies the delay class. The supported values are: 1 to 4.
<reliability>	A numeric parameter that specifies the reliability class. The supported values are: 1 to 5.
<peak>	A numeric parameter that specifies the peak throughput class. The supported values are: 1 to 4.
<mean>	A numeric parameter that specifies the mean throughput class. The supported values are: 1 to 18 and 31.

Example
AT+CGQMIN?
+CGQMIN:
OK AT+CGQMIN=?
+CGQMIN: "IP",(0-3),(0-4),(0-5),(0-9),(0-18,31)
+CGQMIN: "PPP",(0-3),(0-4),(0-5),(0-9),(0-18,31)
+CGQMIN: "IPV6",(0-3),(0-4),(0-5),(0-9),(0-18,31)
OK AT+CGQMIN=1,1,4,1,8,8
OK AT+CGQMIN?
+CGQMIN: 1,1,4,1,8,8
OK AT+CGQMIN=1,1,,1,5,7
OK AT+CGQMIN?
+CGQMIN: 1,1,0,1,5,7
OK



4.13.1.6. +CGQREQ, Quality of Service Profile (Requested)

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

Command Type	Syntax	Response/Action	Remarks
Set	AT+CGQREQ=[<cid> [,<precedence> [,<delay> [,<reliability> [,<peak> [,<mean>]]]]]]]	OK or: +CME ERROR: <err>	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.
Read	AT+CGQREQ?	+CGQREQ: <cid>, <precedence>, <delay>, <reliability>, <peak>, <mean> OK or: +CME ERROR: <err>	Read command returns the current settings for each defined context.
Test	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) [<CR><LF>+CGQREQ: <PDP_type>, (list of supported <precedence>s), (list of supported <delay>s), (list of supported <reliability>s), (list of supported <peak>s), (list of supported <mean>s) [...]] OK Or: +CME ERROR: <err>	Test command returns values supported as a compound value. If the ME supports several PDP types, the parameter value ranges for each PDP type are returned on a separate line.



Note: Any omitted parameters in set command will be set to 0.
Set values are stored in NVM and remain in effect across power cycles.

The following table shows the +CGQREQ parameters.

Table 4-193: +CGQREQ Parameters

<Parameter>	Description
<cid>	A numeric parameter that specifies a particular PDP context definition. The supported values are: 1 to 16.
<precedence>	A numeric parameter that specifies the precedence class. The supported values are: 1 to 3.
<delay>	A numeric parameter that specifies the delay class. The supported values are: 1 to 4.
<reliability>	A numeric parameter that specifies the reliability class. The supported values are: 1 to 5.
<peak>	A numeric parameter that specifies the peak throughput class. The supported values are: 1 to 4.
<mean>	A numeric parameter that specifies the mean throughput class. The supported values are: 1 to 18 and 31.

Example

AT+CGQREQ?
+CGQREQ:

OK AT+CGQREQ=?
+CGQREQ: "IP",(0-3),(0-4),(0-5),(0-9),(0-18,31)
+CGQREQ: "PPP",(0-3),(0-4),(0-5),(0-9),(0-18,31)
+CGQREQ: "IPV6",(0-3),(0-4),(0-5),(0-9),(0-18,31)

OK AT+CGQREQ=1,2,1,4,9,18
OK AT+CGQREQ?
+CGQREQ: 1,2,1,4,9,18

OK



4.13.1.7. +CGATT, GPRS Attach or Detach

This command attaches/detaches the ME to/from the GPRS service. When the command has completed, the ME remains in V.25ter command state. If the ME 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.

Command Type	Syntax	Response/Action	Remarks
Set	AT+CGATT= <state>	OK or: +CME ERROR: <err>	The Set command attaches/detaches the ME to/from the GPRS service.
Read	AT+CGATT?	+CGATT: <state> OK or: +CME ERROR: <err>	The Read command returns the current GPRS service state.
Test	AT+CGATT=?	+CGATT: (list of supported <state>s) OK or: +CME ERROR: <err>	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.

The following table shows the +CGATT parameters.

Table 4-194: +CGATT Parameters

<Parameter>	Description
<state>	Indicates the state of the GPRS attachment: 0 Detached. 1 Attached.

Example

```
AT+CGATT=?
+CGATT: (0,1) OK AT+CGATT?
+CGATT: 0
OK AT+CGATT=0
OK
```



4.13.1.8. D*99, Request GPRS Service "D"

This command enables the ME 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 ME to enter the ITU V.25ter Online Data state and together with the terminal, to start the specified layer 2 protocol. The ME 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 ME enters the ITU V.25ter command state and returns the NO CARRIER final result code.

If <called address> is supported and provided, the ME automatically sets up a virtual call to the specified address after the PDP context has been activated.

If <L2P> and <cid> are supported, 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 ME uses a layer 2 protocol appropriate to the PDP type.

If <cid> is not supported, or is supported but omitted, the ME 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 ME.
- A prior knowledge, for example, the ME 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.

Command Type	Syntax	Response/Action
Set	ATD*<GPRS_SC> [*[<called_address>][*[<L2P>] [*[<cid>]]]]#	CONNECT or: ERROR



The following table shows the D*99 parameters.

Table 4-195: 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". 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.
<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").

Example

```
ATD*99 //Try connecting to GPRS according to the first <cid>, defined in
+CGDCONT
```



4.13.1.9. +CGACT, PDP Context Activate or Deactivate

This command activates/deactivates the specified PDP context(s).

Command Type	Syntax	Response/Action	Remarks
Set	AT+CGACT=[<state>[,<cid>[,<cid>[,...]]]]	OK or: +CME ERROR: <err>	The Set command activates/deactivates the specified PDP context(s). When the command is completed, the ME 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 UE is not PS attached when the activation form of the command is executed, the UE first performs a GPRS attach and then attempts to activate the specified contexts. If the attach fails, the UE responds with an ERROR or, if extended error responses are enabled, with the appropriate failure-to-attach error message.
Read	AT+CGACT?	+CGACT: [<cid>,<state>] [<CR><LF>+CGACT: <cid>,<state>[...]] OK	The Read command returns the current activation states for all the defined PDP contexts.
Test	AT+CGACT=?	+CGACT: (0,1) OK or: +CME ERROR: <err>	The Test command requests information on the supported PDP context activation states.

Note: If no <cid>s are specified the activation form of the Set command activates all defined contexts.
If the set command is in the process of activating all or multiple PDP contexts and one of the contexts cannot be activated, an error will be returned and the activation will not resume for the rest of the contexts not yet activated.
If no <cid>s are specified the deactivation form of the Set command deactivates all active contexts.

The following table shows the +CGACT parameters.

Table 4-196: +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. The supported values are: 1 to 16.

Example

```
AT+CGACT?
+CGACT: 1,0
+CGACT: 2,0
+CGACT: 3,0
```

```
OK AT+CGACT=?
+CGACT: (0,1)
```

```
OK AT+CGACT=1,1
OK AT+CGACT?
+CGACT: 1,1
+CGACT: 2,0
+CGACT: 3,0
```

```
OK
```



4.13.1.10. +CGPADDR, Show PDP address

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

Command Type	Syntax	Response/Action	Remarks
Set	AT+CGPADDR[=<cid>,<cid>[,...]]	[+CGPADDR:<cid>,<PDP_addr>][<CR><LF>+CGPADDR:<cid>,<PDP_addr>[...]] OK Or +CME ERROR: <err>	The Set command returns a list of PDP addresses for the specified context identifiers.
Test	AT+CGPADDR=?	+CGPADDR:(list of defined <cid>s) OK Or +CME ERROR: <err>	The Test command returns the list of defined <cid>s.

Note: AT+CGPADDR command returns a list of PDP addresses for all defined context identifiers.

The following table shows the +CGPADDR parameters.

Table 4-197: +CGPADDR Parameters

<Parameter>	Description
<cid>	A numeric parameter that specifies a particular PDP context definition. The supported values are: 1 to 16.
<PDP_addr>	A string that identifies the UE in the address space applicable to the PDP. The address may be static or dynamic. For a static address, it will be the one set by the +CGDCONT command when the context was defined. For a dynamic address, it will be the one assigned during the last PDP context activation that used the context definition referred to by <cid>. <PDP_address> is omitted if none is available.

Example

```
AT+CGPADDR=1
+CGPADDR: 1,"0.0.0.0" OK
```



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		<p><Residual bit error ratio>s),(list of supported <Delivery of erroneous SDUs>s),(list of supported <Transfer delay>s),(list of supported <Traffic handling priority>s) [...]] OK</p> <p>OR</p> <p>+CME ERROR: <err></p>	
--	--	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--



The following table shows the +CGEQREQ command parameters.

Table 4-198: +CGEQREQ Command Parameters

<Parameter>	Description
<cid>	A numeric parameter that specifies a particular PDP context definition. The supported values are: 1 to 16.
<Traffic class>	Numeric parameter that indicates the type of application for which the EDGE bearer service is optimized. 0 - conversational 1 - streaming 2 - interactive 3 - background 4 - subscribed value If the Traffic class is specified as conversational or streaming, then the Guaranteed and Maximum bit rate parameters should also be provided
<Maximum bitrate UL>	Numeric parameter that indicates the maximum number of kbits/s delivered to UMTS/EDGE (up-link traffic) at a SAP. As an example a bit rate of 32kbit/s would be specified as '32' (e.g. AT+CGEQREQ=...,32,...). If the parameter is set to '0' the subscribed value will be requested. This parameter should be provided if the Traffic class is specified as conversational or streaming. The supported values are: 0 to 5760.
<<Maximum bitrate DL>	Numeric parameter that indicates the maximum number of kbits/s delivered by UMTS/EDGE (down-link traffic) at a SAP. As an example a bit rate of 32kbit/s would be specified as '32' (e.g. AT+CGEQREQ=...,32,...). If the parameter is set to '0' the subscribed value will be requested. This parameter should be provided if the Traffic class is specified as conversational or streaming. The supported values are: 0 to 7168.
<Guaranteed bitrate UL>	Numeric parameter that indicates the guaranteed number of kbits/s delivered to UMTS/EDGE (up-link traffic) at a SAP (provided that there is data to deliver). As an example a bit rate of 32kbit/s would be specified as '32' (e.g. AT+CGEQREQ=...,32,...). If the parameter is set to '0' the subscribed value will be requested. This parameter should be provided if the Traffic class is specified as conversational or streaming. The supported values are: 0 to 5760.



+CGEQREQ Command Parameters (Cont.)

<Parameter>	Description
<Guaranteed bitrate DL>	Numeric parameter that indicates the guaranteed number of kbits/s delivered to UMTS/EDGE (down-link traffic) at a SAP (provided that there is data to deliver). As an example a bit rate of 32kbit/s would be specified as '32' (e.g. AT+CGEQREQ=...,32, ...). If the parameter is set to '0' the subscribed value will be requested. This parameter should be provided if the Traffic class is specified as conversational or streaming. The supported values are: 0 to 7168.
<Delivery order>	Numeric parameter that indicates whether the UMTS/EDGE bearer shall provide in-sequence SDU delivery or not. 0 - no 1 - yes 2 - subscribed value.
<Maximum SDU size>	Numeric parameter that indicates the maximum allowed SDU size in octets. If the parameter is set to '0' the subscribed value will be requested. The supported values are: 0 to 1520.
<SDU error ratio>	String parameter that indicates the target value for the fraction of SDUs lost or detected as erroneous. SDU error ratio is defined only for conforming traffic. The value is specified as 'mEe'. As an example a target SDU error ratio of 5×10^{-3} would be specified as '5E3' (e.g. AT+CGEQREQ=..., "5E3",...). '0E0' means subscribed value.
<Residual bit error ratio>	String parameter that indicates the target value for the undetected bit error ratio in the delivered SDUs. If no error detection is requested, Residual bit error ratio indicates the bit error ratio in the delivered SDUs. The value is specified as 'mEe'. As an example a target residual bit error ratio of 5×10^{-3} would be specified as '5E3' (e.g. AT+CGEQREQ=..., "5E3",...). '0E0' means subscribed value.
<Delivery of erroneous SDUs>	Numeric parameter that indicates whether SDUs detected as erroneous shall be delivered or not. 0 - no 1 - yes 2 - no detect 3 - subscribed value
<Transfer delay>	Numeric parameter that indicates the targeted time between request to transfer an SDU at one SAP to its delivery at the other SAP, in milliseconds. If the parameter is set to '0' the subscribed value will be requested. The supported values are: 0, 100 to 4000.



+CGEOREO Command Parameters (Cont.)

<Parameter>	Description
<Traffic handling priority>	Numeric parameter (1,2,3,...) that specifies the relative importance for handling of all SDUs belonging to the UMTS/EDGE bearer compared to the SDUs of other bearers. If the parameter is set to '0' the subscribed value will be requested.
<PDP_type>	(See +CGDCONT command). If a value is omitted for a particular class then the value is considered to be unspecified.

Example

AT+CGEQREQ?
+CGEQREQ:

OK AT+CGEQREQ=1,2,2048,7168,0,0,1,1500,"0E0","0E0" OK
AT+CGEQREQ?
+CGEQREQ: 1,2,2048,7168,0,0,1,1500,"0E0","0E0",3,0,0

OK



		<p>UL>,<Guaranteed bitrate DL>,<Delivery order>,<Maximum SDU size>,<SDU error ratio>,<Residual bit error ratio>,<Delivery of erroneous SDUs>,<Transfer delay>,<Traffic handling priority>[...]]</p> <p>OK</p> <p>or:</p> <p>+CME ERROR: <err></p>	
Test	+CGEQMIN=?	<p>+CGEQMIN:<PDP_type>,(list of supported <Traffic class>s),(list of supported <Maximum bitrate UL>s),(list of supported <Maximum bitrate DL>s),(list of supported <Guaranteed bitrate UL>s),(list of supported <Guaranteed bitrate DL>s),(list of supported <Delivery order>s),(list of supported <Maximum SDU size>s),(list of supported <SDU error ratio>s),(list of supported <Residual bit error ratio>s),(list of supported <Delivery of erroneous SDUs>s),(list of supported <Transfer delay>s),(list of supported <Traffic handling priority>s)</p> <p>[<CR><LF>+CGEQMIN:<PDP_type>,(list of supported <Traffic class>s),(list of supported <Maximum bitrate UL>s),(list of supported <Maximum bitrate DL>s),(list of supported <Guaranteed bitrate UL>s),(list of supported <Guaranteed bitrate DL>s),(list of supported <Delivery order>s),(list of supported <Maximum SDU size>s),(list of supported <SDU error ratio>s),(list of supported <Residual bit error ratio>s),(list of supported <Delivery of erroneous SDUs>s),(list of supported <Transfer delay>s),(list of supported <Traffic handling priority>s)</p> <p>[...]] OK or:</p> <p>+CME ERROR: <err></p>	<p>Test command returns values supported as a compound value. If the ME supports several PDP types, the parameter value ranges for each PDP type are returned on a separate line.</p>



The following table shows the +CGEQMIN command parameters.

Table 4-199: +CGEQMIN Command Parameters

<Parameter>	Description
<cid>	A numeric parameter that specifies a particular PDP context definition. The supported values are: 1 to 16.
<Traffic class>	Numeric parameter that indicates the type of application for which the EDGE bearer service is optimized. 0 - conversational 1 - streaming 2 - interactive 3 - background 4 - subscribed value If the Traffic class is specified as conversational or streaming, then the Guaranteed and Maximum bit rate parameters should also be provided.
<Maximum bitrate UL>	Numeric parameter that indicates the maximum number of kbits/s delivered to UMTS/EDGE (up-link traffic) at a SAP. As an example a bit rate of 32kbit/s would be specified as '32' (e.g. AT+CGEQMIN = ...,32, ...). If the parameter is set to '0' the subscribed value will be requested. This parameter should be provided if the Traffic class is specified as conversational or streaming. The supported values are: 0 to 5760.
<Maximum bitrate DL>	Numeric parameter that indicates the maximum number of kbits/s delivered by UMTS/EDGE (down-link traffic) at a SAP. As an example a bit rate of 32kbit/s would be specified as '32' (e.g. AT+CGEQMIN=...,32, ...). If the parameter is set to '0' the subscribed value will be requested. This parameter should be provided if the Traffic class is specified as conversational or streaming. The supported values are: 0 to 7168.
<Guaranteed bitrate UL>	Numeric parameter that indicates the guaranteed number of kbits/s delivered to UMTS/EDGE (up-link traffic) at a SAP (provided that there is data to deliver). As an example a bit rate of 32kbit/s would be specified as '32' (e.g. AT+CGEQMIN=...,32, ...). If the parameter is set to '0' the subscribed value will be requested. This parameter should be provided if the Traffic class is specified as conversational or streaming. The supported values are: 0 to 5760.



±CGEQMIN Command Parameters (Cont.)

<Parameter>	Description
<Guaranteed bitrate DL>	Numeric parameter that indicates the guaranteed number of kbits/s delivered to UMTS/EDGE (down-link traffic) at a SAP (provided that there is data to deliver). As an example a bit rate of 32kbit/s would be specified as '32' (e.g. AT+CGEQMIN=...,32, ...). If the parameter is set to '0' the subscribed value will be requested. This parameter should be provided if the Traffic class is specified as conversational or streaming. The supported values are: 0 to 7168.
<Delivery order>	Numeric parameter that indicates whether the UMTS/EDGE bearer shall provide in-sequence SDU delivery or not. 0 - no 1 - yes 2 - subscribed value.
<Maximum SDU size>	Numeric parameter that indicates the maximum allowed SDU size in octets. If the parameter is set to '0' the subscribed value will be requested. The supported values are: 0 to 1520.
<SDU error ratio>	String parameter that indicates the target value for the fraction of SDUs lost or detected as erroneous. SDU error ratio is defined only for conforming traffic. The value is specified as 'mEe'. As an example a target SDU error ratio of 5×10^{-3} would be specified as '5E3' (e.g. AT+CGEQMIN = ..., "5E3", ...). '0E0' means subscribed value.
<Residual bit error ratio>	String parameter that indicates the target value for the undetected bit error ratio in the delivered SDUs. If no error detection is requested, Residual bit error ratio indicates the bit error ratio in the delivered SDUs. The value is specified as 'mEe'. As an example a target residual bit error ratio of 5×10^{-3} would be specified as '5E3' (e.g. AT+CGEQMIN = ..., "5E3", ...). '0E0' means subscribed value.
<Delivery of erroneous SDUs>	Numeric parameter that indicates whether SDUs detected as erroneous shall be delivered or not. 0 - no 1 - yes 2 - no detect 3 - subscribed value
<Transfer delay>	Numeric parameter that indicates the targeted time between request to transfer an SDU at one SAP to its delivery at the other SAP, in milliseconds. If the parameter is set to '0' the subscribed value will be requested. The supported values are: 0, 100 to 4000.



+CGEQMIN Command Parameters (Cont.)

<Parameter>	Description
<Traffic handling priority>	Numeric parameter (1,2,3,...) that specifies the relative importance for handling of all SDUs belonging to the UMTS/EDGE bearer compared to the SDUs of other bearers. If the parameter is set to '0' the subscribed value will be requested.
<PDP_type>	(See +CGDCONT command). If a value is omitted for a particular class then the value is considered to be unspecified.

Example

```
AT+CGEQMIN?  
+CGEQMIN:
```

```
OK AT+CGEQMIN=1,2,2048,1024,0,0,1,1500,"0E0","0E0" OK  
AT+CGEQMIN?  
+CGEQMIN: 1,2,2048,1024,0,0,1,1500,"0E0","0E0",3,0,0
```

OK



4.13.3. TCP/UDP IP

4.13.3.1. Introduction to MIP Commands

MIP (Motorola IP) commands are a complete set of GPRS commands that allows the user to create and manage a network connection using the module internal TCP/UDP IP stack. In order to create a connection between the module and the Network, the user performs the following steps:

- PDP context activation (refer to “+MIPCALL, Create Network Call”).

PDP context activation is based on specific network service provider parameters, like APN (Access Point Name), user name and password. When PDP context activation completes successfully, a network connection is established and the user receives a valid IP from its network service provider.

- Open a socket, based on internal TCP/UDP stack (refer to “+MIPOPEN, Open a Socket”).

The user is able to open a TCP (active or listen) socket(s) the same as a UDP socket(s). A remote side IP (or Host name) and port number will be used, when user opens an active socket with the remote side.

- Manage an opened socket(s) as well as opened network

connection. The user is able to:

- Send data to the network through the socket (refer to “+MIPSEND, Add Data to Socket”, “+MIPPUSH, Send a Socket Data to Network” and “+MIPSETS, Set Watermark and Timeout for Automatic Push” commands).
- Receive data from the network through the socket (refer to “+MIPRTCP, Socket Network Data Received by TCP Stack Unsolicited Indication” and “+MIPRUDP, Socket Network Data Received by UDP Stack Unsolicited Indication” unsolicited indication).
- Receive flow control notifications (refer to “+MIPXON, Socket Flow ON Unsolicited Indication” and “+MIPXOFF, Socket Flow OFF Unsolicited Indication” unsolicited indications).
- Close the socket (refer to “+MIPCLOSE, Close a Socket” command).
- Close the network connection (refer to “+MIPCALL, Create Network Call” command).

4.13.3.2. MIP Commands Description

4.13.3.2.1. +MIPCALL, Create Network Call

This command causes the module to activate PDP context (to create a Network Call) and to return a valid IP; or to deactivate a PDP context, activated by the same command previously.



Command Type	Syntax	Response/Action
Set	AT+MIPCALL=<CallID>,<Operation>,<CID>¹, [<Phone Number>²	OK +MIPCALL: <CallID>,<CallStatus>[,<LocalIP>] Or ERROR: <ErrorCode>³
Read	+MIPCALL?	+MIPCALL: <CallID>,<CID> ⁴ [,<LocalIP>] [<CR><LF>+MIPCALL: <CallID>,<CID> ⁴ [,<LocalIP>]] ⁵ ... OK
Test	+MIPCALL=?	+MIPCALL: (range of supported <CallID>S), (list of supported <Operation>S), (range of supported <CID>S) OK

- Note:**
- ¹) The parameter is mandatory for open a Network Call operation. When Circuit Switched (CSD) based call activation requested, the CID parameter will ignored.
 - ²) Phone Number is used for CSD-based call PDP activation (will be implemented later).
 - ³) The Set command returns an ERROR indication when the command's process fails (see Table 4-220). ErrorCode is returned when numeric/verbose responses mode is enabled.
 - ⁴) When Circuit Switched (CSD) based call activated, the reported CID parameter has 0 - value.
 - ⁵) When no active MIP call found, zero Call ID and zero CID values are returned:
 +MIPCALL: 0,0

The following table shows the command's parameters and returned results.

Table 4-200: +MIPCALL Parameters

<Parameter>	Description
CallID	A unique number that identifies a call in 0-2 range. Call ID value in 1-2 range represents a valid Call ID and can be used for +MIPCALL set command type. Call ID value 0 is used in +MIPCALL read command type and responses, when no active call found.
operation	0 - close a Network Call 1 - open a Network Call 2 - open a Circuit Switched Call ¹
CID	PDP Context Identifier in 0-16 range. 1-16 range is valid PDP CID values, 0 - value represents invalid CID ² .

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Phone Number	Phone number of CSD service provider (in quotation marks) ³ up to 64 characters. ¹
Local IP	IP address given by the network service provider.
Call Status	0 - Closed 1 - Opened

- Note:** ¹) The feature will be implemented later.
²) Zero CID value will be used in
+MIPCALL command set case as CID parameter when CSD based call activation requested.
+MIPCALL command read case, when CSD-based active call found.
³) Contact your service provider for details.

Example

AT+MIPCALL?

+MIPCALL: 0,0

AT+MIPCALL=1,1,1

OK

+MIPCALL: 1,1,"172.16.157.152" AT+MIPCALL=2,1,2

OK

+MIPCALL: 2,1,"172.16.1.34" AT+MIPCALL?

+MIPCALL: 1,1,"172.16.157.152"

+MIPCALL: 2,2,"172.16.1.34" OK

AT+MIPCALL=1,0

OK

+MIPCALL: 1,0

AT+MIPCALL?

+MIPCALL: 2,1,"172.16.1.34" OK

AT+MIPCALL=?

+MIPCALL: (1-2),(0-1),(1-16) OK



4.13.3.2.2. +MIOPEN, Open a Socket

This command causes the module to create a socket (unsecured or a TCP secured with SSL), based on an active PDP context, according to the parameters received by the module.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MIOPEN=<CallID> , <SocketID>, <SourcePort>, <RemoteIP>, <RemotePort>2, <SocketType> [,TransferDataMode]5,7 [,PseudoCommandMode]6	OK +MIOPEN: <CallID>,<SocketID>,<SocketStatus> [,<RemoteIP>,<RemotePort>]1 Or ERROR [<ErrorCode>]3	
Read	AT+MIOPEN?	+MIOPEN: <SocketID>[,<SocketID's>]4 OK Or +MIOPEN: 04 OK	



<p>Test</p>	<p>AT+MIPOPEN=?</p>	<p>+MIPOPEN: (list of supported <CallID>s),(list of supported <SocketID>s),(list of supported <SourcePort>s),<IP/URL>, (list of supported <RemotePort>s),(list of supported <SocketType>s),(list of supported <TransferDataMode>s), (list of supported <PseudoCommandMode>s) OK</p>	
--------------------	---------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--

Note: ¹⁾ The Set command asynchronous response returns <RemoteIP> and <RemotePort> parameters only for sockets opened in listen mode.

²⁾ When TCP socket open is requested with <RemoteIP> parameter value is "0.0.0.0" and <RemotePort> parameter value is "0", a listen TCP socket will open. When UDP socket open is requested with <RemoteIP> parameter value "0.0.0.0" and <RemotePort>

parameter value "0", a UDP socket with "any IP" datagram receive functionality is open, see MIP Commands Using Cases / Transfer data through UDP socket. UDP Listen is restricted for <TransferDataMode> equal to "Text Mode" only (Online Data Mode shall returns error).

³⁾ The Set command returns an ERROR indication when the command process fails (see Table4-220). ErrorCode is returned when numeric/verbose responses mode is enabled.

⁴⁾ The Read command returns a list of free sockets (for example: 1,2,3,7,16,18,20. If there are no free sockets found, '0' is returned.

⁵⁾ There are two data transfer modes supported by the module:

- text data mode
- online data mode (ODM).

Online Data Mode allows the user to transfer raw data (without using the +MIPSEND and +MIPPUSH commands) from terminal to Network and vice versa, see MIP Commands Using Cases / Open / Close a Socket in Online Data Mode for more description.

⁶⁾ When socket is opened in Online Data Mode, the parameter allows to switch the module to Pseudo Command Mode, Please refer to "Online Data Mode Socket Behaviour" section for more details.

⁷⁾ The +MIPOPEN command for Text Mode returns a +MIPSSL unsolicited event(s) in case of alert(s)



occurring during secure connection.

The +MIPOPEN command for Binary Mode returns a +MIPSSL unsolicited event(s) in case of alert(s) occurring during secure connection establishment or in pseudo-command mode.

The following table shows the command's parameters and returned results.

Table 4-201: +MIPOPEN Parameters

<Parameter>	Description
Call ID	A unique number that identifies a call in 1-2 range.
Socket ID	A unique number that identifies a socket in 1-20 range.
Source Port	Port of source site in 1-65535 range.
Remote IP	IP: IP address (in IPv4 format) of remote site. When IPV4 address standard is used, the IP address format consists of 4 octets, separated by decimal point: "AAA.BBB.CCC.DDD". The range of each octet is 0-255. Value can be written in 1, 2, or 3 digits. Host name: of remote site. The host name convention should meet the rules as described in RFC-1035 section: 2.3 Conventions. Syntax is not validated, except for the maximum length (255 characters).
Remote Port	Port of remote site in 1-65535 range for outgoing connection 1. Port 0 reserved for incoming connection (listen mode opened socket).
Socket Type	Type of socket. The module supports the following socket types: 0 - TCP unsecured 1 - UDP 2 - TCP secured (SSL based) 2
Socket Status	0 - inactive socket 1 - non-secured socket active 2 - secured socket active
TransferDataMode	0 - Text Mode (Default) 1 - Online Data Mode
PseudoCommandMode	0 - Enable (Default) 1 - Disable

Note:

- 1) Motorola does not recommend using port numbers below 1024. These numbers are defined to be reserved for operating systems.
- 2) Secured (SSL - based) connection is not supported for sockets, opened in listen mode. Currently, the number of parallel SSL Sessions is limited to 2. Number of simultaneously opened listen sockets is limited and depend to number of inactive TCP sockets. When no active TCP sockets are open, max. number of simultaneously opened listen sockets is 10 (max. number of inactive TCP sockets / 2). When one active TCP socket is opened, a number of inactive TCP sockets is reduced to 19 and the module gives an opportunity to open only 9 listen sockets



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simultaneously. When two active sockets are opened, the number of simultaneously opened listen sockets remains same (9), but three opened active sockets compel the module to reduce the number of simultaneously opened listen sockets to 8, etc.

Example
Text Mode

```
AT+MIOPEN?
+MIOPEN: 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20
OK
AT+MIOPEN=1,2,1080,"87.248.113.14",80,0
OK
+MIOPEN: 1,2,1
AT+MIOPEN=1,3,1081,"www.yahoo.com",80,0
OK
+MIOPEN: 1,3,1
AT+MIOPEN=1,8,1082,"www.google.com",80,0
OK
+MIOPEN: 1,8,1
AT+MIOPEN?
+MIOPEN: 1,4,5,6,7,9,10,11,12,13,14,15,16,17,19,20
OK
```

```
AT+MIOPEN=?
+MIOPEN: (1-2),(1-20),(1-65535),(<IP/URL>),(1-65535),(0-1),(0-1),(0-1)
OK
```

Online Data Mode

1. Opening an Online Data Mode active socket, using TCP protocol, from port 1104, designation IP 172.90.237.221, designation port 1124 over CallID 1, SocketId 1:

```
AT+MIOPEN=1,1,1104,"172.90.237.221",1124,0,1,0
OK
```

```
+MIOPEN: 1,1,1
```

The module is in Online Data Mode.

2. Entering pseudo-command mode, transmitting an escape sequence "+++" from terminal

```
+++
```

```
OK
```

The module is in Pseudo-Command Mode.

3. Check a socket(s) state when the module is in Pseudo-Command Mode:

```
AT+MIOPEN?
+MIOPEN: 2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20
OK
```

4. Opening an Online Data Mode Listen socket, using TCP protocol:

```
AT+MIOPEN=1,1,1100,"0.0.0.0",0,0,1,0Listens on port 1100 to an incoming connection.
OK
```

Until the connection with remote side will be established, the module stays in Command Mode.

```
+MIOPEN: 1,1,122.221.32.64,1200 Remote side IP "122.221.32.64" and Port "1200" is connected to the listen socket.
```

The module is in Online Data Mode.

SSL Example (Text Mode)

```
AT+MIOPEN=1,1,1080,"www.bankhapoalim.co.il",443,2
+MIOPEN=1,1,2
```

A secured TCP/IP session (SSL) is established.



4.13.3.2.3. +MIPCLOSE, Close a Socket

This command causes the module to close a previously opened socket. Data, stored in socket, but not yet pushed to network, will be lost.

Command Type	Syntax	Response/Action
Set	AT+MIPCLOSE = <SocketID>	OK +MIPCLOSE: <SocketID>,<Status> [,<NumberOfAcknowledgedBytes>] Or ERROR [<ErrorCode>] ¹
Read	AT+MIPCLOSE?	+MIPCLOSE: <CallID>:<SocketID>[,<SocketID>s] [<CR><LF>+MIPCLOSE: <CallID>:<SocketID>[,<SocketID>s]] ² ... OK Or +MIPCLOSE: 0 ³ OK
Test	AT+MIPCLOSE=?	+MIPCLOSE: (list of supported <SocketID>s) OK

Note: ¹) The Set command returns an ERROR indication when the command's process fails (see Table 4-220). Error-Code is returned when numeric/verbose responses mode is enabled.

²) The Read command's asynchronous response returns a list of active sockets per CallID, for example:

+MIPCLOSE: 1:1,3,7

+MIPCLOSE: 2:15,16,17,18,20

When no active sockets are found for an active call, the Read command asynchronous response is 0 per CallID, for example:

+MIPCLOSE: 1:0

+MIPCLOSE: 2:0

³) When no active sockets are found, the Read command asynchronous response is '0'.



The following table shows the command parameters and returned results.

Table 4-202: +MIPCLOSE Parameters

<Parameter>	Description
CallID	A unique number that identifies a call in 1-2 range.
SocketID	A unique number that identifies a socket in 1-20 range.
SocketStatus	0 - success. 1 - socket closed error. ¹ 2 - other. ²
numberOfAcknowledgedBytes	The parameter contains four octets unsigned digit (0-4294967295) counter, which counts total number of bytes were acknowledged by the remote side TCP/IP stack. When user open socket, this parameter initialized to zero.

Note: ¹) Socket closed, but an error occurred during the operation.

²) Remote site replied with RST, retransmission timeout occurred, etc..

Example

```
AT+MIPCLOSE?
+MIPCLOSE: 1:2,3,8
OK AT+MIPCLOSE=8
OK
```

```
+MIPCLOSE: 8,0
```

```
AT+MIPCLOSE?
+MIPCLOSE: 1:2,3
OK AT+MIPCLOSE=?
+MIPCLOSE: (1-20) OK
```

4.13.3.2.4. +MIPSETS, Set Watermark and Timeout for Automatic Push

This command causes the module to set a watermark and a timeout for socket automatic push functionality.

When the data amount reaches the watermark, the data is pushed to Network.

Timeout is used to define the delay (in milliseconds.) from the time the module received the data via +MIPSEND command, until pushing the data to Network.

The amount of data, sent by single call of +MIPSEND command from the terminal to the module is limited to 160 ASCII characters (encoded), see MIP Commands Using Cases / Data Encoding for more description. Therefore, in order to reduce the overhead of sending small amounts of data over the air, the socket can accumulate the data and send it only, when the data amount reaches a predefined watermark. The terminal can specify a watermark for an opened socket, indicating how



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much data should be accumulated. When the data exceeds the watermark, the amount of data, equal to the watermark, is sent to Network. The data, remaining in the buffer, will be sent with the next packet.

When timeout is defined as a non-zero value, an amount of data, received by the socket using +MIPSEND command, triggers countdown of the timeout counter. Once timeout is reached, the accumulated data is pushed to Network. If new data arrives before timeout, the counter is reset to the predefined timeout value. When the accumulated data reaches the watermark, the data is pushed to Network as usual. After this automatic push, as usual, there's still data that remains in the socket. In this case the counter is reset to the predefined timeout value and countdown is restarted.

Note: When a socket has a data and +MIPSETS command applies, the +MIPSETS command will be rejected.

Command Type	Syntax	Response/Action	Remarks
Set	+MIPSETS=<SocketID>,<Watermark>[,<Timeout>]	OK +MIPSETS: <SocketID>,<SocketStatus> Or ERROR [<ErrorCode>] ¹	
Read	+MIPSETS?	+MIPSETS: <SocketID>,<Watermark>,<Timeout> [<CR><LF>+MIPSETS: <SocketID>,<Watermark>,<Timeout>] ² ... OK	
Test	+MIPSETS=?	+MIPSETS: (list of supported <SocketID>s), (range of supported <Watermark>s), (range of supported <Timeout>s) OK	

Note: ¹) The Set command returns an ERROR indication when the command process fails (see Table 4-220). ErrorCode is returned when numeric/verbose responses mode is enabled.
²) The Read command returns a report for all active sockets.



The following table shows the command parameters and returned results.

Table 4-203: +MIPSETS Parameters

<Parameter>	Description
SocketID	A unique number that identifies a socket in 1-20 range.
Watermark	Watermark size in bytes. 0 < watermark < max_watermark_size max_watermark_size is 1372 bytes (default watermark settings).
Timeout	Timeout value in mS in 0 - 1000 range. Timeout value = 0 means no timeout is used (default timeout settings).
SocketStatus	0 - success. 1 - failure, there's already data in the socket.

Example

```

AT+MIOPEN=1,1,1400,"212.10.170.2",21,0
OK
+MIOPEN: 1,1,1
AT+MIOPEN=1,3,1500,"212.10.180.16",21,0
OK
+MIOPEN: 1,3,1
AT+MIPSETS?
+MIPSETS: 1,1372,0
+MIPSETS: 3,1372,0
OK AT+MIPSETS=1,1200,0
OK
+MIPSETS: 1,0
AT+MIPSETS?
+MIPSETS: 1,1200,0
+MIPSETS: 3,1372,0
OK
    
```



4.13.3.2.5. +MIPSEND, Add Data to Socket

This command sends data from the terminal to the module and causes the module to accumulate the data in the socket. The data will be automatically sent to Network once, when accumulated data reaches the predefined watermark or timeout occurs (see “+MIPSETS, Set Watermark and Timeout for Automatic Push”).

Motorola recommends to set the watermark prior to +MIPSEND command usage.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MIPSEND = <SocketID>,<Data> ¹	OK +MIPSEND: <SocketID>,<SocketStatus>, <FreeSize> Or ERROR [<ErrorCode>] ²	
Read	AT+MIPSEND?	+MIPSEND: <SocketID>,<FreeSize> [<CR><LF>+MIPSEND: <SocketID>,<FreeSize>] ³ ... OK	
Test	AT+MIPSEND=?	+MIPSEND: (list of supported <SocketID>'s), (<"ASCII data">) OK	

- Note:** ¹) Data in the Set command is limited to 160 ASCII characters (encoded), see MIP Commands Using Cases / Data Encoding for more description.
²) The Set command returns an ERROR indication when the command process fails (see Table4-220). ErrorCode is returned when numeric/verbose responses mode is enabled.
³) The Read command returns a report for all active sockets.



The following table shows the command parameters and returned results.

Table 4-204: +MIPSEND Parameters

<Parameter>	Description
socketID >	A unique number that identifies a socket in 1-20 range.
FreeSize	Number of free bytes remained to reach the watermark: $0 < \text{FreeSize} < \text{watermark}^1$.
Data	Data string encoded with 0-F hexadecimal digits.
SocketStatus	0 - success. 1 - socket is flowed off

Note: ¹⁾ Watermark's default value is 1372 bytes. The value can be changed by AT+MIPSETS command.

Example

AT+MIPSEND=1,"48454C4C4F" OK

+MIPSEND: 1,0,1367

AT+MIPSEND=3,"48454C4C4F21" OK

+MIPSEND: 3,0,1366

AT+MIPSEND?

+MIPSEND: 1,1367

+MIPSEND: 3,1366

OK AT+MIPSEND=?

+MIPSEND: (1-20),(0-1),(<ASCII data >) OK



4.13.3.2.6. +MIPPUSH, Send a Socket Data to Network

This command triggers the module to push the data, accumulated in socket, to Network. It is assumed that before using this command, data should exist due to previous +MIPSEND commands.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MIPPUSH=<SocketID> [,<"RemoteIP">,<RemotePort>] ¹	OK +MIPPUSH: <SocketID>,<SocketStatus> [,<AccumulatedSentLength>] ³ Or ERROR [<ErrorCode>] ²	
Read	AT+MIPPUSH?	+MIPPUSH: <SocketID>,<UsedSize> > [<CR><LF>]+MIPPUSH: H: <SocketID>,<UsedSize> >] ⁴ ... OK	
Test	AT+MIPPUSH=?	+MIPPUSH: (list of supported <SocketID>s) [,<IP>, (list of <RemotePort>s)] OK	

- Note:**
- ¹) Remote IP and Remote Port are optional parameters and are used only for UDP connections. When these parameters are not provided by the user, a datagram is sent to the default target (provided by the +MIPOPEN command).
 - ²) The Set command returns an ERROR indication when the command process fails (see Table4-220). ErrorCode is returned when numeric/verbose responses mode is enabled.
 - ³) Accumulated Sent Length counter. The feature is enabled by +MIPCONF "IsAckIndReq" parameter, see +MIPCONF command description.
 - ⁴) The Read command returns a report for all active sockets.



The following table shows the command parameters and returned results.

Table 4-205: +MIPPUSH Parameters

<Parameter>	Description
SocketID	A unique number that identifies a socket in 1-20 range.
RemoteIP	IP: IP address (in IPv4 format) of remote site. When IPV4 address standard is used, the IP address format consists of 4 octets, separated by a decimal point: "AAA.BBB.CCC.DDD". The range of each octet is 0-255. Value can be written in 1, 2, or 3 digits.
RemotePort	Port of remote site in 1-65535 range for outgoing connection ¹ . Port 0 reserved for listen / "any IP" mode opened socket.
SocketStatus	0 - success 1 - socket is flowed off 2 - there is no data in socket to send 3 - remote IP address not specified
Accumulated-SendLength	The parameter contains four octets unsigned digit (0-4294967295) counter, which counts how many bytes were sent to the remote side by the H24 module TCP/IP stack. When the user opens the socket, this parameter is initialized to zero.

Note: ¹) Motorola does not recommend using port numbers below 1024. These numbers are defined to be reserved for operating systems.

Example

```
AT+MIPPUSH?
+MIPPUSH: 3,160
OK AT+MIPPUSH=3
OK
```

```
+MIPPUSH: 3,0
```

```
AT+MIPPUSH?
+MIPPUSH: 3,0
```

```
OK
```



4.13.3.2.7. +MIPFLUSH, Flush a Socket Data

This command causes the module to flush (delete) data accumulated in a socket.

Command Type	Syntax	Response/Action
Set	AT+MIPFLUSH = <SocketID>	OK +MIPFLUSH: <SocketID>,<SocketStatus> Or ERROR [<ErrorCode>] ¹
Read	AT+MIPFLUSH?	+MIPFLUSH: <SocketID>,<UsedSize> [<CR><LF>+MIPFLUSH: <Sock-etID>,<UsedSize>] ² ... OK
Test	AT+MIPFLUSH=?	+MIPFLUSH: (list of supported <SocketID>s) OK

Note: ¹) The Set command returns an ERROR indication when the command process fails (see Table 4-220). ErrorCode is returned when numeric/verbose responses mode is enabled.
²) The Read command returns a report for all active sockets.

The following table shows the command parameters and returned results.

Table 4-206: +MIPFLUSH Parameters

<Parameter>	Description
SocketID	A unique number that identifies a socket in 1-20 range.
SocketStatus	0 – success 1 - failure

Example

```
AT+MIPFLUSH?
+MIPFLUSH: 8,20
OK AT+MIPFLUSH=8
OK
+MIPFLUSH: 8,0
AT+MIPFLUSH?
+MIPFLUSH: 8,0
OK
```



4.13.3.2.8. +MIPCONF, Configure Internal TCP/IP stack

This command allows to configure TCP stack parameters, such as retransmissions number, upper and bottom limits of retransmission timeout, close delay. It can be used to configure TCP socket

parameters before socket activation or when the socket is in active state. Configuration values will be stored in the module until power circle.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MIPCONF ¹ =<SocketID> ² [,<RetrNum>],[<MinTO>],[<MaxTO>], [<MaxCloseDelay>] [,<IsAckIndReq>] [,<KeepAliveTimeout>] [,<KeepAliveInterval>] [,<KeepAliveProbes>] [,<RcvBuf>] [,<SAck>]]	OK Or ERROR [<ErrorCode>] ³	
Read	AT+MIPCONF?	+MIPCONF: 1,<RetrNum>,<MinTO>,<MaxTO>,<MaxCloseDelay>,<IsAckIndReq>,<KeepAliveTimeout>,<KeepAliveInterval>,<KeepAliveProbes><CR><LF> +MIPCONF: 2,<RetrNum>,<MinTO>,<MaxTO>,<MaxCloseDelay>,<IsAckIndReq>,<KeepAliveTimeout>,<KeepAliveInterval>,<KeepAliveProbes>,<RcvBuf>,<SAck><CR><LF> . . . +MIPCONF: 20,<RetrNum>,<MinTO>,<MaxTO>,<MaxCloseDelay>,<IsAckIndReq>,<KeepAliveTimeout>,<KeepAliveInterval>,<KeepAliveProbes>,<RcvBuf>,<SAck><CR><LF>	



Test	AT+MIPCONF=?	+MIPCONF: (1-20),(1-10),(1-10),(10-1200),(1-1200), (0-2),(0-18000),(1-18000),(1-10), (16-63),(0-1) OK	
------	--------------	-----------------------------------------------------------------------------------------------------------------------	--

- Note:** ¹⁾ If any command's argument (except <SocketID>) is missing in the Set command, the missing argument value will be set to the last configured value. If the missing argument is not configured yet the missing arguments values will be set to its default value.
- ²⁾ The Set command will return ERROR indication if <SocketID> argument is absence.
- ³⁾ The Set command returns an ERROR indication when the command's process fails (see Table 4-220). ErrorCode is returned when numeric/verbose responses mode is enabled.



The following table shows the command's parameters and returned results.

Table 4-207: +MIPCONF Parameters

Parameter	Description
<SocketID>	A unique number that identifies a socket in 1-20 range.
<RetrNum>	Number of retransmissions (1 to 10). Default value is 10 retransmissions.
<MinTo>	Bottom limit to retransmit timeout (100ms to 1sec). Resolution of 100ms. Default value is 500ms.
<MaxTo>	Upper limit to retransmit timeout (1sec to 12 sec). Resolution of 100ms. Default value is 120sec.
<MaxCloseDelay>	Closing delay required by RFC 793 (100ms to 120sec). Resolution of 100ms. Default value is 120sec.
<IsAckIndReq> ¹	TCP ACK indication feature. Activating this parameter enables the module to report the user the total number of bytes that were acknowledged by the remote user application. 0 - feature inactive. 1 - report the total number of bytes that were acknowledged by the remote user application, when the TCP connection is closed. 2 - report the total number of bytes that were acknowledged so far by the remote user application. This parameter is set to 0 after power cycle. Default value is 0.
<KeepAliveTimeout>	Keep alive timeout. The interval between two keep alive transmissions in idle condition (0 sec to 5 hours). 0 - means that keep-alive is off (default) Resolution of 1sec. Default value is 0.
<KeepAliveInterval>	Interval between two successive keep alive retransmissions, if acknowledgement to the previous keep alive transmission is not received (1sec to 5hours). Resolution of 1sec. Default value is 75sec.
<KeepAliveProbes>	The number of unacknowledged retransmissions to send out before closing socket (1-10). Resolution of 1 sec. Default value is 9 retransmissions.
<RcvBuf>	Receive Window Size is the amount of data that Receiver can accept without acknowledging the sender. Resolution of 1 KBytes. Default value 16 KBytes.
<SAck>	TCP Selective Acknowledgment allows a TCP Receiver to precisely inform the TCP server about which segments have been lost. 0 - Disable sack 1 - Enable sack

Note: ¹⁾ In the TCP/IP architecture we are focusing on the TCP ability to acknowledge sent



message.

2) The purpose of the two TCP Stack Options: <RcvBuf> and <SAck>, is to increase TCP DL/UL performance over fast high RTT (round trip time) links. i.e. In order to achieve a High Throughput over an HSDPA/HSUPA network, <RcvBuf> should be set to 63

Kbytes and <SAck> to 1 (Enable). Setting these two parameters affects the next socket session open request.

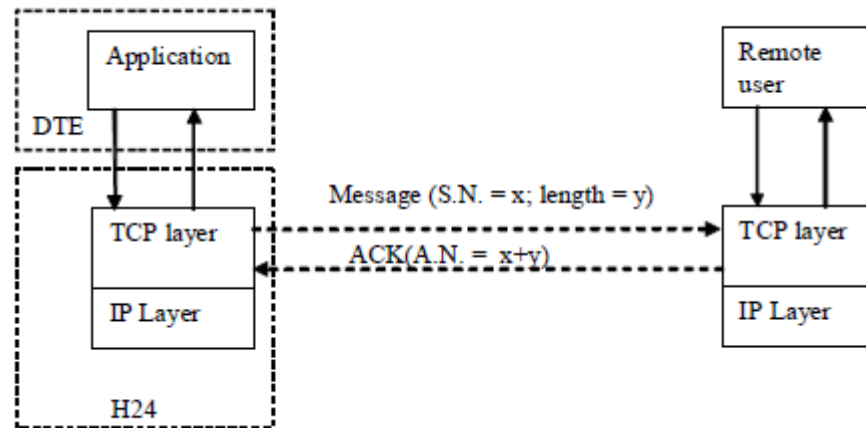


Figure 4-6: TCP Data ACK NACK Indication Feature Overview

S.N. - Sequence Number

A.N. - Acknowledge Number

1. If IsAckIndReq equal to 0, feature is inactive, the module should report nothing regarding to the number of bytes that were acknowledged by the remote user application.
2. If IsAckIndReq equal to 1, the module shall report to the DTE (by MIPSTAT indication), when the TCP connection is closed, the total number of bytes that were acknowledged by the remote user application.

When the TCP connection is closed perform the following calculation:

Total number of bytes that were acknowledged = (last accepted Acknowledge Number) - (TCP connection initial Sequence Number).

3. If IsAckIndReq equal to 2, module shall report to the DTE (by MIPSTAT indication) every time after receiving acknowledge from the remote user application.

When the remote user application sends acknowledge perform the following calculation: Total number of bytes that were acknowledged so far = (last accepted Acknowledge Number) - (TCP connection initial Sequence Number).

Note: AT+MIPCLOSE, AT+MIPUSH and AT+MIPSTAT commands are affected from the IsAckIndReq feature status.

Note: 2) The purpose of these two TCP Stack Options, <RcvBuf> and <SAck>, is to increase TCP DL/UL Performance over fast high RTT (round trip time) links. i.e. In order to achieve High Throughput over HSDPA/HSUPA Network set <RcvBuf> to 63 Kbytes and set <SAck> to 1 (Enable).



Example

AT+MIPCONF = 1,2,3,4,5,1,6,7,8,128,1
OK

AT+MIPCONF?

+MIPCONF: 1,10,5,1200,1200,0,0,75,9,16,0
+MIPCONF: 2,10,5,1200,1200,0,0,75,9,16,0
+MIPCONF: 3,10,5,1200,1200,0,0,75,9,16,0
+MIPCONF: 4,10,5,1200,1200,0,0,75,9,16,0
+MIPCONF: 5,10,5,1200,1200,0,0,75,9,16,0
+MIPCONF: 6,10,5,1200,1200,0,0,75,9,16,0
+MIPCONF: 7,10,5,1200,1200,0,0,75,9,16,0
+MIPCONF: 8,10,5,1200,1200,0,0,75,9,16,0
+MIPCONF: 9,10,5,1200,1200,0,0,75,9,16,0
+MIPCONF: 10,10,5,1200,1200,0,0,75,9,16,0
+MIPCONF: 11,10,5,1200,1200,0,0,75,9,16,0
+MIPCONF: 12,10,5,1200,1200,0,0,75,9,16,0
+MIPCONF: 13,10,5,1200,1200,0,0,75,9,16,0
+MIPCONF: 14,10,5,1200,1200,0,0,75,9,16,0
+MIPCONF: 15,10,5,1200,1200,0,0,75,9,16,0
+MIPCONF: 16,10,5,1200,1200,0,0,75,9,16,0
+MIPCONF: 17,10,5,1200,1200,0,0,75,9,16,0
+MIPCONF: 18,10,5,1200,1200,0,0,75,9,16,0
+MIPCONF: 19,10,5,1200,1200,0,0,75,9,16,0
+MIPCONF: 20,10,5,1200,1200,0,0,75,9,16,0

OK AT+MIPCONF=?

+MIPCONF: (1-20),(1-10),(1-10),(10-1200),(1-1200),(0-2),(0-18000),(1-18000),(1-10),(16-63),(0-1) OK



4.13.3.2.9. +MIPXOFF, Socket Flow OFF Unsolicited Indication

This unsolicited indication is sent by the module to the terminal and indicates that the socket does not have enough memory to process the data or socket operation blocked. The module can't process any +MIPSEND requests from this point.

Unsolicited response format

+MIPXOFF: <SocketID>

The following table shows the indication parameters.

Table 4-208: +MIPXOFF Parameters

<Parameter>	Description
<SocketID>	A unique number that identifies a socket in 1-20 range.

Example

+MIPXOFF: 1

4.13.3.2.10. +MIPXON, Socket Flow ON Unsolicited Indication

This unsolicited indication is sent by the module to the terminal and indicates that the socket has enough free memory for data processing or a socket operation is unblocked. The module can process new +MIPSEND requests from this point.

Unsolicited response format

+MIPXON: <Socket ID>

The following table shows the indication parameters.

Table 4-209: +MIPXON Parameters

<Parameter>	Description
<SocketID>	A unique number that identifies a socket in 1-20 range.

Example

+MIPXON: 1



4.13.3.2.11. +MIPRTCP, Socket Network Data Received by TCP Stack Unsolicited

Indication

This unsolicited indication is sent by the module to the terminal when an opened socket receives data from Network, using the TCP protocol stack.

Unsolicited indication format

+MIPRTCP: <Socket ID>,<Left>,<Data>

The following table shows the indication parameters.

Table 4-210: +MIPRTCP Parameters

<Parameter>	Description
SocketID	A unique number that identifies a socket in 1-20 range.
Left	Size of received data still left in protocol stack in 1 ... 65535 range.
Data¹	Received data string, consists of 0-F hexadecimal digits, limited to 160 ASCII characters (encoded).

Note: ¹) See MIP Commands Using Cases / Data Encoding for more details.

Example

+MIPRTCP: 1,0,32303035292072656164792E0D0A

4.13.3.2.12. +MIPRUDP, Socket Network Data Received by UDP Stack Unsolicited

Indication

This unsolicited indication is sent by the module to the terminal when an opened socket receives data from Network, using the UDP protocol stack.

Unsolicited response format

+MIPRUDP: <SocketID>,<RemoteIP>,<RemotePort>,<Left>,<Data>

The following table shows the indication parameters.

Table 4-211: +MIPRUDP Parameters

<Parameter>	Description
RemoteIP	Remote IP address that the data comes from.
RemotePort	Remote Port that the data comes from.
SocketID	A unique number that identifies a socket in 1-20 range.
Left	Size of received data still left in protocol stack in 1 ... 65535 range.
Data¹	Received data string, consists of 0-F hexadecimal digits, limited to 160 ASCII characters (encoded).



The following table shows the +MPING command parameters.

Table 4-214: +MPING Command Parameters

<Parameter>	Description
<mode>	0 - Abort current ping request execution. 1 - Launch new ping request. There is no default value - appropriate ERROR will be displayed if parameter is not supplied.
<"Destination IP/hostname">	Specifies the target machine (computer), which is identified either by IP address 4 octets long in dotted decimal notation or by host name of maximum 255 (not including double quotes) characters long in dotted notation. Each octet of IP address has valid value range of 0 to 255. Host names are not case sensitive and can contain alphabetic or numeric letters or the hyphen. There is no default value - appropriate ERROR will be displayed if parameter is not supplied.
<count>	Specifies a number of Internet Control Message Protocol (ICMP) Echo Request messages to send. Valid value range is from 1 to 254. Default value: 4
<size>	Specifies the length, in bytes, of the Data field in the Echo Request messages sent. The minimum size is 4. The maximum size is 256. Default value: 64.
<TTL>	Time To Live (TTL). Specifies number of hops (hop is one step, from one router to the next, on the path of a datagram on an IP network), which the Echo Request message may be routed over. The value is set by using TTL field in IP header. Valid value range is from 1 to 255. Default value: 255.
<TimeOut>	Specifies the amount of time, in milliseconds, to wait for the Echo Reply message that corresponds to a sent Echo Request message, measured after Echo Request message was sent. If the Echo Reply message is not received within the time-out, +MPINGSTAT unsolicited response, with <status> equal to 1, will be sent to DTE. Valid value range is from 5000 ms to 10,000 ms (10 minutes). Default value: 10,000.



The following table shows the +MPING unsolicited response parameters.

Table 4-215: +MPING Unsolicited Response Parameters

<Parameter>	Description
<"Destination IP">	Specifies the message sender machine (computer), which is identified by IP address 4 octets long in dotted decimal notation. Each octet of IP address has valid value range of 0 to 255.
<RTT>	Specifies Round Trip Time (RTT) measured in milliseconds. This parameter will be reported in command response only if Echo Reply message was received.

Notes:

1. Ping request is being executed from the moment the valid AT+MPING set command was received by H24 until +MPINGSTAT unsolicited report is sent to DTE or ping request execution was aborted with AT+MPING=0 command. Refer to description of +MPINGSTAT unsolicited response for details.

2. The ping request will be executed only if the provided CID is active.

Example

```
AT+MIPCALL=1,1,1
OK
+MIPCALL: 1,1,10.170.4.111
AT+MPING=1,"10.170.4.112" // Ping remote computer using default parameters
OK
+MPING: "10.170.4.112",400 //Echo Reply message received, RTT is 400 ms.
+MPING: "10.170.4.112",420
+MPING: "10.170.4.112",440
+MPING: "10.170.4.112",410
//Ping request execution is completed. Four Echo Request messages were sent, and four Echo Reply messages
were received. Average RTT is 417 milliseconds.
+MPINGSTAT: 0,"10.170.4.112",4,4,417
```



4.13.3.2.16. +MPINGSTAT, Status Update for +MPING Execution

This is the unsolicited response that the H24 sends to the terminal to inform of ping execution status update and provides summary statistics of ping request when ping request execution is completed.

Command Type	Syntax	Response/Action	Remarks
Unsolicited Response		+MPINGSTAT:<status>[,<"Destination IP">,<SentMessages>,<ReceivedMessages>[,<AverageRTT>]]	The unsolicited response that the H24 sends to the terminal to inform it with ping execution status update. This response also provides a statistics summary of ping request when ping request execution is completed.

The following table shows the +MPINGSTAT unsolicited response parameters.

Table 4-216: +MPINGSTAT Unsolicited Response Parameters

<Parameter>	Description
<status>	Specifies the status of a ping request execution. Defined values: 0 - The unsolicited response with this <status> will be sent to DTE upon completion of ping request or as a result of AT+MPING=0. 1 - The unsolicited response with this <status> will be sent to DTE if no ICMP reply message was received within timeout. DSAT_CME_MEMORY_FAILURE - The unsolicited response with this <status> will be sent to DTE for memory errors. DSAT_CME_SUPS_RETRY_OPERATION - The unsolicited response with this <status> will be sent to DTE for a temporary error. DSAT_CME_MSG_SIZE_TOO_LONG - The unsolicited response with this <status> will be sent to DTE if the ping message size was too large. DSAT_CME_HOST_NOT_FOUND - The unsolicited response with this <status> will be sent to DTE if the destination address was not found or malformed. DSAT_CME_PING_FAILURE - The unsolicited response with this <status> will be sent to DTE all other errors.
<"Destination IP">	Specifies the target machine (computer) for ping request, which is identified by IP address 4 octets long in dotted decimal notation. Each octet of IP address has valid value range of 0 to 255.



+MPINGSTAT Unsolicited Response Parameters (Cont.)

<Parameter>	Description
<SentMessages>	Specifies a total number of sent Echo Request messages.
<ReceivedMessages>	Specifies a total number of received Echo Reply messages corresponding to Echo Request messages.
<AvarageRTT>	Specifies average Round Trip Time (RTT) for this ping request. This value will be reported if and only if <ReceivedMessages> value is greater than zero. Calculation of this value comprises of accumulating all RTT values and dividing total accumulated RTT by <ReceivedMessages> value. Only an integral part of a result will be reported and any digits of a fraction part will be truncated.

Example

```

AT+MIPCALL=1,1,1
OK
+MIPCALL: 10.170.4.111
//Ping host www.motorola.com 3 times with <TTL>=255. All other parameters are default. AT+MPING=1,"
www.motorola.com",3,,255
OK
//ICMP Echo Reply message received, RTT is 522 ms.
+MPING: "88.221.5.223",522
+MPINGSTAT: 1 // No corresponding reply within timeout.
+MPING: "88.221.5.223",638
//Ping request execution is completed. Statistics displayed to terminal. Three Echo Request messages were
sent, and two Echo Reply messages were received. Average RTT is 580 milliseconds.
+MPINGSTAT: 0,"88.221.5.223",3,2,580

```



4.13.3.2.17. +MIPCSC, Motorola Control Secured Connection

This AT command is used to configure the SSL feature behavior in case of non - fatal alerts. For each non - fatal alert, user should decide if the secure connection should be closed automatically or not.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MIPCSC=<SocketID>,<n>	OK or: +CME ERROR: <err>	The Set command is used for setting the SSL connection behavior in case of non - fatal alerts.
Read	AT+MIPCSC?	+ MIPCSC: 1,<n> + MIPCSC: 2,<n> + MIPCSC: 3,<n> + MIPCSC: 4,<n> OK	The Read command returns the current SSL connection behavior in case of non - fatal alerts.
Test	AT+MIPCSC=?	+ MIPCSC: (1-4),(0- 2047) OK	The Test command returns the possible range of values.

The following table shows the +MIPCSC parameters.

Table 4-217: +MIPCSC Parameters

<Parameter>	Description
<SocketID>	A unique number that identifies a connection. Valid socket numbers - 1, 2, 3 and 4
<n>	b11 . . . b5 b4 b3 b2 b1 Bitmap parameter that represents SSL feature behavior configuration. Every 1 bit indicates whether each alert will cause automatically connection termination or not. Bit value 1 indicates automatically connection termination, 0 indicates that connection will not be terminated in case of such an alert. b1 represents the first alert; b2 represents the 2nd alert, and so on. Values range: 0 - 2047 The list of alerts to configure: 1 - SSL_BAD_CERTIFICATE 2 - SSL_UNSUPPORTED_CERTIFICATE 3 - SSL_CERTIFICATE_REVOKED 4 - SSL_CERTIFICATE_EXPIRED 5 - SSL_NO_CERTIFICATE 6 - SSL_UNKNOWN_CA 7 - SSL_CERTIFICATE_BAD_PEM 8 - SSL_CERTIFICATE_NO_SN 9 - SSL_DOMAIN_NAME_MISMATCH 10 - SSL_CERTIFICATE_UNKNOWN 11 - SSL_DECRYPT_ERROR For more information about alerts see Table 4-219.



Notes:This command allows configuring SSL feature behavior for each socket separately.
This command can be used to configure SSL feature behavior before socket activation or when a socket in active state.
In case of receiving the alert, defined by user as source for closing the connection, the connection is closed and +MIPSTAT: <SocketID>,5 unsolicited report sent to TE.
Configuration value <n> is not stored into non volatile memory (NVM) therefore after power recycle it should be reconfigured.

Example

```
AT+MIPCSC=?
+MIPCSC: (1-20),(0-2047): OK
AT+MIPCSC?
+MIPCSC: 1,0
+MIPCSC: 2,0
+MIPCSC: 3,0
+MIPCSC: 4,0
...
+MIPCSC: 20,0
OK
AT+MIPCSC=2,256 // 256 = 00100000000 (binary), so in case of
// SSL_DOMAIN_NAME_MISMATCH alert,
// connection would be closed automatically.
OK AT+MIPCSC?
+MIPCSC: 1,0
+MIPCSC: 2,256
+MIPCSC: 3,0
+MIPCSC: 4,0
...
+MIPCSC: 20,0
OK
AT+MIOPEN=1,2,2222,"www.xyz.com",443,2 // connect to site using SSL protocol
OK
+MIPSSL: 2,19 // SSL_DOMAIN_NAME_MISMATCH alert received.
+MIPSTAT: 2,5 // Connection closed automatically due to received alert.
AT+MIOPEN=1,1,1111,"www.xyz.com",443,2 // Connect to site using SSL protocol
OK
+MIPSSL: 1,19 // SSL_DOMAIN_NAME_MISMATCH alert received.
+MIOPEN: 1,1,2 // Connection established despite of receiving alert.
```



4.13.3.2.18. +MIPSSL, SSL Alerts Unsolicited Report

This unsolicited event is sent to the terminal indicating an errors, warnings or alerts that occurred during SSL connection.

Note: The +MIPSSL alerts are not sent to TE in ODM mode.

Syntax

+MIPSSL: <Socket_ID>,<Alert_ID>

The following table shows the +MIPSSL parameters.

Table 4-218: +MIPSSL Parameters

<Parameter>	Description
<Socket_ID>	1,2,3,4 - Identification Number of Socket.
<Alert_ID>	Alert ID. All alerts are described in Table 4-219.



The following table shows the +MIPSSL Alerts

Table 4-219: +MIPSSL Alerts

Alert ID	Alert Name	Description
1.	SSL_BAD_RECORD_MAC	Returned if a record is received with an incorrect
2.	SSL_DECRYPTION_FAILED	Cipher text decrypted in an invalid way: either it wasn't an even multiple of the block length or its padding values, when checked, were not correct. This alert is fatal.
3.	SSL_UNEXPECTED_MESSAGE	An inappropriate message was received. This alert should never be observed in communication between proper implementations. This alert is fatal
4.	SSL_ILLEGAL_PARAMETER	A field in the handshake was out of range or inconsistent with other fields. This alert is fatal.
5.	SSL_EXPORT_RESTRICTION	A negotiation not in compliance with export restrictions was detected; for example, attempting to transfer a 1024 bit ephemeral RSA key for the RSA_EXPORT handshake method. This alert is fatal
6.	SSL_UNSUPPORTED_PROTOCOL_VERSION	The protocol version the client has attempted to negotiate is recognized, but not supported. (For example, old protocol versions might be avoided for security reasons). This alert is fatal.
7.	SSL_INSUFFICIENT_SECURITY	The server requires ciphers more secure than those supported by the client. This alert is fatal.
8.	SSL_HANDSHAKE_FAILURE	Indicates that the sender was unable to negotiate an acceptable set of security parameters given the options available. This alert is fatal
9.	SSL_BAD_CERTIFICATE_STATUS_RESPONSE	Indicates receiving an invalid certificate status response. This alert is fatal.
10.	SSL_BAD_CERTIFICATE	A certificate was corrupt, contained signatures that did not verify correctly, etc.
11.	SSL_UNSUPPORTED_CERTIFICATE	A certificate was of an unsupported type (unsupported signature algorithm, public key type, etc.
12.	SSL_CERTIFICATE_REVOKED	A certificate was revoked by its signer.
13.	SSL_CERTIFICATE_EXPIRED	A certificate has expired or is not currently valid.
14.	SSL_NO_CERTIFICATE	This alert may be sent in response to a certification request if no appropriate certificate is available



+MIPSSL Alerts(Cont.)

Alert ID	Alert Name	Description
15.	SSL_UNKNOWN_CA	A valid certificate chain or partial chain was received, but the certificate was not accepted because the CA certificate could not be located or couldn't be matched with a known, trusted CA.
16.	SSL_ACCESS_DENIED	A valid certificate was received, but when access control was applied, the sender decided not to proceed with negotiation. This message is fatal.
17.	SSL_CERTIFICATE_BAD_PEM	The delimiters of Base64 encoded certificate are invalid.
18.	SSL_CERTIFICATE_NO_SN	This certificate has no serial number.
19.	SSL_DOMAIN_NAME_MISMATCH	The server's common name mismatches its domain name.
20.	SSL_CERTIFICATE_UNKNOWN	Some other (unspecified) issue arose in processing the certificate, rendering it unacceptable.
21.	SSL_DECRYPT_ERROR	A handshake cryptographic operation failed, including being unable to correctly verify a signature, decrypt a key exchange, or validate a finished message.
22.	SSL_RECORD_OVERFLOW	A Cipher text record was received which had a length more than $2^{14}+2048$ bytes. This message is always fatal.
23.	SSL_DECODE_ERROR	A message could not be decoded because some field was out of the specified range or the length of the message was incorrect. This message is always fatal.
24.	SSL_UNSUPPORTED_EXTENSION	This alert is sent by clients that receive an extended server hello containing an extension that they did not put in the corresponding client hello. This message is always fatal.

Example

```
+MIPSSL: 2,15 // While opening the SSL connection for socket 2, server certificate was received, but
was not accepted because the CA that
signed the certificate could not be located or couldn't be matched with a known, trusted CA.
```



4.13.4. MIP Commands Error Codes description

The following table gives the error codes description.

Table 4-220: Error Codes Description

Error	Code Response	Verbos Response
MIP command execution fails.	See specific MIP command error(s).	
MIP library disconnected or not initialized.	0	"phone failure"
MIP operation unknown.	4	"operation not supported"
MIP operation is rejected as a result of an actual parameter(s) value.	3	"operation not allowed"
MIP command text parameter contains invalid character (like: '"').	25	"invalid characters in text string"
MIP command text parameter too short.	37	"text string too short"
MIP command text parameter too long.	24	"text string too long"



4.13.5. Status Report

The following table gives the status report description.

Table 4-221: Status Report

MIP Command	Status Type	Status
+MIPCALL	Call Status	0 - Closed 1 - Opened
+MIPOPEN	Socket Status	0 - Inactive socket (command fails) 1 - Non-secured socket active 2 - Secured socket active
+MIPCLOSE	Socket Status	0 - Success. 1 - Socket closed error.
+MIPSETS	Socket Status	0 - Success. 1 - Failure, there's already data in the socket
+MIPSEND	Socket Status	0 - Success 1 - Socket is flowed off
+MIPPUSH	Socket Status	0 - Success 1 - Socket is flowed off 2 - There is no data in socket to send
+MIPFLUSH	Socket Status	0 - Success 1 - Failure
+MIPSTAT	Socket Status	0 - ACK indication 1 - Network error 2 - Timeout occurred



4.14. A-GPS

4.14.1. Positioning Methods Configuration

The positioning method depends on two parameters, mode and protocol. Mode selects the type of calculation and protocol selects the transport and standard, i.e. the way the calculation data will be passed between network and the H24.

- Note:**
- Best TTFF is achieved in Assisted MS-Based mode
 - Best Accuracy is achieved in Assisted MS-Assited mode

4.14.1.1. Positioning Fallbacks

The Mode and Protocol configuration in combination of the actual A-GPS support by the network sets the positioning mode as described in the table bellow.

In general there is a fallback from ms-based to standalone, in case of failure in ms-based.

Table 4-222: Protocol and Mode Fallback Per NW Support

H24 Configuration	NW support CP+UPL	NW support UPL	NW support CP	NW support none
Standalone	standalone	standalone	standalone	Standalone
Ms-based CP+UPL	UPL based	UPL based	CP based	standalone
Ms-assisted CP+UPL	UPL assisted	UPL assisted	CP assisted	Fail
Ms-based CP	CP based	standalone	CP based	standalone
Ms-assisted CP	CP assisted	Fail	CP Assisted	Fail
Ms-based UPL	UPL based	UPL based	standalone	Standalone
Ms-assisted UPL	UPL assisted	UPL assisted	Fail	Fail

4.14.1.2. +MGPSMODE, Positioning Mode Configuration

Note: On AT&T model the following At command don't supported Part numbers (PN): FYxxxExxA or FYxxxFxxA.

H24 A-GPS supports the following modes:

- Standalone - Position calculation is based ONLY on GPS receiver measurements.
- Assisted: MS-Based - Network assists in the internal calculation of position and sends assisted data to H24.
- Assisted: MS-Assisted - Network calculates the H24 position and sends it to H24, based on GPS receiver measurements sent from H24.

The mode setting affects the next GPS session.



The mode is saved through power cycle.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MGPSMODE =<mode>	OK or: +CME ERROR: <err>	
Read	AT+MGPSMODE?	+MGPSMODE: <mode> OK	
Test	AT+MGPSMODE=?	+MGPSMODE: (list of supported<mode>s)	

The following table shows the +MGPSMODE parameters.

Table 4-223: +MGPSMODE Parameters

<Parameter>	Description
<mode>	1 - Standalone (default) 2 - MS Based 3 - MS-Assisted

Example

```
AT+MGPSMODE =1 // Set A-GPS mode to Standalone
```

4.14.1.3. +MGPSPROTOCOL , Positioning Assisted Protocol Configuration

Note: On AT&T model the following At command don't supported Part numbers (PN): FYxxxExxA or FYxxxFxxA.

The following protocols are supported:

- No plane - i.e. standalone
- Control plane - Assisted data is shared on the UMTS/GSM L3 based protocol (RRC)
- User plane - Assisted data is shared on the IP based protocol named Secure User Plane Location
- User plane and Control plane

The protocol is saved through power cycle.

The protocol setting takes effect after power cycle. This command sets GPS protocol plane.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MGPSPROTOCOL =<plane>	OK or: +CME ERROR: <err>	

Read	AT+MGPSPROTOCOL?	+MGPSPROTOCOL: <plane> OK	
Test	AT+MGPSPROTOCOL=?	+MGPSPROTOCOL: (list of supported<plane>s)	

The following table shows the +MGPSPROTOCOL parameters.

Table 4-224: +MGPSPROTOCOL Parameters

<Parameter>	Description
<plane>	0 - No plane (default) 1 - Control plane 2 - User plane 3 - User plane and Control plane

Example

```
AT+MGPSPROTOCOL=3 // Set A-GPS Protocol to User Plane and Control Plane
OK
// Now, need to power cycle H24 module
```

4.14.1.4. +MGPSUPPROTOCOLSEL – set user plane protocol

This command selects the user plane protocol.

Command Type	Syntax	Response/Action
Set	AT+MGPSUPPROTOCOLSEL=<protocol>	OK or: +CME ERROR: <err>
Read	AT+ MGPSUPPROTOCOLSEL?	+ MGPSUPPROTOCOLSEL: <protocol> OK
Test	AT+ MGPSUPPROTOCOLSEL=?	+ MGPSUPPROTOCOLSEL: (list of supported <protocol>s)



The following table shows the +MGPSUPPROTOCOLSEL parameters

Table 4-225+MGPSUPPROTOCOLSEL Parameters

<Parameter>	Description
<protocol>	0 – None 1 – PreSUPL (Default value) 2 – X1 3 – SUPL



4.14.2. User Plane Protocol Specific Configurations

When using user plane protocol, the following parameters are required for UPL/SUPL (Secure User Plane) configuration:

1. PDE secure connection certificate.
2. Set Protocol Plane to "User Plane" or "User Plane & Control Plane" (See "+MGSPROTOCOL, Positioning Assisted Protocol Configuration").
3. Set GPS Operation Mode to "MS Based" or "MS Assisted" (see See "+MGPSMODE, Positioning Mode Configuration").
4. Set user plane server parameters:
 - PDP context to communicate with PDE (define through See "+CGDCONT, Define PDP Context").
 - PDE (position determination entity) URL.
 - PDE port id.

4.14.2.1. +MGPSURL, Set User Plane Server Parameters

This command sets the URL and port of the PDE server and PDP context parameters.

The setting is saved through power cycle.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MGPSURL =<context_id>,<url>,<port>	OK or: +CME ERROR: <err>	
Read	AT+MGPSURL?	+MGPSURL: <context id>,<url>,<port> OK	
Test	AT+MGPSURL=?	+MGPSURL: (<context id>),(<url>),(list of supported<port>)	



The following table shows the +MGPSURL parameters.

Table 4-226: +MGPSURL Parameters

<Parameter>	Description
<url>	String
<port>	0-65535
<context_id>	Context id number set by AT+CGDCONT

Example

AT+CGDCONT=1,"IP","internet.pelephone.net.il"// Define <APN> OK

AT+MGPSURL=1,"supl.nokia.com",7275// Set Context id, URL and Port
OK

4.14.2.2. +MGPSSUPL, Set User Plane Security

Using a secure connection in User Plane protocol requires enabling it explicitly by this AT command and having a matching certificate for the SUPL server.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MGPSSUPL=<mode>	OK or: +CME ERROR: <err>	
Read	AT+MGPSSUPL?	+MGPSSUPL: <mode> OK	
Test	AT+MGPSSUPL=?	+MGPSSUPL: (list of supported<mode>s)	

The following table shows the +MGPSSUPL parameters.

Table 4-227: +MGPSSUPL Parameters

<Parameter>	Description
<mode>	0 - OFF - No security algorithm is used (normal TCP/IP - default) 1 - ON

The above setting is saved through power cycle.

Configuration change will affect the next GPS session.

SUPL Certificate

The customer should supply the certificate to Motorola to be placed in H24 for his development phase and production. For this purpose please contact customer care.



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H24 may support secure handshaking and SUPL without the need for AGPS SUPL Server Root CA (SUPL certificate). H24 uses default certificate and as long as it is not receiving SSL Fatal

Alerts, the handshaking succeeds. Using this method is under the responsibility of the customer only.

Example

```
AT+MGPSSUPL=1 // Set secure connection (SSL) in User Plane Protocol  
OK
```

4.14.3. Time To First Fix (TTFF)

Concerning a Global Positioning System (GPS) receiver, Time To First Fix (TTFF) is a specification detailing the time required for a GPS receiver to acquire satellite signals and navigation data, and calculate a position solution (called a fix).

The TTFF is commonly broken down into three, more specific or "real world" scenarios. As defined in the GPS equipment guide:

- Cold or Factory: The receiver is missing, or has inaccurate estimates of, its position, velocity, the time, or the visibility of any of the GPS satellites. As such, the receiver must systematically search for all possible satellites. After acquiring a satellite signal, the receiver can begin to obtain approximate information on all the other satellites, called the almanac. This almanac is transmitted repeatedly over 12.5 minutes. Almanac data can be received from any of the GPS satellites and is considered valid for up to 180 days. Manufacturers typically claim the factory TTFF to be 15 minutes.
- Warm or Normal: The receiver has estimates of the current time within 20 seconds, the current position within 100 kilometers, its velocity within 25 m/s, and it has valid almanac data. It must acquire each satellite signal and obtain that satellite's detailed orbital information called ephemeris data. Each satellite broadcasts its ephemeris data every 30 seconds, and is valid for up to four hours.
- Hot or Standby: The receiver has valid time, position, almanac, and ephemeris data, enabling a rapid acquisition of satellite signals. The time required of a receiver in this state to calculate a position fix may also be termed Time to Subsequent Fix (TTSF).

4.14.3.1. TTFF Timings

- Standalone TTFF
 - HOT Start Scenario - TTFF < ~1 sec
 - WARM Start Scenario - TTFF < ~25 sec
 - COLD Start Scenario - TTFF < ~150 sec
- Assisted MS-Based TTFF
 - COLD Start Scenario - TTFF < ~4 sec

Note: Best TTFF is achieved in Assisted MS-Based mode.



4.14.3.2. +MGPSTTFF, Time To First Fix (TTFF) Control

This command sets/gets TTFF mode.

Using the set command H24 supports the following explicit transitions of TTFF scenarios.

- Exit HOT Scenario - delete ephemeris
- Move to COLD Scenario - delete assisted data: almanac, ephemeris and estimated position

Using the read command H24 supports reporting current TTFF Scenario per query request.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MGPSTTFF =<operation>	OK or: +CME ERROR: <err>	
Read	AT+MGPSTTFF?	+MGPSTTFF: <actual_ttff> OK	
Test	AT+MGPSTTFF=?	+MGPSTTFF: (list of supported<operation>s, <actual_ttff>s	

The following table shows the +MGPSTTFF parameters.

Table 4-228: +MGPSTTFF Parameters

<Parameter>	Description
<operation>	1 - exit hot (delete ephemeris) 2 - move to cold (delete assisted data)
<actual_ttff>	1 - Cold Scenario 2 - Warm Scenario 3 - Hot Scenario

Note: The Assisted data (position, almanac and ephemeris) is saved in the NV and used to improve the TTFF in case of power cycle. The assisted data is maintained in RAM and saved when H24 is powered down normally; in case of sudden power cut the assisted data may not be saved.

Example

```
AT+MGPSTTFF?    // Read TTFF Scenario
+MGPSTTFF: 3    // "HOT" Scenario
OK
AT+MGPSTTFF=1  // Exit "HOT" Scenario / Delete Ephemeris
OK
AT+MGPSTTFF?   // Read TTFF Scenario
+MGPSTTFF: 2   // "WARM" Scenario
OK
AT+MGPSTTFF=2  // Move to "COLD" Scenario / Delete Assisted Data
OK
AT+MGPSTTFF?   // Read TTFF Scenario
+MGPSTTFF: 1   // "COLD" Scenario
OK
```



4.14.4. Application Level Location Request and Report

4.14.4.1. +MGPSLOC, Location Request and Report

Two location request application types are supported:

- Single shot fix information
- GPS Tracking

The Execute command supports single shot fix information; upon issuing of the command, H24 attempts a single position fix and replies with the fix information once fix is achieved.

The Set command enables and configures the H24 to report constant unsolicited position messages, i.e. GPS tracking.

Position information structure is similar for tracking and single shot fix. For QoS dependency see See “+MGPSQOS, Set QoS Parameters”.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MGPSLOC =[<mode>],[<FixInterval>],[<NMEAStatus>]	OK or: +CME ERROR: <err>	Set command controls the presentation of an unsolicited result code +MGPSLOC : When <mode>=1 and valid position is available +MGPSLOC : <Date>,<Time>,<Position>,<Velocity>,<Heading>,<SatelliteInfo>,<ReceiverStatus>. When valid position is not available or QoS was not reached +MGPSLOC : 0,0,0,0,0,0,0 see also AT+MGPSQOS .
Execute	AT+MGPSLOC	+MGPSLOC : <Date>,<Time>,<Position>,<Velocity>,<Heading>,<SatelliteInfo>,<ReceiverStatus> > OK or: +CME ERROR: <err>	When valid position is not available or QoS threshold in meters is not reached within approximately 4.5 Minutes +MGPSLOC : 0,0,0,0,0,0,0 is returned see also AT+MGPSQOS



Command Type	Syntax	Response/Action	Remarks
Read	AT+MGPSLOC?	+MGPSLOC: <mode>,<FixInterval>,<NMEA Status> OK	
Test	AT+MGPSLOC=?	+MGPSLOC: (list of supported<mode>s), (list of supported< FixInterval >s),(list of supported <NMEAStatus>s) OK	

The following table shows the +MGPSLOC parameters.

Table 4-229: +MGPSLOC Parameters

<Parameter>	Description
<mode>	0 - Disable MGPSLOC unsolicited indication (default). 1 - Enable MGPSLOC unsolicited indication. The default value is 0.
<Interval>	1-3600 - Desired Interval in Sec. Desired Time difference to the next unsolicited position indication starting the last unsolicited report. Note: Once unsolicited position indication is reported, H24 starts a timer of <interval> number of second, once timer expires H24 requests position from its GPS engine, normally H24 will get the position and report it within 1 second (in case h24 is in hot state). However due to specific QoS setup by the user or other objective reason it may take more. This is why the interval can NOT be defined as fixed interval, but more of desired interval. Default value: 1.
<NMEAStatus>	0 - Disable NMEA messages streaming via NMEA defined path. 1 - Enable NMEA messages streaming via NMEA defined path.
<Date>	Day: 1..31 Month: 1..12 Year: yyyy
<Time>	Hours: 0..23 Minutes: 0..59 Seconds: 0..59 Note: Time is represented in UTC.



<Position>	Format (GPS Coordinate) - degrees minutes decimal seconds DDMM.MMMMMM followed by comma and then the direction for the coordinate Latitude: 0 to 90 Longitude: 0 to 180 Altitude in meters When converting to other GPS formats that use + and – for direction use the following Latitude: N is "+" S is "-" Longitude: E is "+" W is "-"
<Velocity>	Velocity in 0.25 m/s
<Heading>	0..3599
<SatelliteInfo>	Number of Visible Satellites 0..12
<ReceiverStatus>	Position DOP - poor quality (DOP>8) Fix Type: 0 - No Fix 1 - 2D Fix 2 - 3D Fix

- Note:**
1. When AT+MGPLOC unsolicited indications are enabled, AT+MNMEA set command is not allowed.
 2. Set command is NOT allowed until response for Execute command is received (single shot location message is displayed).
 3. In the case of NMEA messages enabled through <NMEAStatus> parameter, NMEA messages will be output to defined NMEA path every one second until H24 reaches

hot state. Once hot state achieved NMEA message will be output every <FixInterval> seconds.

4. When a valid position is unavailable upon invoking +MGPSLOC in tracking mode (receiving MGPSLOC: 0,0,0,0,0,0), it might be related to QoS setting. Such a failure may occur when using a large <interval> (several minutes). Therefore, in case of an invalid position, and when a user is willing to compromise performance, lowering the QoS should be considered (i.e. setting <performance> towards 255 sec) for acquiring a position.
5. H24 supports efficient power consumption when invoking +MGPSLOC in tracking mode. However, in case of using a large <interval> (several minutes), and when low power consumption is required, a different approach is recommended: the TE should use a single shot fix and manage its own tracking mode.

Example

```
AT+MGPSLOC=1,10,0 // Enable GPS Tracking with Interval set to 10 seconds and disable
OK // NMEA streaming
```

```
// Unsolicited Fix Location report every ~10 seconds
```

```
+MGPSLOC: 8032010,11,43,32,3204.029093,N,03447.653814,E,49,0,0,4,25.5,2
+MGPSLOC: 8032010,11,43,42,3204.029073,N,03447.653880,E,49,0,0,4,25.5,2
```



4.14.4.2. +MGPSQOS, Set QoS Parameters

H24 supports the following QoS parameters:

- Accuracy Threshold (meters)
- Performance (seconds)

The module attempts to reach the specified accuracy threshold within the performance time. If at the end of the performance time the desired accuracy is not achieved, then zero position information is returned.

Changing QoS dynamically within a tracking session affects current session.

Note: The QoS setting has strong influence on the zero reporting (+MGPSLOC: 0,0,0,0,0,0) within GPS tracking mode. For example, setting very high performance and very high accuracy - 1 second performance and 1 meter threshold - may result with many zero position reports.

QoS does not affect NMEA reports.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MGPSQOS=[<threshold>],[<performance>]	OK or: +CME ERROR: <err>	
Read	AT+MGPSQOS?	+MGPSQOS: <threshold>,<performance> OK	
Test	AT+MGPSQOS=?	+MGPSQOS: (list of supported<threshold>s), (list of supported<performance>s)	

The following table shows the +MGPSQOS parameters.

Table 4-230: +MGPSQOS Parameters

<Parameter>	Description
<threshold>	1 - 10000 meters Default:50.
<performance>	1-255 seconds The performance parameter affects GPS Tracking only. The performance does not affect single shot fix and the 1st unsolicited report of GPS Tracking (unsolicited position reports). Default: 2.

Example

```
AT+MGPSQOS=10000,255 // Setting QoS with low performance and low accuracy
OK
```





4.14.5. NMEA Streaming Output

H24 supports the following NMEA messages:

- GSV - Satellites in View
- GGA - Global Positioning System Fixed Data
- RMC - Recommended Minimum Specific GPS Data
- GSA - DOP (Dilution of Precision) and Active Satellites
- VTG - Course Over Ground and Ground Speed

4.14.5.1. +MPNMEA, Configure NMEA Path

The Set commands supports configuring the output path of the NMEA messages.

Available serial ports:

- UART2
- Dedicated USB interface

The NMEA Path setting takes effect after power cycle.

The configuration is saved through power cycle.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MPNMEA =<path>	OK or: +CME ERROR: <err>	
Read	AT+MPNMEA?	+MPNMEA: <path> OK	
Test	AT+MPNMEA=?	+MPNMEA: (list of supported path>s)	

The following table shows the +MPNMEA parameters.

Table 4-231: +MPNMEA Parameters

<Parameter>	Description
<path>	NMEA path configuration: 0 - None (no NMEA channel). 1 - USB. 2 - For future use. 3 - UART2 (default).

Example

```
AT+MPNMEA=3 // Set MNMEA output path to UART2 Serial Port
OK
```

A power cycle of the H24 is required now.



4.14.5.2. MMAD, Query and Monitor ADC Value

This command enables to query and monitor ADC value.
The command returns the current ADC values for the requested channel.

The values received from the first 3 converters represent the DC voltage levels of the input to pins 37, 43 and 47 on the 70 pin connector. The returned value is a multiplication of the input level by 100 (e.g. input level of 1.56V will return 156).

The 4th converter samples the output of the PA thermistor.
The values received should be converted to degrees according to conversion table 3-146.

The 5th converter samples the battery voltage (input voltage) of the H24. The returned value is a multiplication of the input level by 1000 (e.g. input level of 1.56v will return 1560). This command can also calculate the average of the samples in a given duration and to forward it as unsolicited report according to the report interval timer.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MMAD=<Converter_number>[,<Report>],[<Rate>],[<Low>],[<High>],[<Num_Of_Samples>],[<Average_Calc_Duration>],[<Report_Interval>]] AT+MMAD=<Converter_number>	+MMAD: <Converter_number>,<Average> OK Or: +CME ERROR: <err> +MMAD: <Converter_number>,<Converted_Value> OK	If average is active on that converter, the response value will be the latest average calculated. If average is not active on that converter, the response value will be the converted value. If average is active on that converter, and report interval not set, the response value will be the latest average calculated (solicited message).
Read	AT+MMAD?	List of converters and their monitoring setup values: +MMAD: <Converter number>,<Report>,<Rate>,<Low>,<High><Num_of_samples><Average_calc_duration><Report_interval><CR><LF> > <Converter number>,<Report>,<Rate>,<Low>,<High><Num_of_samples><Average_calc_duration><Report_interval><CR><LF> > <Converter number>,<Report>,<Rate>,<Low>,<High><Num_of_samples><Average_calc_duration><Report_interval><CR><LF> > <Converter number>,<Report>,<Rate>,<Low>,<High><Num_of_samples><Average_calc_duration><Report_interval><CR><LF> > <Converter number>,<Report>,<Rate>,<Low>,<High><Num_of_samples><Average_calc_duration><Report_interval>	Read the setting of the A/D converters.



		OK	
Test	AT+MMAD=?	+MMAD:(range of <Converter_Number>'s),(range of <Report>)(range of <Rate>),(range of <Low>),(range of<High>),(range of<Num_of_samples>),(range of<Average_calc_duration>),(range of<Report_interval>) OK	Provides the range of the parameters.
Unsolicited Messages	AT+MMAD=<Converter_number> Case: *. Average calculation is not active : *. Average calculation is active:	+MMAD: <Converter_number>,<Converted_Value> OK +MMAD: <Converter_number>, <Average> OK	If <Report> value is - 3, the report will be generated according to report interval value. If <Report interval> value was not set, there will be no messages but you can ask for solicited message.



The following table shows the +MMAD parameters.

Table 4-232:+MMAD Parameters

Parameter	Description	Remark
<Converter Number>	1-5 Select the A2D converter.	
<Report>	0 Unsolicited report is not active/ stops unsolicited report and deactivates +MMAD operation. 1 Unsolicited report in active for all A2D conversion events. 2 Unsolicited reports are active only for out of boundaries events. 3 "Average report" - send periodic average.	
<Rate>	1-255 Select the time interval between two samples. Units:100 milliseconds - in case of average computation, Seconds - in case of A/D sampling only.	100 milliseconds – for average; seconds - Otherwise. Mandatory for Average calculation.

<low>,<High>	0-450 A decimal value represents the digital value. Low - The lowest boundary level of digital value. High - The Highest boundary level of digital value. Default value for converters 1-3 is 230. Default value for converter 4 is 0-255. Default value for converters 1-3 is 300-450.	
<Converted Value>	A decimal value represents the returned digital value. For converters 1-3 and 5 the returned value represents the input level multiplied by 100. For converter 4 the returned value is a pure number that should be converted according to conversion table (Table 3-146) and Figure 3-2.	
<Num_of_samples>	2-255 The number of samples that are used for average calculation.	Mandatory for average calculation.
<Average_calc_duration>	1-255 For how long the average calculation will be active. 0 - Not active. 255 - Endless. 1...254 - minutes.	1- Default value if average is active. While not active = 0.
<Report_interval>	0-255 Time interval between two average reports (seconds).	0 - Default value.
<Average>	Average calculation result.	

Table 4-233: A/D Value to Temperature Conversion

Temperature (°C)	AD value decimal	Temperature (°C)	AD value decimal	Temperature (°C)	AD value decimal
------------------	------------------	------------------	------------------	------------------	------------------




```
// report originated by G24
// Converter num=1, report=3, rate=5*100ms, low,high, N_samples,
duration=5
AT+MMAD =1,3,5, , ,16,5,30
OK
+MMAD:1,175 //First report
+MMAD:1,140 //Second report
.....
+MMAD:1,160 //Last Avr report
AT+MMAD =1,0,5, , ,16,5,0 // Activate Average calculation during 5 minutes, rate=5.
// Converter num=1, report=0, rate=5*100ms, low,high, 16,
duration=5 min
OK
AT+MMAD=1 //Only on explicit "AT+MMAD=<Converter_number>" command
Ok
+MMAD:1,160
//Operation not allowed because the parameters are valid But the
there is not enough time for calculation:
AT+MMAD =1,3,100, , ,7,1,5 // Activate Average calculation during 1 minute, rate=100,
samples = 7, report interval = 5 sec.
Converter num=1, report=3, rate=100, low,high, 7,
duration=1 min, interval = 5.

AT+MMAD =1,0 // Stop Average calculation and report.
OK //Converter num=1, report=0
AT+MMAD? // Read monitoring setup values of all A2D's
+MMAD:1,0,10,0,230,0,0,0
+MMAD:2,1,15,0,230,0,0,0
+MMAD:3,2,1,25,100,0,0,0
+MMAD:4,0,1,0,255,0,0,0
+MMAD:5,0,1,300,450,0,0,0
OK
AT+MMAD? // Read default values of all A2D's
+MMAD: 1,0,1,0,230,0,0,0
+MMAD: 2,0,1,0,230,0,0,0
+MMAD: 3,0,1,0,230,0,0,0
+MMAD: 4,0,1,0,255,0,0,0
+MMAD: 5,0,1,300,450,0,0,0
OK
AT+MMAD=? //Test command - range of all setup parameters and
+MMAD: (1-5),(0-3),(1-255),(0-450),(0-450),(2-255),(1-255),(0-255)
OK
```



4.14.5.3. +MNMEA, Start/Stop NMEA

Set command starts/stops NMEA messages.

The start operation starts the GPS receiver and an endless GPS position fix session starts. The fix information is reported as an NMEA message every 1 second.

The Stop operation stops the GPS receiver and also the NMEA stream.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MNMEA =<action>	OK or: +CME ERROR: <err>	
Read	AT+MNMEA?	+MNMEA: <mode> OK	
Test	AT+MNMEA=?	+MNMEA: (list of supported action >s)	

The following table shows the +MNMEA parameters.

Table 4-234: +MNMEA Parameters

<Parameter>	Description
<action>	0 - Stop (default) 1 - Start

Note: When AT+MNMEA session is started, AT+MGPSLOC set command is not allowed.

Example

```
AT+MNMEA=1 // Start GPS Position Fix session, NMEA Streaming
OK
```

```
// NMAEA Streaming
```

```
$GPGSV,3,1,12,02,02,323,,16,17,098,,04,19,313,28,23,61,326,33*7C
$GPGSV,3,2,12,31,09,037,23,07,21,205,42,17,04,250,,25,38,205,*7E
$GPGSV,3,3,12,11,28,189,34,20,71,000,,13,44,279,38,32,59,075,*79
$GPGGA,124930.0,3204.051508,N,03447.657149,E,1,04,9.8,-70.5,M,,,*18
$GPRMC,124930.0,A,3204.051508,N,03447.657149,E,,110310,,,A*61
$GPGSA,A,3,07,11,13,23,,,,,,,,,22,8,9,8,20.5*38
$GPVTG,,T,,M,0.0,N,0.0,K*4E
```



4.14.6. A-GPS LCS Standard Support

Mobile Originating Location Request (MO-LR): Any location request from a client MS to the LCS Server made over the GSM air interface. While an MO-LR could be used to request the location of another MS, its primary purpose is to obtain an estimate of the client MS's own location either for the client MS itself or for another LCS client designated by the MS.

Mobile Terminating Location Request (MT-LR): Any location request from an LCS client where the client is treated as being external to the PLMN to which the location request is made.

Network Induced Location Request (NI-LR): Any location request for a target MS from a client that can be considered to lie inside any of the PLMN entities currently serving the target MS. In this case, the LCS client is also within the LCS server. Examples of an NI-LR include a location request needed for supplementary services, for emergency call origination and by O&M in a visited PLMN.

4.14.6.1. MT-LR

Any LCS System client can request getting the location of a Registered H24 module. This request arrives to the module as a Mobile Terminated Location request - MT-LR; the request may have been issued as an MO-LR.

H24 does NOT support MT-LR.



4.14.6.3. +MGPSECALL, GPS Behavior in Emergency Call

Per emergency rules in certain countries the network should supply the MS location to certain LCS clients like public safety in case MS is in emergency status.

The emergency configuration will be saved through power cycle.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MGPSECALL=<behavior>	OK or: +CME ERROR: <err>	
Read	AT+MGPSECALL?	+MGPSECALL: <behavior> OK	
Test	AT+MGPSECALL=?	+MGPSECALL: (list of supported<behavior>s	

The following table shows the +MGPSECALL parameters.

Table 4-236: +MGPSECALL Parameters

<Parameter>	Description
<behavior>	Whether to terminate/reject GPS session in case of E-call: 1 - Emergency rejects all requests - Emergency call terminates on going positions session and reject any position requests while the call is in progress. 2 (Default) - Emergency high priority - When the Emergency call is detected, any on-going position sessions are terminated and ONLY control plane NI-LR position requests are honored while the call is in progress. 3- Emergency low priority - Emergency is not detected and no special processing is performed.



4.14.7. A-GPS General

4.14.7.1. +MGPSAPWR, Set Antenna Mode

This command sets the antenna power supply mode and voltage value.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MGPSAPWR =<mode>,<voltage>	OK or: +CME ERROR: <err>	
Read	AT+MGPSAPWR?	+MGPSAPWR: <mode> OK	
Test	AT+MGPSAPWR =?	+MGPSAPWR: (list of supported< mode >,s,)	

The following table shows the +MGPSAPWR parameters.

Table 4-237: +MGPSAPWR Parameters

<Parameter>	Description
<mode>	0 - power OFF (default) 1 - power ON
<voltage>	1.5V- 3.05V Valid power values should be set with an interval of 0.05 volts, i.e. 1.5V, 1.55V, 1.60V ... 3.05V Default: 0.00V

Example

AT+MGPSAPWR=1 // Set antenna power to default value 3.05V OK

AT+MGPSAPWR?
+MGPSAPWR: 1, 3.00
OK



4.15. RS232 Multiplexer Feature

The MUX provides multiple logical RS232 communication channels between the DTE and H24 over one physical RS232/UART connection. This service enables the DTE device to run multiple applications (such as External PPP, CSD, ODM, SMS and voice calls) while communicating simultaneously with the H24.

4.15.1. System Overview

The MUX service in H24 provides two virtual channels for DTE.

These MUX entities communicate with each other and provide data connection management, which includes establishment, control, release and data transfer between IDLC.

The MUX over RS232/UART is a software module which enables one serial interface to transmit data to two different DTE applications. This is achieved by providing two virtual channels using a multiplexer (MUX).

Both H24 and the DTE application must have MUX components to allow communication with multiplexer protocol.

When in MUX mode H24 AT commands and data are encapsulated into packets. Each packet has channel identification and may vary in length.

4.15.2. Product Architecture

Figure 4-8: MUX Architecture shows the current product architecture (MUX).

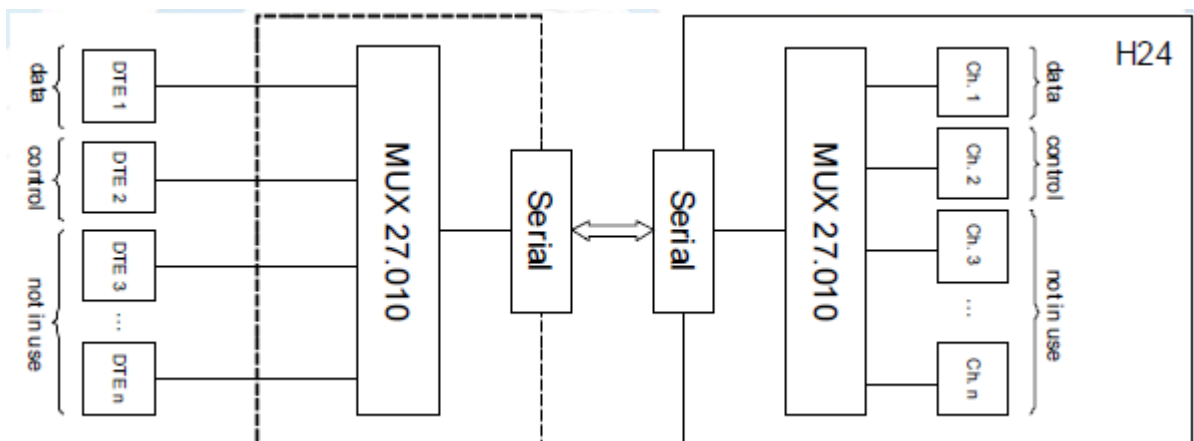


Figure 4-8: MUX Architecture



4.15.3. MUX Channels Definitions

H24 supports two channels configuration.

In this configuration DLC1 will be a data channel while DLC2 will be the control channel. These channels will apply to specification defined within Multi-Channeling feature [1].

Starting MUX can be done only when connectivity configuration is set to +MCONN=3 (UART1 only).

4.15.4. Supported Control Messages

- Multiplexer close down (CLD)
- Test Command (Test)
- Flow Control On Command (FCon)
- Flow Control Off Command (FCoff)
- Modem Status Command (MSC) - except for break signal which is not supported.

4.15.5. Power Management

Power management over MUX will be supported as part of the existing sleep mode feature. No special MUX adjustments were applied, therefore related control message (PSC) is not supported.

Please refer to sleep mode chapter for more information.

4.15.6. Data Applications Impact

Starting or terminating MUX session will:

- Close all opened sockets.
- Close all data sessions (CSD, External Packet or ODM).
- Deactivate PDP contexts if exists.



4.15.7. MUX States Overview

The MUX module has 3 states, MUX-NONE, MUX-WAIT and MUX-ACTIVE (see Figure 4-9).

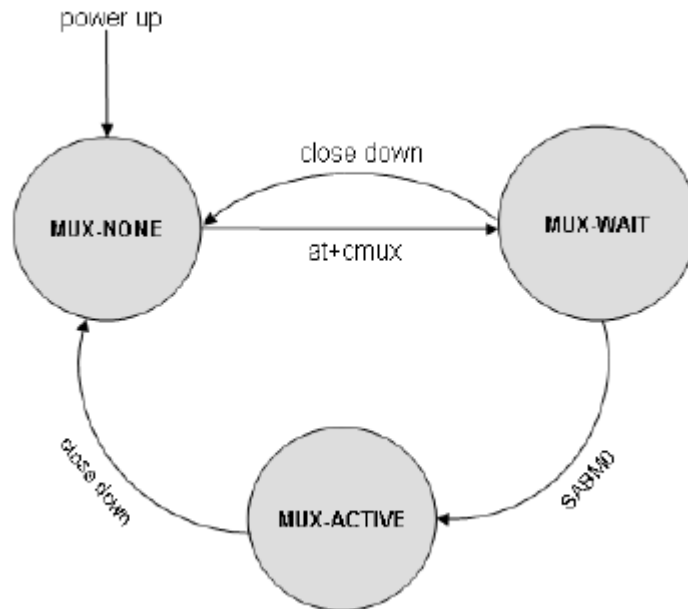


Figure 4-9: MUX States

4.15.7.1. MUX-NONE State

Regular RS232/UART communication when MUX is not established.

Enter to state:

- H24 powers up and opens UART1 related port.
- MUX has been closed (see "MUX Close").

Exit from state:

DTE sends AT+CMUX command for starting H24's MUX stack.

4.15.7.2. MUX-WAIT State

H24 is ready and waits for DTE to either start or close MUX session.

Enter to state:

H24 receives a valid AT+CMUX command and connectivity configuration is set to +MCONN=3 (UART1 only).

Exit from state:

- MUX has been closed (see "MUX Close").
- SABM0 frame is received.



- Timeout after 10 sec H24 didn't receive a SABM0 frame (Transition to MUX-NONE).

4.15.7.3. MUX-ACTIVE State

DTE and H24 are communicating with MUX protocol stack over the serial link.

Enter to state:

H24 receives the SABM0 Frame.

Exit from state:

MUX has been closed (See “MUX Close”).

4.15.8. MUX Close

When one of the following occurs, MUX session will be terminated.

- Receiving CLD control command.
- Receiving DISC command on DLCI 0.
- Toggling DTR line, given AT&D is equal 4 in NON-MUX state

4.15.9. Hardware interface

The HW transport is over a UART.

MUX can be supported with full RS232 HW line and also with 4 HW lines UART (RX, TX, CTS, and RTS) or two lines (RX, TX).

After issuing AT+CMUX command:

Character Framing & Flow Control will remain the same as in MUX-NONE.

Baud rate will be determined by <port speed> parameter in the command. If this parameter is absent, MUX will use the same baud rate that was in MUX-NONE state.

MUX is supported only when connectivity is set to UART only (i.e. AT+MCONN=3).

4.15.9.1. Modem Signals

RI and DCD line are inactive during MUX session.

DSR stays as in MUX_NONE.

Toggling DTR line within MUX-ACTIVE or MUX-WAIT states, given AT&D is equal 4 in NON-MUX state, will close down MUX. (See “MUX Close”). If AT&D was not equal to 4 (in NON-MUX state) the DTR line will be ignored.



4.15.9.2. UART Related AT Commands

[+CBAUD, +IPR, +IFC, +ICF, &K]

While in MUX session:

Execution of these commands will be ignored (doesn't affect hardware configuration).

If a set command was executed, read operation will return the value used, but if it was not executed, return value will be the value used before starting session.

4.15.10. +CMUX, MUX Startup Command

This command is used to activate the MUX protocol stack. Executing a valid +CMUX command, produces OK result and changes MUX state to MUX-WAIT. If parameters are left out, defaults are used.

Command Type	Syntax	Response/Action	Remarks
Set	+CMUX=<mode> [,<subset>[,<port speed>[,<N1>[,<T1>[,<N2>[,<T2>[,<T3>[,<k>]]]]]]]]	OK or: +CME ERROR: <err>	The Set command requests the H24 to open the MUX stack with various parameters. This command works only in MUX-NONE state.
Read	+CMUX?	+CMUX: <mode>, [<subset>], <port speed>,<N1>, <T1>,<N2>,<T2>, <T3>+CME ERROR: <err>	The Read command displays the current mode and settings. This command works only in MUX-ACTIVE state.
Test	+CMUX=?	+CMUX: (list of supported <mode>s),(list of supported <subset>s),(list of supported <port speed>s),(list of supported <N1>s),(list of supported <T1>s),(list of supported <N2>s),(list of supported <T2>s),(list of supported <T3>s),(list of supported <k>s)	The Test Command displays a list of supported modes and parameters. This command works in both MUX-NONE and MUX-ACTIVE states.



The following table shows the +CMUX parameters.

Table 4-238: +CMUX Parameters

<Parameter>	Description
<mode>	MUX mode: 0 Basic
<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 6 230400 bit/sec 7 460800 bit/sec 8 921600 bit/sec 9 Reserved 10 3200000 bit/sec 11 3686400 bit/sec 12 4000000 bit/sec
<N1>	Maximum frame size: 31 32768 The default value is 31.
<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).

Note: Error Recovery Mode and Wake Up are not supported, therefore, <K> and <T3> will not be used.



4.16. Connectivity Configuration

4.16.1. Connectivity Configuration Commands

4.16.1.1. +MCDORM, Control Dormant

This command is used to

1. Enables/Disable the indication of dormant mode.
2. Fast dormancy
3. Exit from dormancy.

When the indication is enabled, an unsolicited report with the current status (dormant or active) per packet call will be sent to the DTE. Then, an update report will be sent to the DTE each time a change in the status is detected.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MCDORM =< mcdorm_action >[,<call_id>]	OK Or: +CME ERROR: <err>	The set command configures the indication of MS mode (dormant/active).
Read	AT+ MCDORM?	+MCDORM: <unsolicited_status>[, <call_id>,<dormant_status>] [<CR><LF>+MCDORM: <unsolicited_status>,<call_id>,<dormant_status>] [...] OK	The read command returns the current settings and status.
Test	+ MCDORM =?	+ MCDORM: (range <mcdorm_action>),(range <call_id>s) OK	The test command returns the possible ranges of <mcdorm_action >s and <call_id>s
Unsolicited Report		+MCDORM: <call_id>,<dormant_status>	Indicates the dormant mode status.

The following table shows the +MJDC parameters.

Parameter	Description
< mcdorm_action >	0 - Disable the dormant status unsolicited result code. 1 - Enable the dormant status unsolicited result code +MCDOMR: <call_id>, 2 - Go to dormant(fast dormancy) 3 - Exit dormant for <call_id>
< call_id >	Integer type, call identification number. Range from 0 to 14.
<unsolicited_status>	0 - Disabled unsolicited indication 1 – Enabled unsolicited indication The default value is 0.
< dormant_status >	0 – call is in dormant mode 1 – call is in active mode



Example

```

at+mcdorm=?
+MCDORM: (0-3),(0-14)

OK
at+mcdorm=1 //Enable unsolicited indication
OK

at+mipcall=1,1,1
OK

+MCDORM: 0,1 //call id 0 is in active mode

+MIPCALL: 1,1,"10.195.159.92"

+MCDORM: 0,0 //call id 0 is in dormant mode

at+mipcall=2,1,1
OK

+MCDORM: 1,1 //call id 1 is in active mode

+MIPCALL: 2,1,"10.195.131.132"
at+mcdorm?
+MCDORM: 1,0,0 //unsolicited is active, call id 0 is in dormant mode
+MCDORM: 1,1,1 // unsolicited is active, call id 1 is in active mode

OK
at+mcdorm=2 //Go to dormant
+MCDORM: 1,0 //call id 1 is in dormant mode

OK
at+mcdorm?
+MCDORM: 1,0,0 //unsolicited is active, call id 0 is in dormant mode
+MCDORM: 1,1,0 //unsolicited is active, call id 1 is in dormant mode

OK
at+mcdorm=3,1 // call_id 1 to exit dormant
OK

+MCDORM: 1,1 //call id 1 is in active mode

+MCDORM: 1,0 //call id 1 is in dormant mode

```

4.16.1.2. +MCONN, Connectivity Configuration

This command allows switching between listed connectivity configurations.

Command Type	Syntax	Response/Action	Remarks
--------------	--------	-----------------	---------



Set	+MCONN =<configuration>	OK or: +CME ERROR: <err>	Settings takes effect after power cycle.
Read	+MCONN?	+MCONN:<active configuration> OK	
Test	+MCONN=?	+MCONN: <range of supported configurations>	

The following table shows the +MCONN parameters.

Table 4-239: +MCONN Parameters

<Parameter>	Description
<configuration>	Connectivity Configuration: 1 - USB (Data) + UART1 (Control) 2 - USB (Data + Control) 3 - UART1 (Data + Control) 4 - USB (Data) + USB (Control) 5 - UART1 (Data) + UART2 (Control) See “Multiple Channel Configurations” for more details about the different configurations.

Note: Conflicts between MCONN and MPLOG on the UART will cause an error.
On MCONN 2 or 3 (single channel), CSD call cannot be established while there's an active MIPCALL and vice versa.

Example

```
AT+ MCONN =1
OK
```

```
AT+ MCONN?
+ MCONN: 1
OK
```

```
AT+ MCONN =?
+ MCONN: (1-4)
OK
```

4.16.1.3. +MPLOG, SW Logging

This command configures the logging channel.

Command Type	Syntax	Response/Action	Remarks
Set	+MPLOG=<n>	OK or: +CME ERROR: <err>	Setting takes effect after power cycle.



Read	+MPLOG?	+MPLOG:<active diagnostic configuration> OK	
Test	+MPLOG=?	+MPLOG: <range of supported diagnostic configurations>	

The following table shows the +MPLOG parameters.

Table 4-240: +MPLOG Parameters

<Parameter>	Description	Remarks
< n >	Diagnostic Channel Configuration: 0 - Disable logs 1 - USB 2 - UART1 3 - UART2	

Note: Conflicts between MCONN and MPLOG on the UART will cause an error.

Example

`AT+MPLOG=1 // set the diagnostic over the USB`

4.17. Multi Channeling

Multi channeling provide multiple connection channels between the TE and H24. This service enables the TE device to run multiple applications (such as packet or CSD, SMS and voice calls) while communicating simultaneously with the H24.

4.17.1. Multi Channeling Overview

Multi channeling allows several parallel connections, each has its own related service on the unit. The available services are (see Figure 4-10):

- **Internal TCP/IP Binary -**
Raw data in online data mode transfers via established network connection (socket), based on internal TCP or UDP protocol stack.
- **Internal TCP/IP Text -**
Text transfers in command mode via established network connection (socket), based on internal TCP or UDP protocol stack.
- **CSD -**
CSD (Circuit Switch Data) bearer service provides both a transparent and non-transparent (error correction and flow control).
- **External TCP/IP -**
Initialize communication between the terminal and the Packet Data Network (PDN), based on external stack over a PPP channel.
- **AT control -**
Basic command mode.



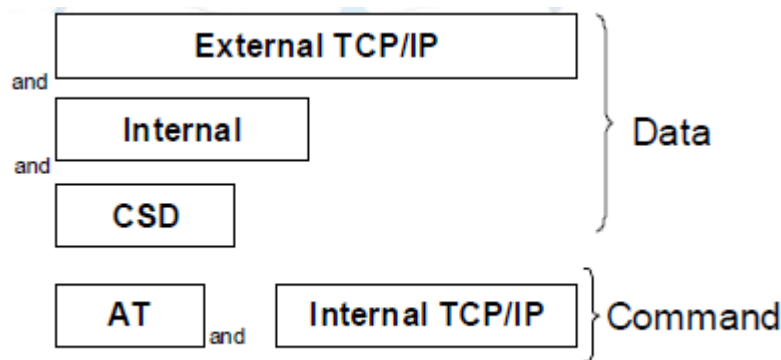


Figure 4-10: Multi Channeling Available Services

4.17.2. Multiple Channel Configurations

The currently available configurations by +MCONN command are:

- Two channels configuration - USB (Data) + UART1 (Control)
- One channel configuration - USB (Data + Control)
- One channel configuration - UART1 (Data + Control)
- Two channels configuration - USB (Data) + USB (Control)
- Two channels configuration - UART1 (Data) + UART2 (Control)

4.17.2.1. One Channel Configurations

This type of configuration is a basic one - only one channel is available. This channel will serve both for Data & Control communication channel.

4.17.2.2. Two Channel Configurations

When two AT commands channels are open for communication between H24 and TE - one of them will be defined as "Control" while the other will be defined as "Data" (see Figure 4-11).

Note: While a control AT command is processed in one channel, the second channel is unavailable for another AT command.

Example:

When in AT+MCONN=1 (UART1 + USB), and AT+COPS=? is processed (few seconds) on UART1, the USB channel is unavailable for any other AT command processing.

This constraint only apply to simultaneous AT commands and not to simultaneous data and control.



Control channel:

Mode: Text only

Permitted AT commands: All AT commands except for Data Call related.

Data Channel: Mode:

Text & Binary

Permitted AT commands: Call control commands that allow establishing and terminating the data session other essential commands.

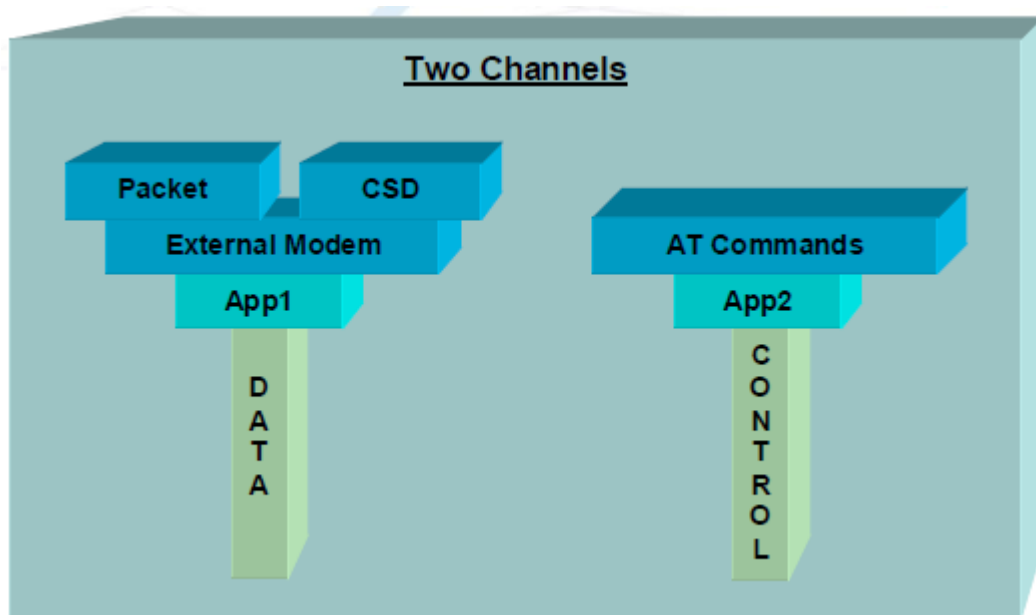


Figure 4-11: Two-channel Configuration

4.17.3. AT Commands per Channel Configuration

The following two tables provide the AT commands that are allowed for each channel. The first table list all the executable at commands with there allowed channels.

The second table lists all the unsolicited result code with there allowed channels.

Use the following legend for the Profile Definition:

- P: Profile command - Per channel setting
- U: Unsolicited command - Enable/disable unsolicited for allowed port
- P-U: Unsolicited command - Enable/disable unsolicited per channel

Currently there are only 2 channels, therefore only columns 1 (All Data connections) & 2 (Control) are relevant.



Channels 3-6 are applications/services:

- Channels 3, 4, 5 are data services, will be applicable on the data channel.
- Channel 6 will be applicable on the control channel.

Example

+CRC which is profile and unsolicited, can be execute on Generic Data channel and Control channel. In case separate channels exist (CSD, external packet data, ODM) it will be enable only for CSD channel.

Table 4-241: Multi Channeling AT Permission

Channel	1	2	3	4	5	6		
Command	All Data Connections	Control	External Packet Data	CSD	Internal Binary Packet Data (ODM)	Internal IRA Packet Data	Comment	Note Unsolicited indication (U) and/or per channel profile (P)
\$QCDMG	v	v	v	v	v	v		
&C	v	v	v	v				P
&D	v	v	v	v				P
&F	v	v	v	v				P
&K	v	v	v	v	v	v		
&Q	v	v	v	v				
&V		v						
&W		v						
&Y		v						
\S	v	v	v	v				
+CALM		v						
+CBAUD	v	v	v	v	v	v		
+CBC		v						
+CBST	v			v				



Multi Channeling AT Permission (Cont.)

Channel	1	2	3	4	5	6		
Command	All Data Connections	Control	External Packet Data	CSD	Internal Binary Packet Data (ODM)	Internal IRA Packet Data	Comment	Note Unsolicited indication (U) and/or per channel profile (P)
+CCFC		v						
+CCLK		v						
+CCWA		v					Unsolicited result code: +CCWA	P - U
+CEER	v	v	v	v	v	v		
+CFUN		v						
+CGACT	v	v	v					
+CGATT	v	v	v					
+CGCLASS	v	v	v					
+CGDCONT	v	v	v					
+CGEQMIN	v	v	v					
+CGEQREQ	v	v	v					
+CGMI	v	v	v	v				
+CGMM	v	v	v	v				
+CGMR	v	v	v	v				
+CGPADDR	v		v					
+CGQMIN	v	v	v					
+CGQREQ	v	v	v					
+CGREG		v					Unsolicited result code: +CGREG	P - U
+CGSMS		v						
+CGSN	v	v	v	v				
+CHLD		v						
+CIMI		v						
+CIND		v						
+CLAC		v						
+CLAN		v						



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+CLCC		v					Unsolicited result code: +CLCC	P - U
-------	--	---	--	--	--	--	-----------------------------------	-------

Multi Channeling AT Permission (Cont.)

Channel	1	2	3	4	5	6		
Command	All Data Connections	Control	External Packet Data	CSD	Internal Binary Packet Data (ODM)	Internal IRA Packet Data	Comment	Note Unsolicited indication (U) and/or per channel profile (P)
+CLCK		v						
+CLIP	v	v		v			Unsolicited result code: +CLIP	P - U
+CLIR		v						
+CLVL		v						
+CMEE	v	v	v	v	v	v		P
+CMER (CIEV only)		v					Unsolicited result code: +CIEV	P - U
+CMGC		v						
+CMGD		v						
+CMGF		v						P
+CMGL		v						
+CMGR		v						
+CMGS		v						
+CMGW		v						
+CMSS		v						
+CMUT		v						
+CNMA		v						
+CNMI		v					Unsolicited result code: +CBM +CDS +CDSI +CMT +CMTI	U
+CNUM		v						
+COLP		v					Unsolicited result code: +COLP	P - U



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+COPN		v						
+COPS		v						
+CPAS		v						
+CPBF		v						

Multi Channeling AT Permission (Cont.)

Channel	1	2	3	4	5	6		
Command	All Data Connections	Control	External Packet Data	CSD	Internal Binary Packet Data (ODM)	Internal IRA Packet Data	Comment	Note Unsolicited indication (U) and/or per channel profile (P)
+CPBR		v						
+CPBS		v						P
+CPBW		v						
+CPIN		v						
+CPLS		v						
+CPMS		v						
+CPOL		v						
+CPUC		v						
+CPWD		v						
+CR	v			v			Unsolicited result code: +CR	P – U
+CRC	v	v		v			Unsolicited result code: +CRING	P – U
+CREG		v					Unsolicited result code: +CREG	P – U
+CRLP		v						
+CRSL		v						
+CRSM		v						
+CRTT		v						
+CSCA		v						
+CSCB		v						
+CSCS		v						
+CSDH		v						
+CSIM		v						



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+CSMP		v						
+CSMS		v						
+CSQ		v						
+CSSN		v					Unsolicited result code: +CSSI +CSSU	P – U

Multi Channeling AT Permission (Cont.)

Channel	1	2	3	4	5	6		
Command	All Data Connections	Control	External Packet Data	CSD	Internal Binary Packet Data (ODM)	Internal IRA Packet Data	Comment	Note Unsolicited indication (U) and/or per channel profile (P)
+CUSD		v					Unsolicited result code: +CUSD	P – U
+EPIN	v	v	v	v				
+ES	v			v				
+ESA	v			v				
+FCLASS	v			v				P
+FMI	v			v				
+FMM	v			v				
+FMR	v			v				
+FRH	v			v				
+FRM	v			v				
+FRS	v			v				
+FTH	v			v				
+FTM	v			v				
+FTS	v			v				
+GMI	v	v	v	v				
+GMM	v	v	v	v				
+GMR	v	v	v	v				
+GSN	v	v	v	v				
+ICF	v	v	v	v	v	v		
+IFC	v	v	v	v	v	v		
+IPR	v	v	v	v	v	v		



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+MACRXG		v						
+MACSTG		v						
+MACTXG		v						
+MAEC		v						
+MAFRST		v						
+MAGRST		v						
+MAHSD		v						
+MAMOD		v						
+MANS		v						

Multi Channeling AT Permission (Cont.)

Channel	1	2	3	4	5	6		
Command	All Data Connections	Control	External Packet Data	CSD	Internal Binary Packet Data (ODM)	Internal IRA Packet Data	Comment	Note Unsolicited indication (U) and/or per channel profile (P)
+MAST		v						
+MATXV		v						
+MBAND		v						
+MCI		v						
+MCONN	v	v	v	v	v	v		
+MCTYPE		v						
+MCWAKE		v						U
+MDC		v						
+MFIC		v						
+MFOTAABORT		v						
+MFOTACNFG		v					Unsolicited result code: +MFOTAREQ	U
+MFOTAIND		v					Unsolicited result code: +MFOTAIND	U
+MFOTAINSTL		v						
+MFOTAREQ		v						
+MFOTARSP		v						
+MFOTAWSCFG		v						
+MIOC		v						



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+MIOD		v						
+MIPCALL						v		U
+MIPCLOSE	v				v	v		U
+MIPCONF	v				v	v		
+MIPCSC	v			v	v	v		
+MIPDATA	v				v	v		
+MIPFLUSH						v		U
+MIPOPEN						v		U
+MIPPUSH						v		U
+MIPRTCP						v		U
+MIPRUDP						v		U
+MIPSEND						v		U

Multi Channeling AT Permission (Cont.)

Channel	1	2	3	4	5	6		
Command	All Data Connections	Control	External Packet Data	CSD	Internal Binary Packet Data (ODM)	Internal IRA Packet Data	Comment	Note Unsolicited indication (U) and/or per channel profile (P)
+MIPSETS						v		U
+MIPSSL	v				v	v		
+MIPSTAT	v				v	v		U
+MIPXOFF						v		U
+MIPXON						v		U
+MMGL		v						
+MMGR		v						
+MODE	v	v	v	v	v	v		
+MPCMC		v						
+MPCMM		v						
+MPDS	v	v	v	v	v	v		
+MPING	v	v			v	v		
+MPLOG	v	v	v	v	v	v		
+MPPP	v	v						
+MPWRDN	v	v	v	v	v	v		
+MREFLASH	v	v	v	v	v	v		
+MRICS		v						



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+MSCTS	v	v	v	v	v	v		
+MSLEEP		v						
+MTTY		v						
+MVC		v						
+MVREF		v						
+PACSP		v						
+TGFCC		v						
+TWFC		v						
+TPIN		v						
+VTD		v						
+VTS		v						
+WS46		v						
A	v	v	v	v				
A/	v	v	v	v				
AT	v	v	v	v	v	v		

Multi Channeling AT Permission (Cont.)

Channel	1	2	3	4	5	6		
Command	All Data Connections	Control	External Packet Data	CSD	Internal Binary Packet Data (ODM)	Internal IRA Packet Data	Comment	Note Unsolicited indication (U) and/or per channel profile (P)
D	v			v			Dial CS data	
D*99#	v		v					
D;		v					Dial voice	
D>	v	v		v				
DL	v	v		v				
E	v	v	v	v				P
H	v	v	v	v				
I	v	v	v	v				
O	v		v	v				
Q	v	v	v	v				P
S0	v	v	v	v				P
S100	v	v	v	v				
S102	v	v	v	v				
S12	v			v				P



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S2	v	v	v	v				P
S24	v	v	v	v				
S3	v	v	v	v				P
S4	v	v	v	v				P
S5	v	v	v	v				P
S7	v	v	v	v				
S8		v						P
Temperature measure		v						
V	v	v	v	v				P
X	v			v				
Z	v	v	v	v				



Table 4-242: Multi Channeling Unsolicited Result Code Permission

Channel	1	2	3	4	5	6		
Command	All Data Connections	Control	External Packet Data	CSD	Internal Binary Packet Data (ODM)	Internal IRA Packet Data	Comment	Enable / Disable by Unsolicited Command
RING / CRING data/fax call	v			v				None - incoming data/fax call
RING / CRING voice call		v						None - incoming data call
RING/CRINGMT GPRS Alert							Not supported	None -GPRS MT call
+CBM		v						+CNMI
+CCWA		v						+CCWA
+CDS		v						+CNMI
+CDSI		v						+CNMI
+CGREG		v						+CGREG
+CIEV		v						+CMER
+CLCC		v						+CLCC
+CLIP	v	v		v				+CLIP
+CMT		v						+CNMI
+CMTI		v						+CNMI
+COLP		v						+COLP
+CR	v			v				+CR
+CREG		v						+CREG
+CRING	v	v		v				+CRC
+CSSI		v						+CSSN
+CSSU		v						+CSSN
+CUSD		v						+CUSD
+MCWAKE		v						+MCWAKE
+MIPCALL						v		+MIPCALL
+MIPCLOSE					v	v		+MIPCALL
+MIPFLUSH						v		+MIPCALL
+MIOPEN						v		+MIPCALL
+MIPPUSH						v		+MIPCALL
+MIPRTCP						v		+MIPCALL
+MIPRUDP						v		+MIPCALL
+MIPSEND						v		+MIPCALL
+MIPSETS						v		+MIPCALL
+MIPSTAT					v	v		+MIPCALL
+MIPXOFF						v		+MIPCALL
+MIPXON						v		+MIPCALL



Multi Channeling Unsolicited Result Code Permission (Cont.)

Channel	1	2	3	4	5	6		
Command	All Data Connections	Control	External Packet Data	CSD	Internal Binary Packet Data (ODM)	Internal IRA Packet Data	Comment	Enable / Disable by Unsolicited Command
+MFOTAREQ		v						+MFOTACNFG
+MFOTAIND		v						+MFOTAIND



4.17.4. Multiple Channel Definitions

The following table provides various multiple channel definitions.

Table 4-243: 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. Note: RING command always sends
AT+MCONN command	All channels can receive this command, to change to current connectivity configuration.
Not allow Error	Any channel receiving a not allowed command returns an ERROR response - +CMEE: "operation not allowed on channel".
Common settings for all channels	Settings that are not stored in the modem profile, but are global and shared by all channels. Any modification to these settings overrides the previous settings in all the other channels. For example, phonebook, network, SIM, and audio settings. These settings are allowed only on one channel. Per channel settings are mentioned in the last column in table as "P".

4.17.5. GPRS Definitions

The definitions below are valid for cases where H24 is camped on 2G (GPRS) network:

- A GPRS session is suspended when a voice/CSD call is connected to the H24. 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 H24 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.



5. Chapter 4: Using the Commands

5.1. Recommended H24 Initialization after Powerup

Figure 5-1: provides a recommended workflow for initializing the H24 after startup. The following sections explain this workflow in detail.

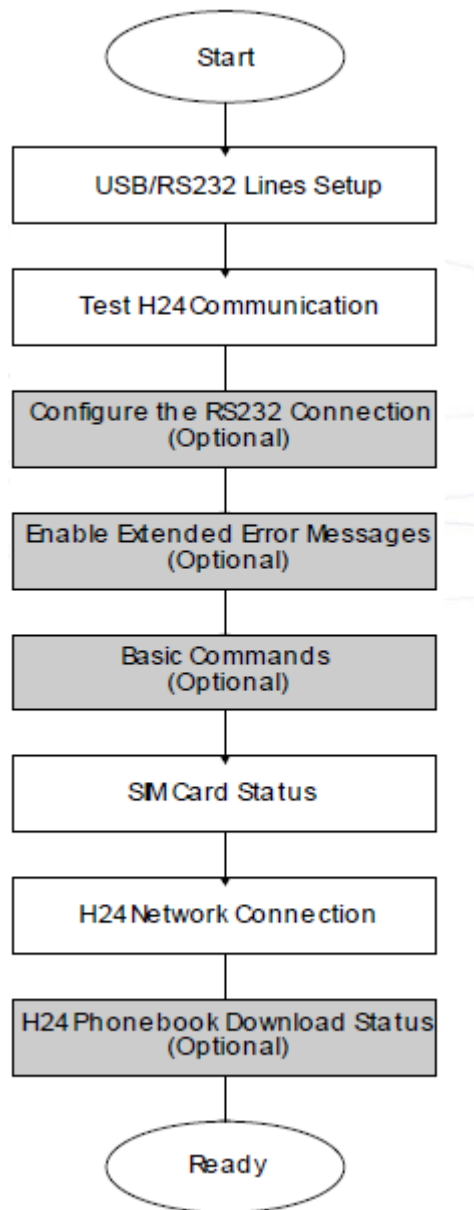


Figure 5-1: Recommended H24 Initialization Workflow



5.1.1. RS232/USB Lines Setup

H24 dynamically detects USB device attachment/Removal, while RS232 device considered "always

attached". H24

allows using:

1. Both USB and RS232 ports in parallel, when one of them may be used for control operations, while the second is used for data transfer.
2. One port - either RS232 or USB.

For details see AT+MCONN

command.

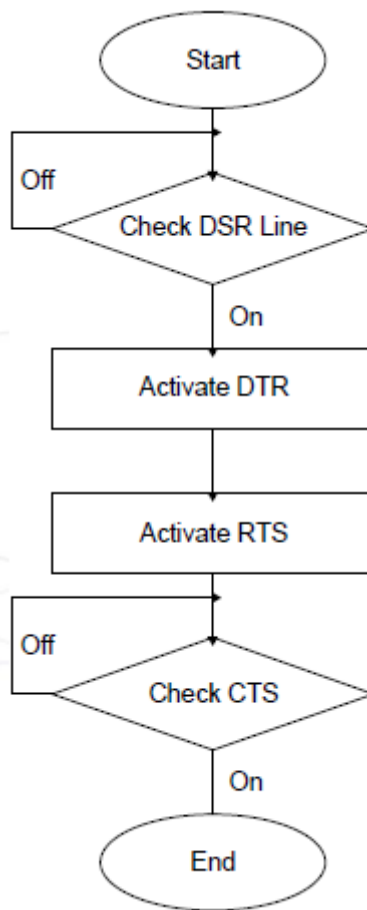


Figure 5-2: RS232 Lines Setup



5.1.2. Test H24 Communication

This is a preliminary step. During this step, the ability to communicate with the H24 using AT commands is tested.

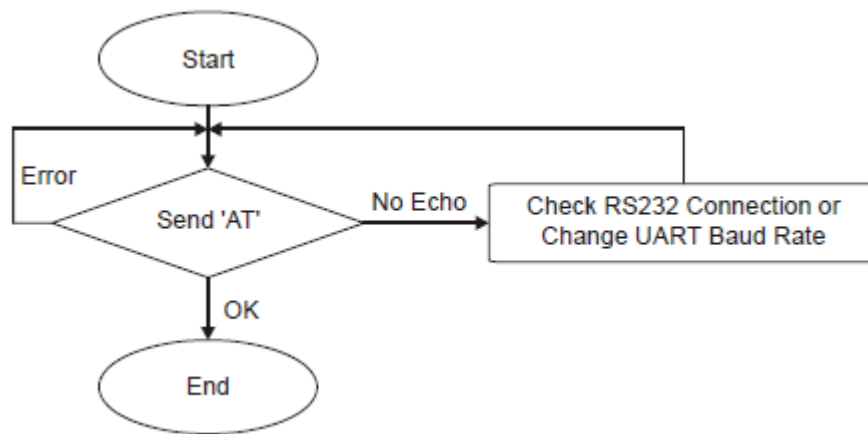


Figure 5-3: Test H24 Communication

Communication example:

AT	
ATE1	//By default, the echo should be enabled
AT	
OK	//Confirm that H24 replies with OK



5.1.3. 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.

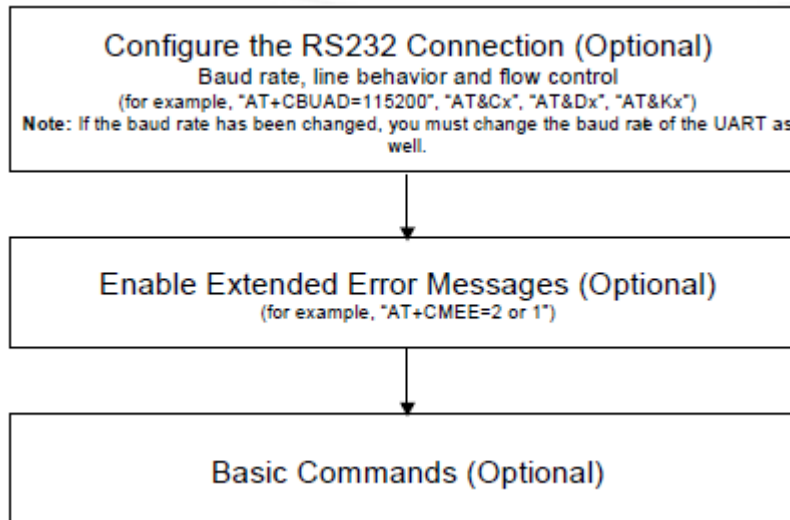


Figure 5-4: Basic Configuration



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): +CGMI,+CGMM,+CGMR,+CGSN
AT+CGMI
+CGMI: "Motorola"
OK
AT+CGMM
+CGMM:
"GSM900","GSM1800","GSM1900","GSM850","MODEL=H24" OK
AT+CGMR
+CGMR: "H24_G_0C.11.45R"
OK
AT+CGSN//Read the IMEI number of the H24
+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



5.1.4. 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.

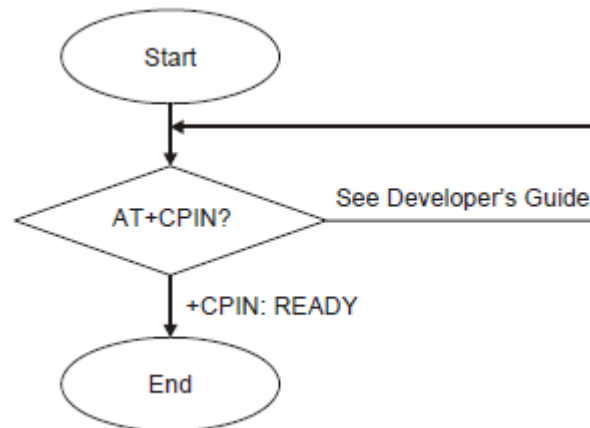


Figure 5-5: SIM Card Status

Note: For a full description of SIM states, see “+CPIN, Enter PIN for Unlocking SIM Card or Enter PUK for Unlocking SIM Card”. 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).
ZZZZ is the new defined PIN/PIN2 password (4-8 digits long).



5.1.5. H24 Network Connection

In this step, the H24 detects existing networks (the user must register to a specific network).

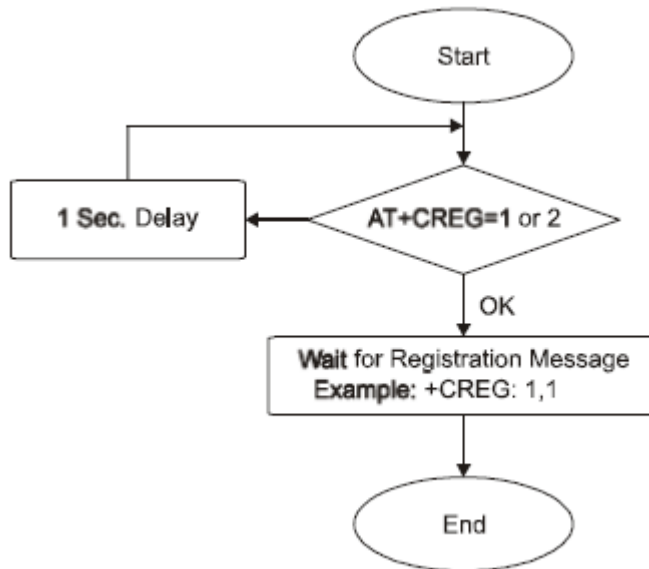


Figure 5-6: H24 Network Connection

1. Registration and call indications example: +CREG, +CLCC
AT+CREG=2
OK
AT+CLC
C=1
OK
2. Get available networks example: +COPS
at+cops=?
+COPS: (2,"IL ORANGE","ORANGE","42501",2),(1,"IL
ORANGE","ORANGE","42501",0),(3,"IL Telephone","PCL","42503",2),(3,"IL
Cellcom","Cellcom","42502",0),(3,"IL Cellcom","Cellcom","42502",2),(0,1,2,3,4),(0,1,2)
OK
3. Get registration messages example: +CREG
AT+CGREG=1
OK
+CREG: 1
AT+CREG=2
OK
+CREG: 1,2648,988b
4. Get GPRS registration status example: +CGREG
AT+CGREG=2
OK
+CGREG: 1,2648,988b

5.1.6. Terminal Synchronization

In this step, the terminal requests the stored phonebook, SMS, and so on, from the H24.

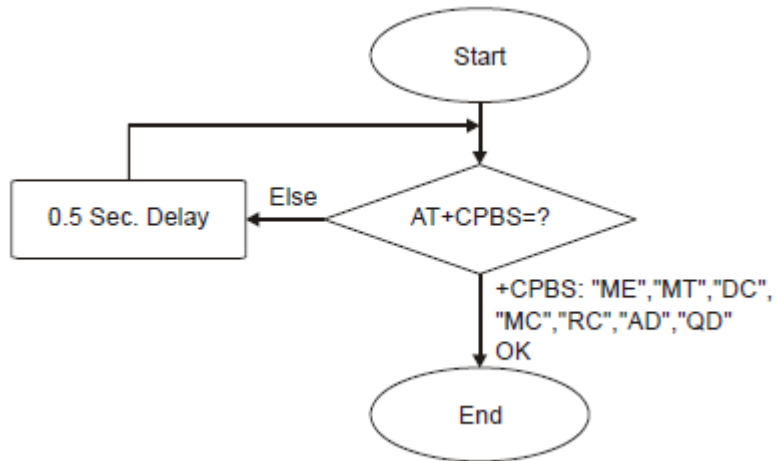


Figure 5-7: Terminal Synchronization



5.2. SMS

5.2.1. Managing Stored Messages in the H24 Memory

```

AT+CPMS="me" //Select NVM as preferred memory storage using the +CPMS
command
+CPMS: 11,61,11,61,2,20
OK
AT+CMGF=1 // move to TEXT mode
OK
AT+CMGL="ALL" //List all messages in memory storage
+CMGL: 225,"STO UNSENT","054565132"
<Message body>
+CMGL: 223,"STO UNSENT","4565029" //Example of H24 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 unspent 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"
<Message body> OK AT+CMGR=9
+CMS ERROR: invalid index
AT+CPMS="sm"
+CPMS: 2,20,11,61,2,20
OK AT+CMGR=9
+CMGR: "REC UNREAD","+97254565132","05/02/18,"21:22:23+08"
<Message body> OK
AT+CSDH=1
OK AT+CMGR=9
+CMGR: "REC UNREAD","+97254565132","05/02/18,"21:22:23+08",145,4,0,0,"+
97254120032",145,<message length>
<Message body> OK
    
```




```
AT+CMGF=0
OK AT+CMGR=129
+CMGR: 2,,1
079179521201009519FF0A815
04465054300005030511222328
00141
AT+CMGW=24
>
079179521201009519000c9179
52428650290000AABBAABB
AABB010441424344
+CMGW: 146
OK
```

5.2.4. Sending Messages (Using AT+CMGS)

Sends an SM from the H24 to the network in TEXT mode, the header parameters will be set according to CSMP settings. 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. Returns the Message Reference
OK
AT+CMGS="+97254565028",145 //Writing a message to be sent to specified destination address
>message text <CTRL/Z>
+CMGS: 239 //Message successfully sent. Returns the Message Reference
OK
```

5.2.5. 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
```



5.3. Call Control

The following figure is a detailed view of the states the H24 goes through for outgoing voice call. Note that between the first "OK" is received to the second "OK" the actual connection occurs (call state is alert).

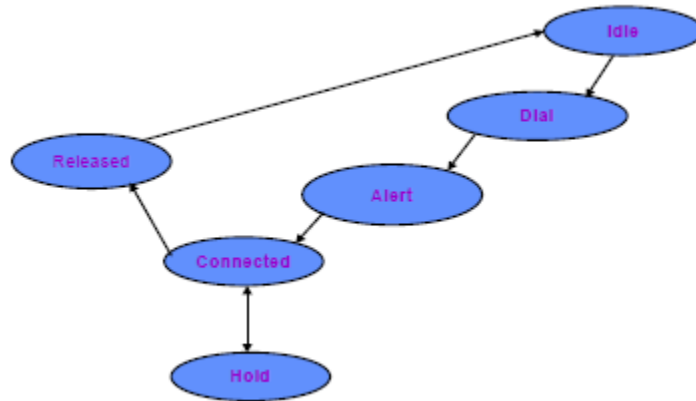


Figure 5-8: Call States



5.3.1. 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
...
CONNECT                  //Move to online Data state
+++                      //ESC sequence back to the Command state. terminal (+++ is not
displayed)               +++ is sent from the
ath                        //Hang up data call
NO CARRIER
OK                          //Data call terminated
AT+FCLASS=1              //change outgoing call type to fax
OK AT+CBST=7,1,0
// set bearer service setting to fax
OK
AT+COPS=,,0              // change to GSM <RAT>
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

```



5.3.3. Dialing the Last Number Example

```

atd03565827
8; 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

```



5.3.4. Voice Call Manipulations

5.3.4.1. Call Waiting

```

AT+CCWA=1 //Enabling the call waiting on H24
OK
atd9311234567; //Originate a voice call
OK
OK //Voice call connected
(...conversation...)
+CCWA: "+358317654321",145,1,"Bob"//Call-waiting indication received by the H24; Bob is calling
+CCWA: "+358317654321",145,1,"Bob"
AT+CHLD=0 //Release the waiting call
OK
NO CARRIER //Current call is still active
  
```

5.3.4.2. Call Forwarding

```

AT+CCFC=3,"0545658278" //Network register UC forward-to default classes - voice and fax
OK
AT+CCFC=0 //Network activate UC forward-to default classes - voice and fax
OK //At this point, the H24 will not receive voice nor fax calls. These
calls will be forwarded by the network to phone number
0545658278

AT+CCFC=0,2 //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
  
```

5.3.4.3. 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
  
```



```
+(Verify 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
```



5.4. Data Call

5.4.1. Switching Modes (Data Mode/Command Mode)

```

atd054565190           //Calling the remote modem
CONNECT
aaaaaaaaaaaa           //Receiving binary data from remote side (H24 is in Data mode)
//Sending escape sequence +++ to H24 (the remote side does not treat +++ as
escape) OK             //H24 is in Command mode
ati3                   //Issuing an AT command
Motorola M2M Cellular Module
OK
ato                   //Switching back to Binary mode
OK
ffffff               //Receiving binary data from remote
side fghhgatfhgfhghhhfhfhghfhfhgfhghgfhgfhghh
+++                   //Sending escape sequence +++ to the H24
ath                   //Hang up the CSD call (return to Command
mode) OK
NO CARRIER

```



5.5. Packet Data

When using the packet data, it is recommended to implement a "keep alive" mechanism.

The H24 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 H24 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 H24 packet data network resources are in an active session, user should not manually detach from the network or place a CSD call etc.

Note: The basic packet data concept is be “always connected” and there is no charge for being connected (only per real data transferred). packet data users are advised to connect the packet data network once in the beginning of a session and remain connected rather than 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.

5.5.1. Establishing Packet Data PDP Context

When using the packet data network for any IP data, you must be attached to the packet data network before activating PDP context.

5.5.1.1. Activating a Saved Profile in H24

```
AT+CGATT=1 //By default, after power-up, the H24 attaches to the packet data
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
```

5.5.1.2. Two Ways to Activate PDP Context

Each of the two main ways in which to activate PDP context are described below.

Using the Packet Data Wizard Application

1. Double-click the button predefined as the dialer for this provider to automatically establish PDP context. If the H24 was not previously attached to packet data, 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 H24 as a port to the Internet.
5. Usage:
 - Open the packet data 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 packet data session message will be displayed.
- Minimize the packet data wizard window and use your http/ftp browser (Internet Explorer, Netscape).

Using the ATD* Command Set

Request packet data 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 H24 will first try to activate a non-empty (predefined) CID. If the attempt fails, the H24 will try the next CID, and so on.

Note: When buffering the terminal message, data in the H24 (both inbound and outbound data), the following apply:

- Turning off the H24 clears any buffered data.
- Removing power from the H24 clears any buffered data.
- Whenever the terminal drops the PPP connection with the H24, via LCP terminate, the buffered data is cleared.
- Whenever the H24 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 H24 buffer.
- Whenever the H24 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 H24 buffer is cleared.
- When the H24 transfers data in the uplink and packet data 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 packet data 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 H24 deactivates the PDP session.



5.6. Changing the Character Set

Example

When an SMS messages with the following text: "Motorola H24 OEM Module", is saved inside the H24 at entry 128, you can read it using several character sets.

When the "IRA" character set is used, the following is received by the terminal:

```
AT+CSCS?           //Read the current character set
+CSCS: "IRA"       //Currently using IRA character set
OK
AT+CMGR=128        //Read SMS entry 128
+CMGR: "STO UNSENT", ""
Motorola H24 OEM Module //The content of SMS entry 128
OK
```

When the "UCS2" 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", ""
004D006F0074006F0072006F006C006100200067003200300020004F0045004D
0020004D006F00640075006C0065 //The content of SM entry 128
OK
```

The following is an IRA 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 IRA letters, each digit quadruplet starts with double zeros (00). When other languages are used, the quadruplets have different values.



5.8. TCP/IP: MIP Commands Using Cases

5.8.1. PDP Context (MIP call) Activation/Deactivation

PDP context activation is based on specific network service provider parameters, such as APN (Access Point Name), user name and password. When PDP context activation completes successfully, a network connection is established and the user receives a valid IP from its network service provider. User should configure specific PDP context (in particular APN of network service provider) before activation, using +CGDCONT command (refer to +CGDCONT command description) as shown in the example below.

```
AT+CGDCONT=1,"IP","internet","0.0.0.0",0,0
OK
```

The operation configured CID #1 by assigning "internet" as the APN name. Refer to your network service provider for more details about appropriate APN names.

The CID number is +MIPCALL's third mandatory parameter. When +MIPCALL command is used, the CID parameter should be configured with a valid APN name for a successful PDP activation.

When PDP context is configured, the user will be able to activate the context by +MIPCALL 'set' command, as shown below:

```
AT+MIPCALL=1,1,1
OK
```

In this example, CallID parameter = 1 and Operation parameter = 1 (i.e. PDP context activation). The valid values for CallID are 1 or 2. An invalid CallID value will result with "numeric parameters out of bounds" error.

+MIPCALL command initiates a PDP activation process. The module reports about a PDP activation process with a +MIPCALL unsolicited response, as shown below:

```
+MIPCALL: 1,1,"172.16.19.201"
```

User may interrupt a PDP activation process by issuing "+MIPCALL=<CallID>,0" (where Operation parameter = 0 - means PDP context deactivation) in any stage of the process. When the user interrupts a PDP activation before +MIPCALL: <CallID>,<CallStatus>,<LocalIP> unsolicited response is received, the module generates "+MIPCALL: <CallID>,0" unsolicited response as shown below:

```
AT+MIPCALL=1,1,1
OK
AT+MIPCALL=1,0
OK
+MIPCALL: 1,0
```

User is able to activate up to 2 PDP contexts (up to 2 MIP calls) simultaneously. Actual feature implementation prohibits a PDP activation based on APN, already used for another active PDP. The following example shows two PDP contexts, activated on different APNs.

```
AT+CGDCONT=1,"IP","internet","0.0.0.0",0,0
OK
AT+CGDCONT=5,"IP","wap","0.0.0.0",0,0
OK
AT+MIPCALL=1,1,1
OK
+MIPCALL: 1,1,"172.16.194.255"
AT+MIPCALL=2,1,5
```



OK
+MIPCALL: 2,1,"172.18.38.35"

The user can get information about an already activated PDP context by +MIPCALL 'read' command, as follows:

AT+MIPCALL?
+MIPCALL: 1,1,"172.16.194.255"
+MIPCALL:
2,5,"172.18.38.35" OK

An active PDP context can be deactivated either by the user or by the module (Network). When the module receives a PDP context deactivation message from the Network, or detects a SIM card was removed, it informs the user about a PDP context inactive by sending "+MIPCALL: <CallID>,0" unsolicited response for each active CallID.

5.8.2. Socket Operations

5.8.2.1. Open/Close a Socket

Actual MIP implementation supports up to 20 socket id's, each of them may be used to open a TCP (active or listen) socket as well as opening a UDP socket. The following example demonstrates how to obtain a list of unoccupied sockets by +MIOPEN 'read' command.

AT+MIOPEN?
+MIOPEN: 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20
OK

The user is able to open a socket (available from the list above) by +MIOPEN 'set' command, as shown below (assuming, that a PDP context was successfully activated by +MIPCALL with 'call id' parameter = 1).

AT+MIOPEN=1,1,1080,"www.google.com",80,0
OK
+MIOPEN: 1,1,1

As shown in this example, socket id = 1 is opened, with the following parameters:

protocol: TCP

local port:

1080 remote

port: 80

remote network address: www.google.com

After the socket open process is initiated, its id is removed from list of unoccupied sockets.

At this stage, the unoccupied sockets' list will look as follows:

AT+MIOPEN?
+MIOPEN: 2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20
OK

Let's open one more socket:

AT+MIOPEN=1,3,1082,"www.yahoo.com",80,0
OK
+MIOPEN: 1,3,1



Now, the list of unoccupied sockets will look, like this:
AT+MIOPEN?

```
+MIOPEN: 2,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20
OK
```

Please, note, that if a socket id is not in the list of unoccupied sockets, it does not necessarily mean, that the socket is completely open. It means that a socket is not in idle state. User is required to wait for the +MIOPEN unsolicited response to surely know if the process has succeeded or failed.

The example below demonstrates an unsuccessful socket opening case with the different responses for querying the "list of unoccupied sockets" between +MIOPEN command and +MIOPEN unsolicited response:

```
AT+MIOPEN=1,1,1080,"www.yahoo.com",80,0<-- socket id 1 open request
OK
AT+MIOPEN?
+MIOPEN: 2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20
OK
+MIOPEN: 2,1,0 <-- socket id 1 open unsuccessful result
AT+MIOPEN?
+MIOPEN: 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20
OK
```

Another way to know what socket is not in idle state is +MIPCLOSE 'read' command. The command returns the list of not-idle sockets per MIP call id (socket with a possibility to close), see the next example:

```
AT+CGDCONT?
+CGDCONT: 1,"IP","internet","0.0.0.0",0,0
+CGDCONT: 8,"IP","wap","0.0.0.0",0,0
OK
AT+MIPCALL=1,1,1 <-- create 1st MIPCALL (call id = 1)
OK
+MIPCALL: 1,1,"172.16.94.38"
AT+MIPCALL=2,1,8 <-- create 2nd MIPCALL (call id = 2)
OK
+MIPCALL: 2,1,"172.18.62.178"
AT+MIOPEN=2,1,1080,"www.yahoo.com",80,0<-- open socket id = 1 based on call id = 2
OK
AT+MIOPEN=1,8,1082,"www.yahoo.com",80,0<-- open socket id = 8 based on call id = 1
OK
AT+MIOPEN=1,9,1084,"www.yahoo.com",80,0<-- open socket id = 9 based on call id = 1
OK
AT+MIPCLOSE?
+MIPCLOSE: 1:8,9 <-- socket ids 8 and 9 are able to close, regardless to +MIOPEN
unsolicited response not received yet
+MIPCLOSE: 2:1 <-- socket id 1 is able to close, regardless to +MIOPEN
unsolicited response not received yet
OK
+MIOPEN: 1,8,1 <-- socket id 8 open success unsolicited response
+MIOPEN: 1,9,1 <-- socket id 9 open success unsolicited response
AT+MIPCLOSE=1 <-- socket id 1 close request
OK
+MIPCLOSE: 1,0
```

When no sockets are open for a call id, +MIPCLOSE returns 0 socket ids per call id, as shown in the example below:
AT+MIPCALL?



```
+MIPCALL: 1,1,"172.16.94.38"
+MIPCALL:
2,8,"172.18.62.178" OK
AT+MIPCLOSE?
+MIPCLOSE: 1:0
+MIPCLOSE: 2:0
OK
```

5.8.2.2. Close a Socket

The user is able to close a socket in any non-idle state by +MIPCLOSE 'set' command, as follows:
AT+MIPCLOSE?

```
+MIPCLOSE: 1:1
OK
```

```
AT+MIPCLOSE=1
OK
```

```
+MIPCLOSE: 1,0
```

Close a socket by closing a MIP call

When an active MIP call is closed, the call-based opened sockets are close automatically, as shown in the example below:

```
AT+MIPCALL=1,1,1
OK
```

```
+MIPCALL: 1,1,"172.16.118.53"
```

```
AT+MIPOPEN=1,12,1086,"www.google.com",8
```

```
0,0
OK
```

```
+MIPOPEN: 1,12,1
```

```
AT+MIPOPEN=1,1,1080,"www.yahoo.com",80,0
OK
```

```
+MIPOPEN: 1,1,1
```

```
AT+MIPCALL=1,0
OK
```

```
+MIPSTAT: 12,4
```

```
+MIPSTAT: 1,4
```

```
+MIPCALL: 1,0
```



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The +MIPSTAT socket status unsolicited response with status value 4 (Network error) means, the socket closed as result of Network error (Network closed). When an active MIP call is closed and

a non-connected socket is opened (for example listen socket without an accepted connection), +MIPOPEN error report is sent to user instead of +MIPSTAT response as shown in the example below:

```
AT+MIPCALL=1,1,1
OK
```

```
+MIPCALL: 1,1,"172.16.166.42"
```

```
AT+MIPOPEN=1,1,1200,"0.0.0.0",0,0
OK
```

```
AT+MIPOPEN=1,6,1088,"www.yahoo.com",80,0
OK
```

```
+MIPOPEN: 1,6,1
```

```
AT+MIPCALL=1,0
OK
```

```
+MIPOPEN: 1,1,0
```

<-- MIPOPEN error unsolicited response on non-connected socket

```
+MIPSTAT: 6,4
```

```
+MIPCALL: 1,0
```

5.8.2.3. Online Data Mode Socket Behavior

Feature Description

The Online Data Mode (ODM) feature, allows the user to transfer binary raw data (without using the +MIPSEND and +MIPPUSH commands) between the module and Network. The data is transferred via established network connection (socket), through the module internal TCP/IP or UDP/IP protocol stack. Hereinafter, Serial will refer to RS232 or USB connection between the module and the terminal. A Serial connection with Hardware flow control is required for the feature execution.

Usage

Two Optional fields have been added to +MIPOPEN AT Command in order to open a socket in Online Data Mode. The socket connection leans on an already established PDP-IP context acquired by the command +MIPCALL. The command provides a set of parameters for the feature configuration and controls the socket behavior.

Socket behavior

When a socket is successfully opened in Online Data Mode, all data, comes from terminal, is being



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sent "as is" (binary raw data), to Network and vice versa: all data, comes from Network, is being sent "as is" to terminal.

Each socket, opened in Online Data Mode, allocates an accumulating buffer whose size is 10kb bytes. When the user sends amount of data, less then this buffer size, the data will be sent to the

Network after a spooling timeout (200 mS), otherwise the data will be sent to the Network immediately.

ODM socket can be opened in listen mode by simply omitting the <Remote-host> parameter. Upon ODM socket is opened in listen mode, it can read/write binary raw data only after accepting remote side socket (+MIPOPEN unsolicited sent to terminal).

When remote side socket is closed or a TCP error occurred, the ODM socket closes automatically, the module operation mode is restored to command mode and +MIPSTAT unsolicited response is sent to terminal.

CTS

When using a TCP ODM socket, the CTS is turned off (XOFF) to control data flow when the serial port buffer is almost full. The CTS is turned on (XON) when receiver is ready for more data.

Switching from Online Data Mode to Pseudo-Command Mode

The user can suspend an opened Online Data Mode socket for example, by transmitting an escape sequence (by default "+++") from terminal (when pseudo-command mode was enabled by +MIPOPEN <PseudoCommandMode> parameter. In this case, the module is switched to Pseudo-Command Mode, allowing the user to enter AT commands from terminal. When the ODM socket's data arrives from Network and the module is in Pseudo-Command mode, a special unsolicited event +MIPDATA will be sent to terminal indicating the amount of received bytes (see "+MIPDATA, Network Incoming Data Unsolicited Indication in Pseudo-command Mode"). The ATO command can be used to resume Online Data Mode from Pseudo-Command mode. When socket is in Online Data Mode, Serial communication DCD line is enabled.

Avoid ODM UDP Data Loss on High Data Rate

In common NWs, and especially in HSDPA NW, one MUST consider the following constraint regarding Motorola IP ODM UDP Downlink transfer session:

In order to avoid UDP significant Data Loss Rate, the best performance achieved is when using High Connectivity throughput (i.e. USB, or fast UART1) if H24 is the Receiving side. Otherwise significant UDP Data Loss Rate on the NW Layer may occur. In case slow UART is used (115200 or less) the sending side MUST limit the throughput or suffer significant Data loss.

5.8.2.4. SSL

General Description

SSL (Secure Socket Layer) and its successor TLS (Transport Layer Security) are cryptographic



protocols which provide endpoint authentication and communication privacy over the TCP/IP. There are slight differences between SSL 3.0 and TLS 1.0, but the protocol remains substantially the same. The term "SSL" as used here applies to both protocols unless clarified by context.

Cipher Suite

Cipher Suite is a set of cryptographic algorithms. A cipher suite specifies one algorithm for each of the following tasks: Key exchange, Bulk encryption and Message authentication. For example, Cipher Suite TLS_RSA_WITH_RC4_128_MD5 specifies RSA as key exchange algorithm, RC4

with key length 128 bit as a stream cipher algorithm, to encrypt data transfer after handshake, and MD5 as algorithm for SSL message authentication.

The H24 SSL feature supports the following Cipher Suites:

- TLS_RSA_WITH_AES_128_CBC_SHA
- TLS_DHE_RSA_WITH_AES_128_CBC_SHA
- TLS_DH_ANON_WITH_AES_128_CBC_SHA

5.8.2.5. Write/Send a Data Through a Socket

The user can write data to an opened socket by AT+MIPSEND command. Write data means, that the data is stored inside a socket, but not sent to Network, excluding following cases:

- socket data storage watermark reached
- socket autopush timeout expired (if enabled)

Socket data storage watermark is configured by AT+MIPSETS command (second parameter). Refer to the command's description for more details. When a socket is opened, its data storage watermark is set to a default value: 1372 bytes.

Socket autopush timeout is configured by AT+MIPSETS command (third parameter). Refer to the command's description for more details. When a socket is opened, its autopush timer is disabled (autopush timeout value = 0).

Autosend Data by Watermark Reach

Let's configure a socket #3 data storage watermark to 16 bytes and disable socket autopush timeout:

AT+MIPSETS = 3,16,0

OK

+MIPSETS: 3,0

Write 15 bytes of data (30 bytes in encoded form) to socket #3:

AT+MIPSEND=3,"6162636465666768696A6B6C6D6E6F"

OK

+MIPSEND: 3,0,1357

The unsolicited response means 1357 free bytes remained in socket storage. User can check how many bytes of data are already written to the socket data storage by invoking AT+MIPPUSH command "read":

AT+MIPPUSH?

+MIPPUSH: 3,15



OK

Write another 15 bytes of data to socket #3 and check how many bytes of data are stored in the socket data storage:

AT+MIPSEND=3,"6162636465666768696A6B6C6D6E6F"

OK

+MIPSEND: 3,0,1358

AT+MIPPUSH?

+MIPPUSH: 3,14

OK

After the 30 bytes were written, 14 bytes of data still remain in the socket data storage, because after second write operation, an amount of data in socket data storage reached the watermark (16 bytes) and first 16 bytes were sent to the Network.

Let's write 40 bytes of data to empty socket #3, with the same data storage configuration (watermark = 16 bytes):

AT+MIPSEND=3,"606162636465666768696A6B6C6D6E6F707172737475767778797A7B7C7D7E7F808182838485868

7" OK

+MIPSEND: 3,0,1364

AT+MIPPUSH?

+MIPPUSH: 3,8

OK

8 bytes of data still remain in the socket data storage, because the amount of data reached 2x16 watermark level value and the first 32 bytes of data were sent to the Network.

Write data to "flowed off" socket shown in the example below.

AT+MIPSEND=3,"6162636465666768696A6B6C6D6E6F" <-- write 15 bytes to socket #3

OK

+MIPSEND: 3,0,1357

<-- the data stored successfully

AT+MIPSEND=3,"6162636465666768696A6B6C6D6E6F" <-- write another 15 bytes to socket #3

OK

+MIPSEND: 3,0,1342

<-- the data was stored successfully, first 16 bytes will be sent to the Network.

+MIPXOFF: 3

<-- socket responds "flow off"

AT+MIPSEND=3,"6162636465666768696A6B6C6D6E6F" <-- write another 15 bytes to socket

#3

OK

+MIPSEND: 3,1,1342

<-- data write fails, because writing to "flowed off" socket is prohibited, the data is rejected

+MIPXON: 3

<-- socket responds "flow on" and the remaining 16 bytes of data are sent to

the Network automatically

AT+MIPPUSH?

+MIPPUSH: 3,14

<-- 14 bytes of data remain in socket

OK

Autosend Data by Timeout

Let's configure a socket #3 data storage watermark to 1372 bytes (max value) and socket autopush timeout to 1000 (1 sec).

AT+MIPSETS = 3,1372,1000

OK



+MIPSETS: 3,0

Write 15 bytes of data (30 bytes in encoded form) to socket #3:

AT+MIPSEND=3,"6162636465666768696A6B6C6D6E6

F" OK

+MIPSEND: 3,0,1357

and wait 1 sec. The data will send to remote side after 1 sec timer expired.

Autosend Data by Watermark and by Timeout Iteraction

Let's configure a socket #3 data storage watermark to 3 bytes and socket autopush timeout to 1000 (1 sec).

AT+MIPSETS = 3,3,1000

OK

+MIPSETS: 3,0

Write 4 bytes of data (8 bytes in encoded form) to empty socket #3:

AT+MIPSEND=3,"61626364"

OK

+MIPSEND: 3,0,1371

A +MIPSEND unsolicited response returns 1371 empty bytes value - it means, that only one byte (last byte) was stored, because first three bytes was sent as result watermark reach. The last byte will send when autosend timeout expired (after 1000 mS). The remote side will receive two packets of data:

+MIPRTCP: 1,0,616263 <-- data was sent as result watermark reach

+MIPRTCP: 1,0,64 <-- data was sent as result autopush timeout expired

Manual Data Sending

User can send data from the socket data storage to the Network by +MIPPUSH command, as shown below:

AT+MIPSEND=3,"6162636465666768696A6B6C6D6E6F"

OK

+MIPSEND: 3,0,1357 <-- 15 bytes of data written to socket

AT+MIPPUSH=3

OK

+MIPPUSH: 3,0 <-- 15 bytes of data successfully sent to the Network

Send data to "flowed off" socket shown on example below.

AT+MIPSEND=3,"6162636465666768696A6B6C6D6E6F"

OK

+MIPSEND: 3,0,1357 <-- 15 bytes of data written to socket

AT+MIPPUSH=3

OK

+MIPPUSH: 3,1 <-- send data command fails

+MIPXOFF: 3 <-- socket is "flowed off"

+MIPXON: 3 <-- socket is "flowed on", so user needs to repeat +MIPPUSH command

AT+MIPPUSH=3

OK

+MIPPUSH: 3,0 <-- 15 bytes of data successfully sent to Network



Transfer Data Through UDP Socket

In addition to establishing a UDP connection to a specific address, the user is able to open a UDP socket in order to receive a UDP datagram from "any IP" and "any Port" remote address, as shown below:

AT+MIPCALL=1,1,1

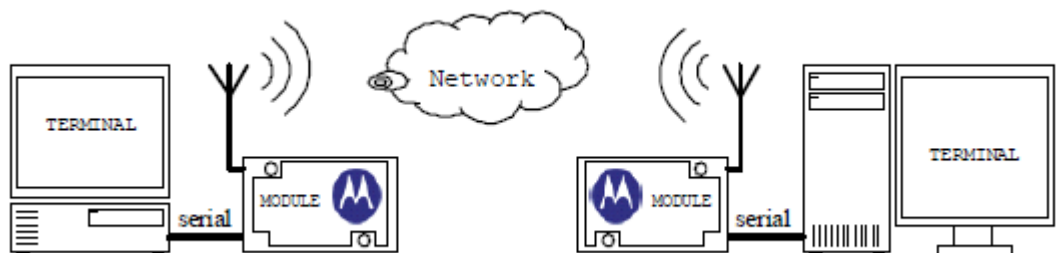
```

OK
+MIPCALL:
1,1,"172.16.242.
166"
AT+MIPOPEN
=1,1,1200,"0.0.0
.0",0,1
OK
+MIPOPEN: 1,1,1
    
```

In this example, the remote IP address 0.0.0.0 means "any IP" and the remote Port ID "0" means "any Port".

Now, the module is able to receive data from a remote side as well as to send a data to the remote side. The remote side will open a UDP socket, using the module's IP address (for example:

172.16.242.166) and the module's local port (for example: 1200), see connection diagram below:



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Setup the PDP context

AT+CGDCONT=1,"IP","apn","0.0.0.0",0,0

OK

Create MIP Call (activate PDP context)

AT+MIPCALL=1,1,1

OK

+MIPCALL: 1,1,"172.16.157.52"

Open "any IP" remote address UDP socket

AT+MIPOPEN=1,1,1200,"0.0.0.0",0,1

OK

+MIPOPEN: 1,1,1

Receive data from remote side. The unsolicited response contains an actual remote address/port

+MIPRUDP: 1,172.16.80.103,1300,0,4869

Send data to remote side. The user will provide an actual remote side address! AT+MIPSEND=1,"2233"

OK

+MIPSEND: 1,0,1370

AT+MIPPUSH=1,"172.16.80.103",1300

OK

+MIPPUSH: 1,0

Receive data from remote side. The unsolicited response contains an actual remote address/port

+MIPRUDP: 1,172.16.157.52,1200,0,2233

Setup the PDP context

AT+CGDCONT=1,"IP","apn","0.0.0.0",0,0

OK

Create MIP Call (activate PDP context)

AT+MIPCALL=1,1,1

OK

"+MIPCALL: 1,1,"172.16.80.103"

Open UDP socket, based on a known remote address

AT+MIPOPEN=1,1,1300,"172.16.157.52",1200,1

OK

+MIPOPEN: 1,1,1

Write data to the socket

AT+MIPSEND=1,"4869"

OK

+MIPSEND: 1,0,1370

Send the socket data to remote side

AT+MIPPUSH=1

OK

+MIPPUSH: 1,0



the user should wait for +MIPXON indication in order to continue data sending.

5.8.3. Intermodule Communication Example

Following is an example of a basic TCP/IP communication between two H24 modules.



Setup the PDP context

```
AT+CGDCONT=1,"IP","apn","0.0.0.0",0,0
OK
```

Create MIP Call (activate PDP context)

```
AT+MIPCALL=1,1,1
OK
+MIPCALL: 1,1,"172.16.157.52"
```

Open TCP active socket (secondly)

```
AT+MIPOPEN=1,1,1020,"172.16.80.103",1010,0
OK
+MIPOPEN: 1,1,1
```

Write data to the socket

```
AT+MIPSEND=1,"48656C6C6F"
OK
+MIPSEND: 1,0,1367
```

Send the socket data to remote side

```
AT+MIPPUSH=1
OK
+MIPPUSH: 1,0
```

Close the socket

```
AT+MIPCLOSE=1
```

Setup the PDP context

```
AT+CGDCONT=1,"IP","apn","0.0.0.0",0,0
OK
```

Create MIP Call (activate PDP context)

```
AT+MIPCALL=1,1,1
OK
"+MIPCALL: 1,1,"172.16.80.103"
```

Open TCP listen socket (firstly)

```
AT+MIPOPEN=1,1,1010,"0.0.0.0",0,0
OK
```

```
+MIPOPEN: 1,1,1,"172.16.80.103",1020
```

Receive data from remote side

```
+MIPRTCP: 1,0,48656C6C6F
```



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OK

+MIPCLOSE: 1,0

+MIPSTAT: 1,4

Following is an example of a basic UDP/IP communication between two H24 modules.



Setup the PDP context

AT+CGDCONT=1,"IP","apn","0.0.0.0",0,0

OK

Create MIP Call (activate PDP context)

context) AT+MIPCALL=1,1,1

OK

+MIPCALL: 1,1,"172.16.157.52

socket

AT+MIPOPEN=1,1,1020,"172.16.80.103",1010,1

,1

OK

+MIPOPEN: 1,1,1

Write data to the socket

AT+MIPSEND=1,"486

9" OK

+MIPSEND: 1,0,1367

Send the socket data to remote side

AT+MIPPUSH=1

OK

+MIPPUSH: 1,0

Close the socket

AT+MIPCLOSE=1

OK

Setup the PDP context

AT+CGDCONT=1,"IP","apn","0.0.0.0",0,0

OK

Create MIP Call (activate PDP

AT+MIPCALL=1,1,1

OK

"+MIPCALL: 1,1,"172.16.80.103" Open UDP

Open UDP socket

AT+MIPOPEN=1,1,1010,"172.16.157.52",1020

OK

+MIPOPEN: 1,1,1

Receive data from remote side

+MIPRUDP: 1,172.16.157.52,1200,0,4869

Close the socket

AT+MIPCLOSE=1

OK



+MIPCLOSE: 1,0

+MIPCLOSE: 1,0

5.9. Firmware Update Over the Air (FOTA)

5.9.1. FOTA Command for Non-Automatic Mode (Non-Transparent Mode)

//Set parameters for GPRS session entry
AT+CGDCONT=15,"IP","internet"

// First, set the GPRS default entry
AT+MFOTAWSCFG=15
OK

// Second, set the DM session as Non-Automatic
// We would like to control all the FOTA steps, that the reason that we se the Non-Automatic mode.

AT+MFOTACNFG?
+MFOTACNFG: 0
// Enable FOTA indications
AT+MFOTAIND=1
+MFOTAREQ: 1 // Request to begin DM session (Bootstrap)
AT+MFOTARSP=0
OK // Confirm DM session

+MFOTAIND: 10, 5
+MFOTAIND: 10, 10

+MFOTAREQ: 2 // Update package request

AT+MFOTARSP=0 // Confirm the update process
OK
+MFOTAIND: 10, 5 // DM Session in progress
+MFOTAIND: 10, 7 // DM Session complete
+MFOTAIND: 30, 13, 0 // Update-package progress bar indicate 0%
+MFOTAIND: 30, 13, 10 // Update-package progress bar indicate 10%
+MFOTAIND: 30, 13, 20 // Update-package progress bar indicate 20%
+MFOTAIND: 30, 13, 30 // Update-package progress bar indicate 30%
+MFOTAIND: 30, 13, 40 // Update-package progress bar indicate 40%
+MFOTAIND: 30, 13, 50 // Update-package progress bar indicate 50%
+MFOTAIND: 30, 13, 60 // Update-package progress bar indicate 60%
+MFOTAIND: 30, 13, 70 // Update-package progress bar indicate 70%
+MFOTAIND: 30, 13, 80 // Update-package progress bar indicate 80%
+MFOTAIND: 30, 13, 90 // Update-package progress bar indicate 90%
+MFOTAIND: 30, 13, 100 // Update-package progress bar indicate 100%

+MFOTAREQ: 3 // Install package request

AT+MFOTARSP=0 // Confirm the install process

OK

+MFOTAIND: 40, 19 // Update has started indication

// During the Update process, the phone will be in flash-mode. The update process is supposed to take a few minutes.



5.9.2. FOTA Command for Automatic Mode (Transparent Mode)

In automatic/transparent mode, FOTA process includes SW Upgrade without any user interaction.

In this case any +MFOTAREQ operational reports will not be sent toward DTE. By setting AT+MFOTIND to 1, the user can still get an indication on DTE.

The default mode is the transparent mode.

```

AT+MFOTACNFG?           // Get the FOTA DM session mode
+MFOTACNFG: 0           // Mode is transparent
OK
AT+MFOTACNFG=1         // Change the FOTA DM session mode to Non-Automatic
OK
AT+MFOTACNFG?           // Get the FOTA DM session mode
+MFOTACNFG: 1           // Mode was set to non-transparent
  
```



6. Chapter 5: Tools

H24 tools are located at:

<http://developer.motorola.com/products/wirelessmodules/h24/>



7. Appendix A: Reference Tables

This appendix contains the following sections:

- AT Commands Alphabetical Summary, below
- Character Set Table CS1: (GSM -> UCS-2)
- Character Set Table CS2: (GSM -> IRA)
- Character Set Table CS3: (UCS-2 full table)
- Character Set Table CS4: (IRA Table)

Note: Character Set Table CS3: (UCS-2) is provided on CD due to its size.

7.1. AT Commands Alphabetical Summary

The following table contains an alphabetical list of all the H24 AT commands.

Table A-1: AT Commands (Alphabetical)

AT Command	Description	Page
\S	This command displays the status of selected commands and S-registers.	on page 4-258
&C	This command determines how the state of the DCD line relates to the detection of the received line signal from the distant end.	on page 4-169
&D	This command determines how the H24 responds when the DTR (Data Terminal Ready) status is changed from ON to OFF during the online data state.	on page 4-171
&F	This command restores the factory default configuration profile.	on page 4-258
&K	This command configures the RTS/CTS flow control.	on page 4-167
&V	This command lists the user's profile configurations.	on page 4-260
&W	This command stores the user profile configuration to the NV.	on page 4-260
&Y	This command sets the user profile to the power up configuration.	on page 4-263
+CALM	This command handles the selection of the H24's alert sound mode.	on page 4-208
+CBAUD	This command sets the baud rate.	on page 4-165
+CBC	This command queries the battery charger connection.	on page 4-164
+CBM	This unsolicited message forwards the SMS upon its arrival.	on page 4-110



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+CPMS	This command handles the selection of the preferred storage area for messages.	on page 4-86
+CPOL	This command is used to edit the list of preferred operators located in the SIM card.	on page 4-146
+CPWD	This command sets a new password for the facility lock.	on page 4-231
+CR	This command controls whether or not the extended format of an outgoing or incoming data call is displayed or not.	on page 4-44

Table A-1: AT Commands (Alphabetical) (Cont.)

AT Command	Description	Page
+CRC	This command controls whether to present the extended format of the incoming call indication.	on page 4-17
+CREG	This command enables/disables the network status registration unsolicited result code.	on page 4-139
+CRING	This unsolicited event indicates the type of incoming call.	on page 4-17
+CRLP	This command displays the Radio Link Protocol parameters.	on page 4-136
+CRSL	This command sets the different alerts volume level of the active audio mode.	on page 4-205
+CRSM	This command provides limited access to the Elementary Files on the SIM.	on page 4-285
+CRTT	This command plays one cycle of a ring tone, stops the cycle in the middle, and sets the ring tone to be used.	on page 4-209
+CSCA	This command handles the selection of the SCA and the TOSCA.	on page 4-83
+CSCB	This command handles the selection of cell broadcast message types and data coding schemes received by the H24.	on page 4-122
+CSCS	This command selects the H24 character set.	on page 4-4
+CSDH	This command shows the Text Mode parameters.	on page 4-92
+CSIM	This command allows a direct control of the SIM by a distant application on the TE.	on page 4-288
+CSMP	This command sets the Text Module parameters.	on page 4-90
+CSMS	This command handles the selection of the SMS message service type.	on page 4-99
+CSQ	This command displays the signal strength received by the H24.	on page 4-135
+CSSN	This command handles the enabling and disabling of supplementary service-related, network-initiated, notifications.	on page 4-54
+CUSD	This command allows control of Unstructured Supplementary Service Data (USSD), according to GSM 02.90.	on page 4-59
+EPIN	This command is only relevant for phones that use SIM cards. It verifies the PIN2 indicator.	on page 4-227



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.	on page 4-249
X	This command defines the data adaptor response set, and the CONNECT result code format.	on page 4-252
Z	This command resets the default configuration.	on page 4-259

7.2. Character Set Table CS1: (GSM -> UCS-2)

The following table shows the conversion between the GSM and UCS-2 character sets.

GSM 7-bit Default Alphabet (Hexadecimal)	UCS-2	Symbol
0x00	0x0040	@
0x01	0x00A3	£
0x02	0x0024	\$
0x03	0x00A5	¥
0x04	0x00E8	è
0x05	0x00E9	é
0x06	0x00F9	ù
0x07	0x00EC	ì
0x08	0x00F2	ò
0x09	0x00C7	Ç
0x0A	0x000A	LF
0x0B	0x00D8	Ø
0x0C	0x00F8	ø
0x0D	0x000D	CR



GSM 7-bit Default Alphabet (Hexadecimal)	UCS-2	Symbol
0x0E	0x00C5	À
0x0F	0x00E5	á
0x10	0x0394	Ä
0x11	0x005F	-
0x12	0x03A6	Ö
0x13	0x0393	Ã
0x14	0x039B	Ë
0x15	0x03A9	Û
0x16	0x03A0	Ð
0x17	0x03A8	Ø
0x18	0x03A3	Ó
0x19	0x0398	È
0x1A	0x039E	Ï
0x1B	0x001B	Escape
0x1B0A	0x0C	Form feed
0x1B14	0x5E	^
0x1B28	0x7B	{
0x1B29	0x7D	}
0x1B2F	0x5C	\
0x1B3C	0x5B	[
0x1B3D	0x7E	~
0x1B3E	0x5D]
0x1B40	0x7C	
0x1B65	0x20AC	€
0x1C	0x00C6	Æ
0x1D	0x00E6	æ
0x1E	0x03B2	ß
0x1F	0x00C9	É
0x20	0x0020	SP
0x21	0x0021	!
0x22	0x0022	"
0x23	0x0023	#
0x24	0x00A4	¤
0x25	0x0025	%



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GSM 7-bit Default Alphabet (Hexadecimal)	UCS-2	Symbol
0x26	0x0026	&
0x27	0x0027	'
0x28	0x0028	(
0x29	0x0029)
0x2A	0x002A	*
0x2B	0x002B	+
0x2C	0x002C	,
0x2D	0x002D	-
0x2E	0x002E	.
0x2F	0x002F	/
0x30	0x0030	0
0x31	0x0031	1
0x32	0x0032	2
0x33	0x0033	3
0x34	0x0034	4
0x35	0x0035	5
0x36	0x0036	6
0x37	0x0037	7
0x38	0x0038	8
0x39	0x0039	9
0x3A	0x003A	:
0x3B	0x003B	;
0x3C	0x003C	<
0x3D	0x003D	=
0x3E	0x003E	>
0x3F	0x003F	?
0x40	0x00A1	¡
0x41	0x0041	A
0x42	0x0042	B
0x43	0x0043	C
0x44	0x0044	D
0x45	0x0045	E
0x46	0x0046	F
0x47	0x0047	G



GSM 7-bit Default Alphabet (Hexadecimal)	UCS-2	Symbol
0x48	0x0048	H
0x49	0x0049	I
0x4A	0x004A	J
0x4B	0x004B	K
0x4C	0x004C	L
0x4D	0x004D	M
0x4E	0x004E	N
0x4F	0x004F	O
0x50	0x0050	P
0x51	0x0051	Q
0x52	0x0052	R
0x53	0x0053	S
0x54	0x0054	T
0x55	0x0055	U
0x56	0x0056	V
0x57	0x0057	W
0x58	0x0058	X
0x59	0x0059	Y
0x5A	0x005A	Z
0x5B	0x00C4	Ä
0x5C	0x00D6	Ö
0x5D	0x00D1	Ñ
0x5E	0x00DC	Ü
0x5F	0x00A7	§
0x60	0x00BF	ı
0x61	0x0061	a
0x62	0x0062	b
0x63	0x0063	c
0x64	0x0064	d
0x65	0x0065	e
0x66	0x0066	f
0x67	0x0067	g
0x68	0x0068	h
0x69	0x0069	i



GSM 7-bit Default Alphabet (Hexadecimal)	UCS-2	Symbol
0x6A	0x006A	j
0x6B	0x006B	k
0x6C	0x006C	l
0x6D	0x006D	m
0x6E	0x006E	n
0x6F	0x006F	o
0x70	0x0070	p
0x71	0x0071	q
0x72	0x0072	r
0x73	0x0073	s
0x74	0x0074	t
0x75	0x0075	u
0x76	0x0076	v
0x77	0x0077	w
0x78	0x0078	x
0x79	0x0079	y
0x7A	0x007A	z
0x7B	0x00E4	ä
0x7C	0x00F6	ö
0x7D	0x00F1	ñ
0x7E	0x00FC	ü
0x7F	0x00E0	à



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0x1B3C	0x5B	[
0x1B3D	0x7E	~
0x1B3E	0x5D]
0x1B40	0x7C	
0x1B65		€
0x1C	0xC6	Æ



GSM 7-bit default alphabet (Hexadecimal)	IRA (Hexadecimal)	Symbol
0x1D	0xE6	æ
0x1E	0xDF	ß
0x1F	0xC9	É
0x20	0x20	SP
0x21	0x21	!
0x22	0x22	"
0x23	0x23	#
0x24	0xA4	¤
0x25	0x25	%
0x26	0x26	&
0x27	0x27	'
0x28	0x28	(
0x29	0x29)
0x2A	0x2A	*
0x2B	0x2B	+
0x2C	0x2C	,
0x2D	0x2D	-
0x2E	0x2E	.
0x2F	0x2F	/
0x30	0x30	0
0x31	0x31	1
0x32	0x32	2
0x33	0x33	3
0x34	0x34	4
0x35	0x35	5
0x36	0x36	6
0x37	0x37	7
0x38	0x38	8
0x39	0x39	9
0x3A	0x3A	:



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0x3B	0x3B	;
------	------	---

GSM 7-bit default alphabet (Hexadecimal)	IRA (Hexadecimal)	Symbol
0x3C	0x3C	<
0x3D	0x3D	=
0x3E	0x3E	>
0x3F	0x3F	?
0x40	0xA1	i
0x41	0x41	A
0x42	0x42	B
0x43	0x43	C
0x44	0x44	D
0x45	0x45	E
0x46	0x46	F
0x47	0x47	G
0x48	0x48	H
0x49	0x49	I
0x4A	0x4A	J
0x4B	0x4B	K
0x4C	0x4C	L
0x4D	0x4D	M
0x4E	0x4E	N
0x4F	0x4F	O
0x50	0x50	P
0x51	0x51	Q
0x52	0x52	R
0x53	0x53	S
0x54	0x54	T
0x55	0x55	U
0x56	0x56	V
0x57	0x57	W
0x58	0x58	X



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0x59	0x59	Y
0x5A	0x5A	Z

GSM 7-bit default alphabet (Hexadecimal)	IRA (Hexadecimal)	Symbol
0x5B	0xC4	Ä
0x5C	0xD6	Ö
0x5D	0xD1	Ñ
0x5E	0xDC	Ü
0x5F	0xA7	§
0x60	0xBF	ı
0x61	0x61	a
0x62	0x62	b
0x63	0x63	c
0x64	0x64	d
0x65	0x65	e
0x66	0x66	f
0x67	0x67	g
0x68	0x68	h
0x69	0x69	i
0x6A	0x6A	j
0x6B	0x6B	k
0x6C	0x6C	l
0x6D	0x6D	m
0x6E	0x6E	n
0x6F	0x6F	o
0x70	0x70	p
0x71	0x71	q
0x72	0x72	r
0x73	0x73	s
0x74	0x74	t
0x75	0x75	u
0x76	0x76	v
0x77	0x77	w



0x78	0x78	x
0x79	0x79	y

GSM 7-bit default alphabet (Hexadecimal)	IRA (Hexadecimal)	Symbol
0x7A	0x7A	z
0x7B	0xE4	ä
0x7C	0xF6	ö
0x7D	0xF1	ñ
0x7E	0xFC	ü
0x7F	0xE0	à

Note: 1) This code value is reserved for the extension to another extension table. On receipt of this code, a space is displayed.

7.4. Character Set Table CS3: (UCS-2 Full table)

Character Set Table CS3: (UCS-2) is provided on CD due to its size.



7.5. Character Set Table CS4: (IRA table)

The following table shows the conversion for the IRA character set.

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)



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Decimal	Octal	Hex	Binary	Value	Description
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 Acknowledgment)
022	026	016	00010110	SYN	(Synchronous Idle)
023	027	017	00010111	ETB	(End of Trans. Block)
024	030	018	00011000	CAN	(Cancel)
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)



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Decimal	Octal	Hex	Binary	Value	Description
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 Acknowledgment)
022	026	016	00010110	SYN	(Synchronous Idle)
023	027	017	00010111	ETB	(End of Trans. Block)
024	030	018	00011000	CAN	(Cancel)
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)



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036	044	024	00100100	\$	(dollar sign)
------------	-----	-----	----------	----	---------------

Decimal	Octal	Hex	Binary	Value	Description
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)
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	



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100	144	064	01100100	d	
-----	-----	-----	----------	---	--

Decimal	Octal	Hex	Binary	Value	Description
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)



8. Appendix B: H24 USB Compositions

The product id is 0x2D9n (1 < n < B) depending on the current composition.

Vendor id is 0x22B8.

8.1.1. Type of Connections Available Over USB

- ACM (Modem)
- OBEX (AT Port)
- OBEX (Diag)
- OBEX (NMEA)

The following table shows the compositions available.

Index	Composition	Product ID	AT command configuration		
			+MCONN	+MPLOG	+MPNMEA
1	Modem	0x2D91	1 or 2	≠1	≠1
2	Diagnostic	0x2D94	3 or 5	1	≠1
3	NMEA	0x2D9B	3 or 5	≠1	1
4	Modem + AT Port	0x2D93	4	≠1	≠1
5	Modem + Diagnostic	0x2D92	1 or 2	1	≠1
6	Modem + NMEA	0x2D96	1 or 2	≠1	1
7	Diagnostic + NMEA	0x2D98	3 or 5	1	1
8	Modem + AT Port + Diagnostic	0x2D95	4	1	≠1
9	Modem + AT Port + NMEA	0x2D99	4	≠1	1
10	Modem + Diagnostic + NMEA	0x2D97	1 or 2	1	1
11	Modem + AT Port + Diagnostic + NMEA	0x2D9A	4	1	1

Note: Composition number 11 will use 9 endpoints which is the maximum value.



8.1.2. ACM

ACM Class has two interfaces (CDC/ACM Class + Data Class):

1. CDC/ACM Class interface includes:
 - Interface descriptor
 - Header Functional Descriptor
 - Abstract Control Management Descriptor
 - Call Management Descriptor
 - Interrupt endpoint descriptor
2. Data Class interface includes:
 - Interface Descriptor
 - 2 bulk endpoint descriptors

8.1.3. OBEX

OBEX class has one data interface which includes:

- Interface Descriptor
- 2 bulk endpoint descriptors



Select "USB support" sub menu:

```
^(-)
  Input device support --->
  Character devices --->
{M} I2C support --->
[*] SPI support --->
[*] GPIO Support --->
{M} Dallas's 1-wire support --->
-* Power supply class support --->
{*} Hardware Monitoring support --->
{*} Generic Thermal sysfs driver --->
[*] Watchdog Timer Support --->
    Sonics Silicon Backplane --->
    Multifunction device drivers --->
    Multimedia devices --->
    Graphics support --->
<M> Sound card support --->
[*] HID Devices --->
[*] USB support --->
<M> MMC/SD card support --->
< > Sony MemoryStick card support (EXPERIMENTAL) --->
-* LED Support --->
[ ] Accessibility support --->
<M> InfiniBand support --->
[*] EDAC - error detection and reporting (EXPERIMENTAL) --->
<*> Real Time Clock --->
[*] DMA Engine support --->
[*] Auxiliary Display support --->
<M> Userspace I/O drivers --->
```

Select "USB Modem (CDC ACM) support" as module:

```
^(-)
[*] USB device filesystem
[ ] USB device class-devices (DEPRECATED)
[ ] Dynamic USB minor allocation
[*] USB selective suspend/resume and wakeup
[*] USB Monitor
*** USB Host Controller Drivers ***
<M> Cypress C67x00 HCD support
<M> EHCI HCD (USB 2.0) support
[*] Root Hub Transaction Translators
[*] Improved Transaction Translator scheduling (EXPERIMENTAL)
<M> ISP116X HCD support
<M> ISP 1760 HCD support
<M> OHCI HCD support
[ ] OHCI support for Broadcom SSB OHCI core
<M> UHCI HCD (most Intel and VIA) support
<M> Elan U132 Adapter Host Controller
<M> SL811HS HCD support
<M> CF/PCMCIA support for SL811HS HCD
<M> R8A66597 HCD support
*** USB Device Class drivers ***
<M> USB Modem (CDC ACM) support
<M> USB Printer support
<M> USB Wireless Device Management support
*** NOTE: USB_STORAGE enables SCSI, and 'SCSI disk support' ***
*** may also be needed; see USB_STORAGE Help for more information ***
<M> USB Mass Storage support
[ ] USB Mass Storage verbose debug
v(+)
```



2. Compile separately (only module):

Create a makefile in the cdc-acm.c directory (<linux src root>/drivers/usb/class) Copy & paste the following code to the new file.
obj-m:= cdc-acm.o

```
KDIR:= /lib/modules/$(shell uname -r)/build
```

```
PWD:= $(shell pwd)
```

```
default:
```

```
$(MAKE) -C $(KDIR) SUBDIRS=$(PWD) modules
```

Execute the following to build the module (cdc-acm.ko)

```
# make
```

To install the driver copy it to '/lib/modules/^uname -r^/kernel/drivers/usb/class' or use the install command.

Execute the following line to load the driver.

```
# modprobe cdc-acm
```

If you don't want to install the module use:

```
# insmod cdc-acm.ko
```

9.2. Serial Driver - Control Interface

Driver name: **usbserial**

This driver can be used as reduced modem - taking over ACM interface. In this case no modem signals will be available.

Another usage is as control channel in multi channeling configuration - having 2 channels work in parallel, the ACM driver to handle Data and the Serial Driver for handling control.

Loading this driver should be done with vendor & product arguments (Use lsusb command to verify current product id).

For Example:

```
# lsusb
```

```
BUS007 Device 010: ID 22b8:2d91 Motorola PCS
```

```
.  
.
.
```

```
# modprobe usbserial vendor=0x22b8 product=0x2d91
```



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After loading driver, a new device will be added for each relevant interface (n) - /dev/USBn

Check '/var/log/messages' for any abnormalities.

Verify that the driver exists within kernel. If not, build it via kernel configuration menu (kernel build):

Select "USB support" sub menu:

```

^(-)
[*] SanDisk SDDR-09 (and other SmartMedia) support
[*] SanDisk SDDR-55 SmartMedia support
[*] Lexar Jumpshot Compact Flash Reader
[*] Olympus MAUSB-10/Fuji DPC-R1 support
[ ] Support OneTouch Button on Maxtor Hard Drives
[*] Support for Rio Karma music player
[ ] SAT emulation on Cypress USB/ATA Bridge with ATACB
[*] The shared table of common (or usual) storage devices
    *** USB Imaging devices ***
<M> USB Mustek MDC800 Digital Camera support
<M> Microtek X6USB scanner support
    *** USB port drivers ***
<M> US5720 parport driver
<M> USB Serial Converter support --->
    *** USB Miscellaneous drivers ***
<M> EMI 6|2m USB Audio interface support
<M> EMI 2|6 USB Audio interface support
<M> ADU devices from Ontrak Control Systems
<M> USB Diamond Rio500 support
<M> USB Lego Infrared Tower support
<M> USB LCD driver support
<M> USB BlackBerry recharge support
<M> USB LED driver support
<M> Cypress CY7C63xxx USB driver support
<M> Cypress USB thermometer driver support
<M> USB Phidgets drivers
<M> USB PhidgetInterfaceKit support
v(+)
    
```

Select "USB Generic Serial Driver" as build-in driver:

```

--- USB Serial Converter support
-*- Functions for loading firmware on EZUSB chips
[*] USB Generic Serial Driver
<M> USB AIRcable Bluetooth Dongle Driver
<M> USB ARK Micro 3116 USB Serial Driver
<M> USB Belkin and Peracom Single Port Serial Driver
<M> USB Winchiphead CH341 Single Port Serial Driver
<M> USB ConnectTech WhiteHEAT Serial Driver
<M> USB Digi International AccelePort USB Serial Driver
<M> USB CP2101 UART Bridge Controller
<M> USB Cypress MB USB Serial Driver
<M> USB Empeg empeg-car Mark I/II Driver
<M> USB FTDI Single Port Serial Driver
<M> USB Fundamental Software Dongle Driver
<M> USB Handspring Visor / Palm m50x / Sony Clie Driver
<M> USB PocketPC PDA Driver
< > USB IR Dongle Serial Driver
<M> USB Inside Out Edgeport Serial Driver
<M> USB Inside Out Edgeport Serial Driver (TI devices)
<M> USB Garmin GPS driver
<M> USB IPWireless (3G UMTS TDD) Driver
< > USB Infinity USB Unlimited Phoenix Driver
<M> USB Keyspan PDA Single Port Serial Driver
<M> USB Keyspan USA-xxx Serial Driver
<M> USB KL5KUSB105 (Palmconnect) Driver
<M> USB KOBIL chipcard reader
<M> USB MCT Single Port Serial Driver
v(+)
    
```



9.3. ACM Driver Adjustments

Path: <linux src root>/drivers/usb/class/cdc-acm.c

The following code change should be applied:

Add these elements to acm_ids array (static struct usb_device_id acm_ids[])

USB_DEVICE(0x22b8, 0x2d91)

USB_DEVICE(0x22b8, 0x2d92)

USB_DEVICE(0x22b8, 0x2d93)

USB_DEVICE(0x22b8, 0x2d95)

USB_DEVICE(0x22b8, 0x2d96)

USB_DEVICE(0x22b8, 0x2d97)

USB_DEVICE(0x22b8, 0x2d99)

USB_DEVICE(0x22b8, 0x2d9A)

Note: USB serial driver does not need adjustment. It probes with vendor & product arguments.



9.4. USB Power Management

9.4.1. Enabling Autosuspend

To enable autosuspend, you must compile your kernel with CONFIG_USB_SUSPEND. You may also want to enable CONFIG_USB_DEBUG so you can see suspend and resume messages via dmesg.

9.4.2. Autosuspending USB Devices

To attempt to autosuspend your USB device, first use lsusb as root to find out the bus number and device number of your usb device:

```
#lsusb
Bus 001 Device 003: ID 22b8:2d92 Motorola FCS
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
Bus 005 Device 001: ID 1d6b:0001 Linux Foundation 1.1 root hub
Bus 004 Device 002: ID 0461:4d15 Primax Electronics, Ltd
Bus 004 Device 001: ID 1d6b:0001 Linux Foundation 1.1 root hub
Bus 003 Device 001: ID 1d6b:0001 Linux Foundation 1.1 root hub
Bus 002 Device 001: ID 1d6b:0001 Linux Foundation 1.1 root hub
```

Then, find your device's directory in /sys/bus/usb/devices/. Look in directories that are named with two numbers separated with a dash:

```
/sys/bus/usb/devices# ls
1-0:1.0 1-5 1-5:1.0 1-5:1.1 2-0:1.0 3-0:1.0 4-0:1.0 4-2 4-
2:1.0 5-0:1.0 usb1 usb2 usb3 usb4 usb5

/sys/bus/usb/devices# cat 1-5/idProduct
2d92

/sys/bus/usb/devices# cat 1-5/idVendor
22b8
```

We know the H24 USB device directory is 1-5 because the idProduct and idVendor match the lsusb output. Now we can tell the kernel that it should suspend this device automatically if it



is not being used. First we set the idle timeout to 2 seconds:

```
sys/bus/usb/devices# echo 2 > 1-2/power/autosuspend
```

The timeout can be set to any integer number of seconds. If set to -1, the device will not autosuspend. Then we make sure the kernel will automatically suspend the device, and resume the device if data needs to be transferred:

```
/sys/bus/usb/devices# echo auto > 1-2/power/level
```

Other options to echo to this file are "on" and "suspend":

- "on" will force the device to be on all the time.
- "suspend" will permanently suspend the device until the user echoes "on" or "auto" to this file.

(Note that this is a simplification, since the value of the power/wakeup file may allow the device to signal a remote wakeup).

For a more complete description of USB power management, see the file Documentation/usb/power-management.txt, which is in kernel sources 2.6.24-rc2 and later.



10. Acronyms and Abbreviations

Abbreviation	Full Name
--------------	-----------

A

A ACCH	AT Command Channel - Used for AT-commands, TCP/IP, Internal-GPRS session, Voice-Call, and SMS applications
A AOC	Advice of Charge
A APN	Access Point Name
A ASCII	A standard seven-bit code character set
A ATA	AT command for call answer
A ATD	AT command for call originating
A ATH	AT command for Hanging-up a call
A ATO	AT command to return to Data mode after temporarily exiting by ESC

B

B BM	Broadcast Message
-------------	-------------------

C

C CA	A certificate authority or certification authority is an entity which issues digital certificates for use by other parties. It is an example of a trusted third party.
CB	Cell Broadcast
CBM	Cell Broadcast Message
CDS	Call Data Services (External-GPRS session, CSD session, FAX session)
Certificate	A public key certificate (or identity certificate) is a certificate which uses a digital signature to bind together a public key with an identity - information such as the name of a person or an organization, their address, and so forth. The certificate can be used to verify that a public key belongs to an individual.
CID	PDP Context Identifier.
Cipher Suite	A set of cryptographic algorithms. A cipher suite specifies one algorithm for each of the following tasks: Key exchange, Bulk encryption and Message authentication.
CS	Circuit Switch
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).



Abbreviation	Full Name
--------------	-----------

D

DA	Destination Address
DCD	Data Carrier Detect
DCE	Data Communication Equipment (H24)
DCSs	Data Coding Schemas
D DLC	DataLinkConnection
D DLC0	The multiplexer control channel.
D DLCI	Data Link Connection Identifier
D	
DSP	Digital Signal Processor
D DSR	Data Set Ready
D DSR	MGOM is ON and ready to communicate with the DTE device.
D DT	Discharge Time
D DTE	Data Terminal Equipment (such as terminals, PCs and so on). Also called Application Processor (AP).
D DTMF	Dual-Tone Multi-Frequency
D DTR	Data Terminal Ready

E

E EF	Elementary Files
E EONS	Enhanced Operator Name String
E ERM	Error Recovery Mode
E ESC	Exit to Command Mode from Data Mode (usually the +++ sequence)
E ETSI	European Telecommunication Standards Institute

F

FCC	Federal Communications Commission (U.S.)
FO	First Octet
FTA	Full Type Approval



Abbreviation	Full Name
--------------	-----------

G

GCF	GSM Certification Forum
GGSN	Gateway GPRS Support Node
GPIO	General Purpose Input/Output
GPRS	General Packet Radio Service
GRLLC	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

H

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.
------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

I

IC	Integrated Circuit
ID	Identification
IDLC	Information DLC - refers to all the data channels except the control channel.
IMEI	International Mobile Equipment Identification.
IP	Internet Protocol.
ISR	Interrupt Service Routine
I ITU	International Telecommunication Union

L

L LCA	Low Cost Architecture
--------------	-----------------------

M

M MCC/MNC	Mobile Country Code / Mobile Network Code
M ME	Mobile Equipment
M MGOM	Motorola H24 GSM OEM Modem, also called Base Band processor.
M MIDs	Message IDs (Channels)
M MO	Mobile Originated - sets up a call session.
M MR	Message Reference
M MT	Mobile Terminated - accepts a call session.
M MUX	Multiplexer entity



Abbreviation	Full Name
--------------	-----------

O

O OA	Origination Address
O ODM	Online Data Mode
O OEM	Original Equipment Manufacturer

P

P2K	Platform 2000
PCB	Printed Circuit Board
PCM	Pulse Code Modulation
PDCP	Packet Data Compatibility Protocol
PDN	Packet Data Network
PDP	Packet Data Protocol
PDU	Packet Data Unit
PID	Protocol Identifier
PLMN	Public Land Mobile Network
PPP	Point-to-Point Protocol
PS	Packet Switch

Q,R

QoS	Quality of Service
RA	Recipient Address
RI	Ring Indicator
RLC	Radio Link Control
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).
RXD	DTE received data from MGOM.



Abbreviation	Full Name
--------------	-----------

S

S S-register	Software Resister
S SC	Service Center
S SCA	Service Center Address
S SCTS	Service Center Time Stamp
S SGSN	Serving GPRS Support Node
S SIM	Subscriber Identity Module
S SM	Short Message
S SMS	Short Message Service
S SN	Serial Number
S SSL	Secure Socket Layer protocol. Created by Netscape to ensure secure transactions between a client and a server.
S ST	Status
S SW flow con - troll	ISO/IEC 646 SW flow control (the DC1/XON and DC3/XOFF control characters).

T

TBD	To Be Defined
TCP	Transmission Control Protocol
TDMA	Time Division Multiple Access
TE	Terminal Equipment
TLS	Transport Layer Security protocol for establishing a secure connection between a client and a server. TLS is based on SSL 3.0 protocol.
TODA	Type of Destination Address
T TOOA	Type of Origination Address
T TORA	Type of Recipient Address
T TOSCA	Type of SCA
T TTY	Tele Typewriter
T TXD	DTE transmit data to MGOM

U

U UA	Unnumbered Acknowledgement
U UDP	User Datagram Protocol
U UIH	Unnumbered Information, with Only Header Checksum
U USB	Universal Serial Bus



V

V 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.



10.1. Document History

Revision	Date	Changes
0	2011-07-12	<ul style="list-style-type: none"> Conversion into telit layout the former Motorola revision of April 2010 (D)
1	2012-03-01	<ul style="list-style-type: none"> New commands: +CPAS, +CRSM, +CSIM, +MMAD, +MCDORM, +CSVM, +MCI
2	2012-08-31	<ul style="list-style-type: none"> Modified: +MGPSUPPROTOCOLSEL ,+MGPSPROTOCOL,+MGPSMOLR,+MGPSM ODE, +MPAUTH, +CMUT Added + MGPSUPPROTOCOLSEL Modified Table 4 228: +MGPSLOC Parameters

