NOVATEL WIRELESS

Technical Manual

with Specifications

Merlin and Expedite GPRS Products

P/N 90023363 Rev. 1.8

NOVATEL WIRELESS

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AT+CEER 85
AT+CEXTBUT 85
AT+CEXTHS 86
AT+CFUN 86
AT+CGACT 87
AT+CGAPNR 87
AT+CGAPNW 88
AT+CGATT 89
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AT+CGDCONT 89
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AT+CGMI 92
AT+CGMM 92
AT+CGMR 92
AT+CGOI 93
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AT+CLCC 97
AT+CLCK 99
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AT+CLIP 101
AT+CLIR 101
AT+CLTS 102
AT+CLVL 102
AT+CMEE 103
AT+CMGD 103
AT+CMGF 103
AT+CMGL 104
AT+CMGR 106
AT+CMGW 108
AT+CMSS 109
AT+CMUT 110
AT+CMUX 110
AT+CNMI 111
AT+CNUM 112
AT+COLP 113

AT+COPN 114
AT+COPS 115
AT+CPAS 116
AT+CPBF 116
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AT+CPIN 119
AT+CPMS 120
AT+CPOL 120
AT+CPUC 121
AT+CPWD 121
AT+CR 123
AT+CRC 123
AT+CREG 124
AT+CRES 124
AT+CRLP 125
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AT+CSAS 126
AT+CSCA 126
AT+CSCB 127
AT+CSCS 127
AT+CSDH 128
AT+CSIM 128
AT+CSMINS 129
AT+CSMP 129
AT+CSMS 130
AT+CSQ 131
AT+CSSN 131
AT+CSTA 131
AT+CUSD 132
AT+DR 132
AT+DS 133
AT+FCLASS 134
AT+FMI 134
AT+FMM 135
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Chapter 1: Product Overview

GPRS (General Packet Radio Service) is a digital, packet-switched, data extension to the GSM voice and circuit-switched data network. GPRS substitutes binary data for the voice data which is subsequently routed to a data network (internet) rather than the public switched telephone network. This routing features enables high-speed data communication on a global wireless network, using the same frequency bands as the underlying GSM network. GPRS provides single band 1900 MHz support within North America and dual band support (900/1800 MHz) elsewhere in the world. Novatel Wireless products provide fast and reliable wireless data communications at speeds up to 53.6 kbps in GPRS coverage areas, and circuit switched data to 14.4 kbps in GSM coverage areas. (Where a network is set up for Multi-slot class 10 (MS-10) and Coding Scheme 2 (CS-2), the maximum data rates with GPRS service are 53.6 kbps for uploading data and 26.8 kbps for downloading data.)

Adopted by 149 countries around the world, GSM is the most widely used digital wireless standard in the world, with more than 330 million subscribers world wide. The GSM association predicts that the number of subscribers will more than triple by the year 2003.

Novatel Wireless GPRS/GSM products consist of the following.

- Merlin G100 PC Card (1900 MHz band) for North America.
- Merlin G200 PC Card (900/1800 MHz bands) for Europe and Asia.
- Merlin G201 PC Card, same as the G200 with a voice jack to make GSM voice calls.
- Merlin G301 PC Card (900/1800/1900 MHz bands) for worldwide access to GSM/GPRS networks.
- Expedite G301 OEM Module (900/1800/1900 MHz bands) for embedding into wireless products for global GSM/GPRS access. The Expedite G301 is a triband OEM module that can be used in either the North American or European markets.

Topics Included in this Chapter

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Introduction to GSM and GPRS

GPRS is a packet-switched technology, meaning that on a GPRS network, information is split into separate but related packets before being transmitted and reassembled upon receiving. The use of packets allows for greater transport flexibility, as the data is not tied to one specific transport protocol (TCP, LAT,.25X and Telnet are examples of other transport protocols).

As well as providing the user with design and development information, this chapter will also provide the user with information on the following GPRS elements:

- network requirements
- local system requirements
- Interfaces
    - hardware
    - air
    - electrical
- hardware (including pinout assignments)
- SIM card functions

GSM Technology

GSM uses a time division multiplexing access method that permits up to eight users to communicate using one frequency channel. The channel is broken up into eight time slots with each slot operating independently, sending data between the network and the mobile device.

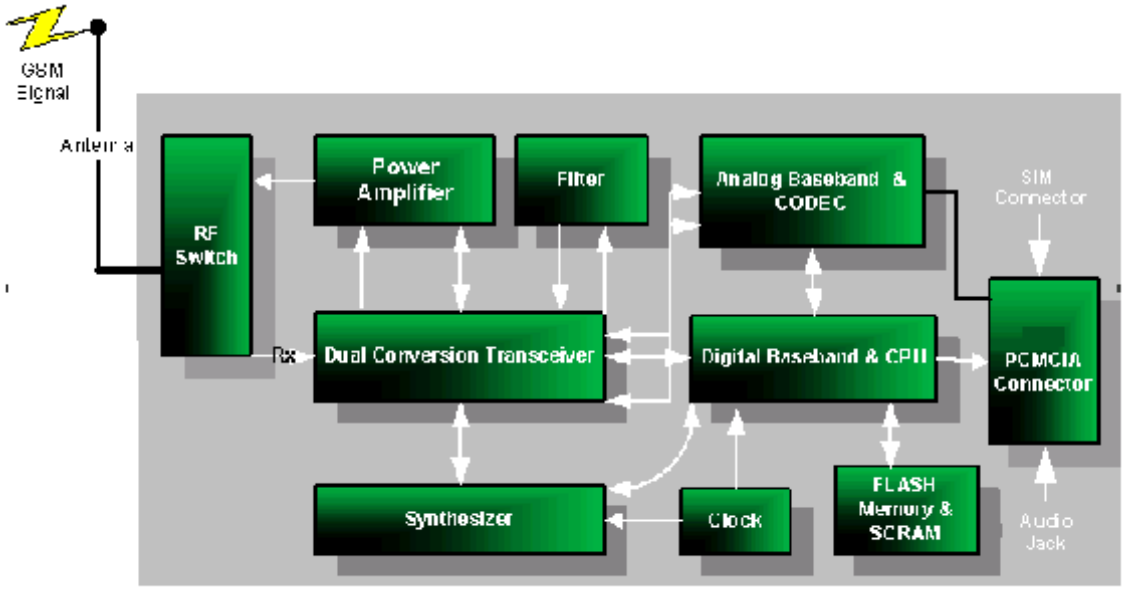


Figure 1 GSM–Merlin Interface

GPRS (General Packet Radio Service) is a digital, packet-switched, data extension to the GSM voice and circuit-switched data network. In short, it substitutes binary data for the voice data, which is subsequently routed to a data network, the Internet, rather than the public switched telephone network. This enables high-speed data communication on a global wireless standard, using the same frequency bands as the underlying GSM network.

Advantages of GPRS

The advantage of a packet-based approach is that GPRS only uses the medium, in this case the radio link, for the duration of time that data is being sent or received. GPRS has one distinct advantage over the traditional GSM in that a channel is not dedicated to one user. Communication channels are being used on a “shared-use as packets are needed” basis rather than dedicated to one user at a time. This means that multiple users can share the same radio channel. In contrast, with current circuit-switched connections, users have dedicated connections during their entire call, whether they are sending data or not. Many applications have idle periods during a session, with packet data, users will only pay for the amount of data they actually communicate, and not the idle time.

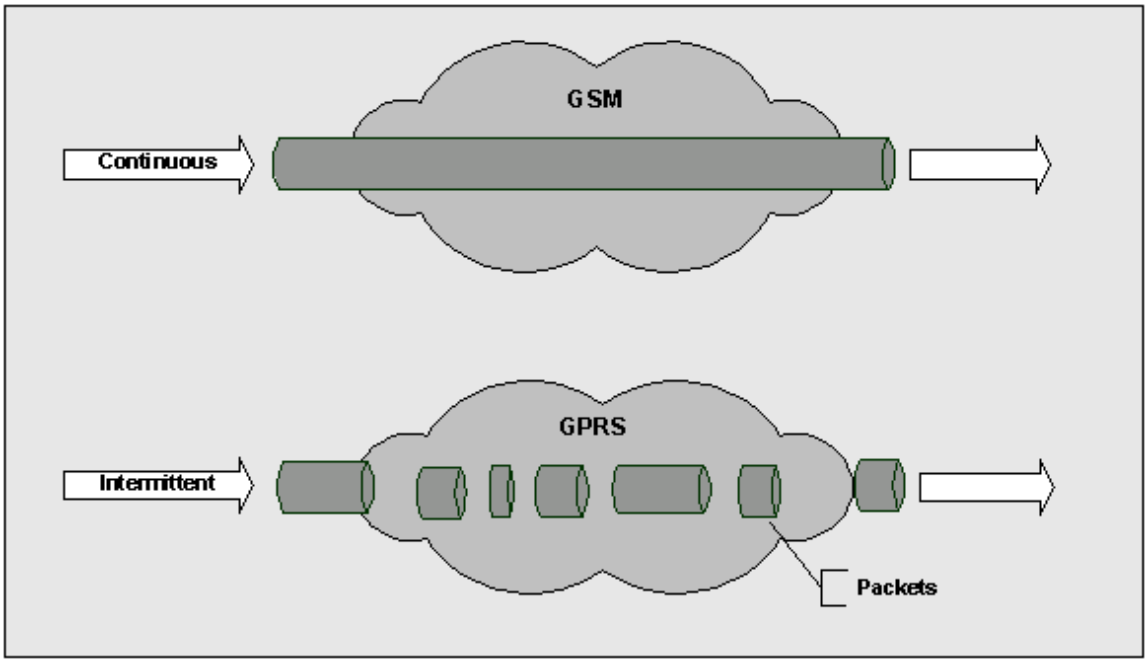


Figure 2 GSM Vs. GPRS Data Transfer

GPRS Network Architecture

To better understand GPRS, we take a quick tour beginning with the mobile PC and traversing through the network. First, we have a notebook computer connected to a GPRS-capable modem through a serial cable, Universal Serial Bus (USB), or PC Card. The GPRS modem communicates with GSM base stations, but unlike circuit-switched data calls that are connected to voice networks by the mobile switching center, GPRS packets are sent from the base station (BTS) to what is called a Serving GPRS Support Node (SGSN).

Enabling GPRS on a GSM network requires the addition of two core modules:

- Gateway GPRS Service Module (GGSN)

  The GGSN acts as a gateway between the GPRS network and the Public Data Networks such as IP. GGSN's also connect to other GPRS networks to facilitate GPRS roaming.

- Serving GPRS Support Node (SGSN)

  The SGSN provides packet routing to and from the SGSN service node for all users in that particular service area. It also keeps track of the mobiles within its service area. The SGSN communicates with what is called the Gateway GPRS Support Node (GGSN), a system that maintains connections with other networks such as the Internet or private networks. A GPRS network can use multiple serving nodes, but requires only one gateway node for connecting to an external network such as the Internet.

When the mobile station sends packets of data, it is via the SGSN to the GGSN, which converts them for transmission over the desired network, which could be the Internet networks or private networks. IP packets from the internet addressed for the mobile station are received by the GGSN, forwarded to the SGSN and then transmitted to the mobile station.

To forward IP packets between each other, the SGSN and GGSN encapsulate these packets using a specialized protocol called the GPRS tunnel protocol (GTP) which operates over top of standard TCP/IP protocols. The details of the SGSN and GGSN are both invisible and irrelevant to the user who simply experiences a straight forward IP connection that just happens to be wireless. See **Figure 3 GPRS Network Architecture** below for an illustrated display of the GPRS network.

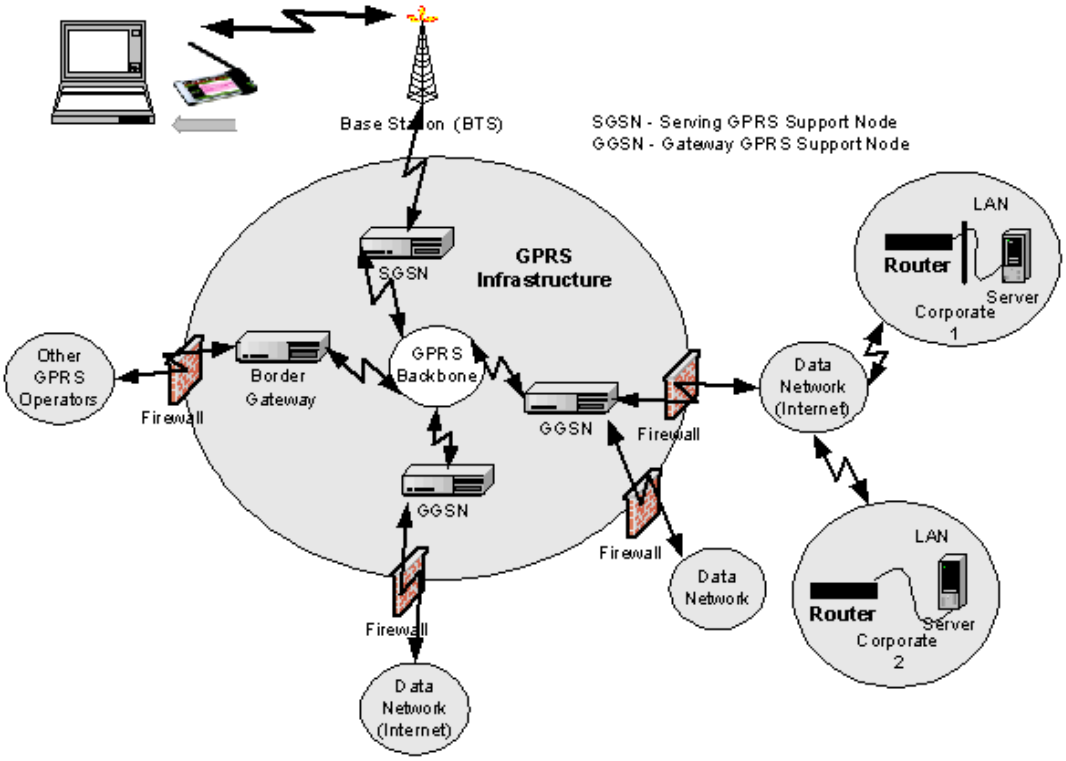


Figure 3 GPRS Network Architecture

An interesting aspect of GPRS is how it achieves its high speeds to over 100 kbps when circuit-switched data today is limited to 9600 (baud rate) or 14.4 kbps. GPRS uses the same radio channel as voice calls, a channel that is 200 kHz wide. This radio channel carries a raw digital radio stream of 271 kbps, which for voice calls is divided into 8 separate data streams, each carrying about 34 kbps. After protocol and error correction 13 kbps remains for each voice connection or about 14 kbps for data.

Circuit-switched data today uses one voice channel. GPRS can combine up to 8 of these channels, and since each of these can deliver up to 14 kbps of data throughput, the net result is that users will be able to enjoy rates over 100 Kbps. But not all eight-voice channels have to be used. In fact, most mobile stations (MS) will be ones that are limited to 56 kbps. The GPRS standard defines a mechanism by which a MS can request the amount of bandwidth it desires at the time it establishes a data session.

Data Rates

Four major factors affect actual GPRS data rates:

- Multi-slot Class

  Each timeslot can handle a given amount of data, established through negotiation between the device and the network.

- Channel Coding Scheme

  Four CS schemes are defined, each with a different level of error correction (basically “overhead”, similar to CDPD, which takes the 19.2 down to a real data rate somewhere between 10 and 12 kbps). As the amount of error correction is reduced, the quantity of data in the packets increases, but the probability that packets of data will need to be retransmitted increases. Conversely, as the amount of error correction increases, less data can be sent in each packet or timeslot, but the chance that re-transmission of packets is required decreases. With no error correction, a maximum of 21.4 kbps per channel can be supported - which, at the maximum 8 timeslots, equals 171.2 (for CS-4) kbps. At CS-1, there is 9.05 kbps per timeslot; this increases to 13.4 kbps per timeslot at CS-2 and 15.6 kbps per time slot at CS-3.

- Network Capacity

  The device and the network will negotiate the appropriate combination of MS class and CS scheme to determine the actual data, based on capabilities of the device, and how busy the network is at a given point in time.

  Because GPRS is an extension of the digital voice GSM network, voice calls will always take priority over data calls (real time voice is more important than data); therefore real data rates will, in many cases, be lower than the device can support.

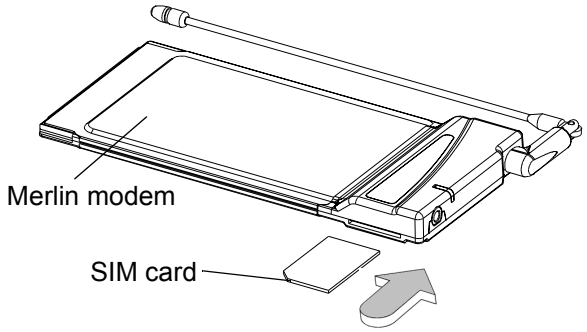
- Quality of Service (QoS)

  There is the ability to assign a Quality of Service to a specific account. The QoS is used to guarantee a certain data rate as well as capacity.

Most devices will be limited to MS-10, which, at CS-2, is a maximum of 53.6 kbps (4 * 13.4 = 53.6) Rx and 26.8 kbps (4 * 13.4) Rx, or nominally 56 and 28.

SIM

GPRS requires a unique SIM (Subscriber Identity Module) card for each device. The SIM Card identifies individual users to the network for billing and other purposes, ensures a common set of SIM-based features, and maintains security with other GSM devices.



A SIM card must be present in the device at all times to allow network access.

A SIM card is required for all PC Card functions except emergency calls.

SIM cards can be moved from one device to another without the need to inform the network carrier. SIM cards may be configured differently to support different modes of operation.

Operational Features

Table 2: Summary of Operational Features

Feature	Description
Class of Operation	Class B: Modem supports both GSM CSD and GPRS Packet data, but will not support both simultaneously
GSM Circuit Switched Data (CSD)	Transparent and non-transparent CSD over GSM networks up to 14.4kbps
General Packet Data Service (GPRS)	• MS-10 operation • Type 1 device (Simplex RF operation) • up to 4 receive slots, up to 2 transmit slots, for a combined maximum of 5 slots • 4/1, 3/1,3/2,2/2, 2/1 combination provides theoretical rates of up to 56 kbps receive and 28 kbps transmit • automatically maintains GPRS virtual circuit when CSD or Voice traffic is present
SMS (Short Messaging Service)	Mobile originated and mobile terminated SMS messages.
Voice (May not be supported on all devices)	Supports voice communication using any differential headset.
AT Commands	Standard GSM AT Command set with enhancements (See Chapter 3: AT Commands).

Feature	Description
Software Interface	• standard GSM AT Command set with enhancements • supports PPP protocols for external hosting • supports channel coding schemes CS-1 and CS-2
Software included	• Compatible with Windows 98SE/ME/2000/XP, Windows NT 4.0 SP4, Pocket PC 3.0 and Pocket PC 2002
Approvals	• Full Type Approval, compliant to GSM Phase 2+ standard (all) • FCC Part 15 and Part 24 (PCS1900) (Merlin G100, G301, Expedite G301) • Essential requirements of the Radio and Telecommunications Terminal Equipment (R&TTE) Directive, 1999/5/EC; 3GPP TS 51.010-1 Digital Cellular Telecommunications SYstem (Phase 2+) Mobile Station (MS) conformance Specification; Part 1: Conformance Specification (Merlin G201,G301)
Frequency Band	• PCS 1900 North American GSM (Merlin G100) or • GSM 900 / DCS 1800 (Merlin G200 series) or • GSM 900 / PCS 1900 / DCS 1800 (Merlin G301 and Expedite G301)
Data Power Connector	• standard 16 bit PCMCIA PC Card Interface • 70 pin electrical interface for Expedite
SIM Card	• SIM card supplied by the carrier as a separate item. Expedite provides connection signals for an external SIM Module
Antenna Interface	• standard 50-ohm MMCX antenna termination (Expedite G301, Merlin G201) • standard 50-ohm Radial MC card type antenna connector (Merlin G100)
Output Power Level	• GSM Power Class 1 at DCS 1800 and PCS 1900 frequency bands. • GSM Power Class 4 at GSM 900 frequency bands
Temperature	• Operating -10°C to +55 ^{o}C • Storage -30°C to +75 ^{o}C
Power Supply	• nominal 3.6 volt DC supply for Expedite module

Notices

Safety Warning

Neither Merlin or Expedite GPRS products may be used in an environment where radio frequency equipment is prohibited or restricted in its use. This includes aircraft/airports, hospitals, and other sensitive electronic areas. To ensure that the modem is deactivated remove it from the computer under the above conditions.

Under extended operation the Merlin modem will generate a noticeable amount of heat. Like all PC Cards, the modem generates heat during normal operation and will be heated by the host computer. For this reason it is recommended that after extended periods of operation, prior to removal and handling, the user allow the modem to cool down.

FCC RF Interference Statement

Federal Communications Commission Radio Frequency Interference Statement.

This equipment has been certified to comply within the limits of a class B digital device pursuant to part 15 and Part 24 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in residential situations. This equipment generates, uses, and can radiate radio frequency energy, and, if not properly installed and used in accordance with the instructions, may cause harmful interference to radio or television reception, or to laptop computers and PDAs. This can be determined by turning the equipment on and off. The user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna of the television, radio or cordless telephone.
- Increase the separation between the equipment and the receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/television technician for additional suggestions

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Regulatory Requirements

The regulatory requirements for the embedded module may include the following, depending on the market where the module will be sold.

United States of America

FCC CFR47 Part 2 (General Rules and Regulations, RF Exposure Evaluation)

FCC CFR47 Part 15 (All Radio Frequency Devices)

FCC CFR47 Part 24 (Narrow and wideband PCS modules)

Canada

Industry Canada RSS-118 (Cellular Band)

Industry Canada RSS-102 (RF Exposure)

Industry Canada RSS-133 (2GHz PCS band)

Europe and Asia

Radio and Telecommunications Terminal Equipment (R&TTE) Directive, 1999/5/EC.”

Mobile Station (MS) Conformance Specification Part 1:3GPP TS 51.010-1.

Harmonized Radio Standard ETSI EN 301 511 V.7.0.1

Additional regulatory information for Asia will be made available in future versions of this document.

Radio Frequency Exposure Evaluation Requirements

For applications that provide a separation of at least 20 cm from the radiating element to the users and bystanders in the United States market, the embedded modules are treated as “mobile devices” as per FCC CFR47 paragraph 2.1091.

A mobile device is defined as “a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 cm is normally maintained between the transmitter’s radiating structure(s) and the body of the user or nearby persons.” The antenna type used for the radio frequency exposure evaluation must be specified in the documentation and sold with the module. If the module is used with a different antenna type and/or in a design where the separation distance of 20 cm is not normally maintained, the radio frequency exposure evaluation should be repeated for the new configuration. Use of this device in applications that would not ensure the 20 cm minimum separation are in violation of the FCC quthorization for this device. A new FCC application and authorization would be required for use at less than 20 cm separation.

Some devices are not subject to radio frequency exposure evaluation prior to equipment authorization, depending on the transmitter power level and frequency band of operation.

Regulation and Compliance

The Merlin G100 conforms to ETSI EN 300 607-1 for the digital cellular telecommunications system (Phase 2+) mobile station conformance specification, Part 1 Conformance Specification.

Merlin G200 Declaration of Conformity

The Merlin G200 Series (G200, G201) conforms to the essential requirements of the Council Directive 1999/5/EC of the European Parliament and the Council on the basis of Technical Construction. File titled “Merlin G200/G201” in relation to the essential requirements of Article 3.2 of the Directive.

Technical Support Contacts

To obtain technical support for a Merlin GPRS PC Card, please contact the provider of your GPRS SIM card, your local GSM/GPRS service operator, or the supplier of your Merlin GPRS PC Card. Where local support is not available, contact the Novatel Wireless Technical Support Team.

WWW: www.nvtl.com/support/index.htm

Email: gprs_support@nvtl.com

To obtain technical support for an Expedite GPRS OEM module, please contact your NVTL sales agent to arrange a direct support contact.

Limited Warranty and Liability

Hardware Warranty

Novatel Wireless™ warrants that during the Warranty Period that:

1. the Product will be free from defects in material and workmanship under normal use and service and will conform to Novatel Wireless's (Novatel Wireless Technologies™) specifications
2. the software will be free from error that materially affect performance

Products

One (1) year

Accessories

90 days (in each case from the date sold by Purchaser)

These warranties are expressly written in lieu of all other warranties, either expressed or implied, including, without limitation, all implied warranties of merchantability and fitness for a particular purpose. Novatel Wireless™ liability hereunder is expressly limited to refund of all amounts paid to Novatel Wireless™ for any defective units or products, whether Novatel Wireless™ liability arises from breach of warranty, or with respect to any obligation arising from breach of warranty, or otherwise with respect to the manufacture and sale of any units of the product, whether liability is asserted in contract or tort, including negligence and strict product liability. Novatel Wireless™ shall in no event be liable for special, indirect, incidental, or consequential damages of any kind or nature due to any cause.

Purchaser's exclusive remedy for a claim under this warranty shall be limited to the repair or replacement, at Novatel Wireless™'s option, of defective or nonconforming materials, parts or components.

The foregoing warranties do not extend to the following:

- nonconformities, defects or errors in the Products due to accident, abuse, misuse or negligent use of the Products or use in other than a normal and customary manner, environmental conditions not conforming to Novatel Wireless™'s specifications, or failure to follow prescribed installation, operating and maintenance procedures
- defects, errors or nonconformities in the Products due to modifications, alterations, additions or changes not made in accordance with Novatel Wireless™'s specifications or authorized by Novatel Wireless™
- normal wear and tear
- damage caused by force of nature or act of any third person, (v) shipping damage
- service or repair of Product by the Purchaser without prior written consent from Novatel Wireless™

- products designated by Novatel Wireless™ as beta site test samples, experimental, developmental, preproduction, sample, incomplete or out of specification Products
- returned Products if the original identification marks have been removed or altered

Software Warranty

Novatel Wireless™ warrants that for a period of 12 months from delivery at the FCA point, that the Products are free from defects in material and workmanship, conform to Novatel Wireless™ specifications and the software is free from errors which materially affect performance. This warranty is exclusive and Novatel Wireless™ makes no representation or warranty of any other kind, express or implied, with respect to its products, whether as to merchantability, fitness for a particular purpose or any other matter. The foregoing warranty does not extend to (i) non-conformities, defects or errors in the Products due to accident, abuse, misuse or negligent use of the Products or use in other than a normal or customary manner, environmental conditions not conforming to Novatel Wireless™'s specifications, or failure to follow prescribed operating and/or maintenance procedures; (ii) defects, errors or non-conformity in the Products due to modifications, alterations, additions, or changes not made or authorized to be made by Novatel Wireless™; (iii) normal wear and tear; or (iv) damage caused by force of nature or act of any third party.

- Novatel Wireless™'s obligations are limited to correction of a failure or defect in the Products by implementation of a module swap whenever practicable. Novatel Wireless™ does not warrant that the execution of the software shall be uninterrupted or error free.
- In the event of a warranty claim, the Purchaser shall return the Products to Novatel Wireless™'s Calgary facility for testing and examination at the Purchaser's expense. After testing and examination Novatel Wireless™ shall either:
    - determine the claim is a valid warranty claim in which case the Products will be repaired and returned to the Purchaser at Novatel Wireless™'s cost and the Purchaser shall be reimbursed for the original cost of shipping the Products to Novatel Wireless™ to evaluate the warranty claim

    or

    - determine the claim is not valid or that the warranty has been voided in which case the Products shall be returned to the Purchaser at the Purchaser's cost
- Purchaser's exclusive remedy for claims arising hereunder shall be for damages. Novatel Wireless™'s liability for any and all losses and damages to purchaser resulting from any cause whatsoever including Novatel Wireless™'s negligence or alleged damage or defective products, irrespective of whether such defects are discoverable or latent, shall in no event exceed the purchase price of the particular products with respect to which losses or damages are claimed, or at Novatel Wireless™'s election, the repair or replacement of defective or damaged products or the issuance of a credit memo in lieu thereof. In no event, including in the case of a claim of negligence, shall Novatel Wireless™ be liable for incidental or consequential damages.

Novatel Wireless™ may, at its discretion, implement changes in the Products, modify the drawings and its specifications for the Products, or substitute product of more recent design; provided, however, that any such changes, modifications or substitutions, under normal and proper use shall not materially and adversely affect functional performance, form or fit of the Products. Novatel Wireless™ agrees to use reasonable efforts to provide the Purchaser with 30 days written notice of such changes.

Version Compatibility

Novatel Wireless™ will make all efforts to ensure that firmware upgrades are backwards compatible with earlier versions of both firmware and hardware. Hardware revisions introduced must be used with factory loaded firmware or a compatible version of a later release. At no time will Novatel Wireless™ warrant a device which is loaded with a firmware version which predates the devices hardware revision date.

Validity of Warranty Claim

The validity of any warranty claim shall be subject to, and conditional upon confirmation by Novatel Wireless™ within 30 days from receipt of such claim. Postage, freight or other such transportation charges for shipping parts subject to the warranty claim to an authorized Novatel Wireless™ repair facility shall be borne by Purchaser. The Purchaser agrees to pay an additional $40/unit to cover the cost testing and handling for any unit submitted which is determined by Novatel Wireless™ to be invalid claim. Novatel Wireless™ shall bear the cost of postage, freight or other such transportation charges for the return to Purchaser provided the warranty claim is determined by Novatel Wireless™ to be a valid claim. Any unit repaired or replaced under warranty shall be warranted only for the balance of the warranty period already in effect for the original item or if the balance of the warranty period is less than 90 days, the warranty shall be for 90 days from the date of repair or replacement.

Care, Repair and Return

The following criteria must be met prior to returning products to Novatel Wireless Inc™.:

- Contact our Technical Support team to obtain a Return Material Authorization (RMA) number. An RMA number is valid for 15 business days and must be received within those 15 days.

  The following information must be provided:

  - IMEI or serial number
  - reason for return
  - original invoice (if possible)
  - user name, phone number, email address
  - charging information
- Returns on defective products are not subject to the 15% restocking fee. The product defect must be verified by the Novatel Wireless™ Technical Support staff before a replacement unit or refund is issued.
- Defective products that are returned outside of the 30 day period, but still covered by Novatel Wireless™ Limited Warranty will either be repaired or replaced. **No** refund is issued on these units.

- Returns on defective products that are no longer covered by the Novatel Wireless™ Limited Warranty will be subject to a repair fee. Please contact our Technical Support staff for more information.
- Returns on opened, non-defective product are subject to a 15% restocking fee. All items must be in “as new” condition, in the original packaging and include all warranty cards, documentation and software. Should any items be missing the user will be billed or a portion of the refund will be deducted.
- There will be a $15.00 repackaging fee for products not returned in the original packaging. The user is responsible for shipping costs on all returns.
- There are no returns for credit on product accessories.

Mailing Address

Novatel Wireless, Inc™.

9360 Towne Centre Drive, Suite 110

San Diego, CA 92121-3030

Icon Usage

Throughout this manual icons are used to signify information that may require special attention. The icons are as follows:

Note: Signifies an item that may be noted and used in more then one situation.

Hint: Signifies a time saver or a specific function that must be performed in order to experience success. May also indicate that a shortcut may be used.

Reference Material: Other sources of information exist and may be referred to.

Warning: Performing a specific function may cause an operation to fail, subsequently losing information or affecting system performance.

Chapter 2: Specifications

This section contains specifications for Merlin G100 and G200 GPRS PC Card modems and the Expedite G301 OEM modem module.

Merlin GPRS PC Card Specifications

The Merlin G100 and G200 are wireless modems designed to be plugged into the PC Card slot of a host computer.

Topics Included in this Chapter

Merlin GPRS PC Card Specifications 15
Expedite G301 OEM Module Specifications 24
Air Interface 38
Subscriber Identification Module (SIM) 39
Modes of Operation 40
Application Information 41

Merlin General Specifications

Table 3: General Specification for Merlin GPRS PC Cards

Physical Dimensions and Weight	Merlin G100	Merlin G200
Length		
Total	111.64 mm	111.71mm
Width		
Without Antenna	54.0 mm	54.0 mm
With Antenna	60.63 mm	
Thickness		
Insertion Thickness	5.60 mm	5.60 mm
Exposed Thickness	7.68 mm	8.96 mm
Weight		
Complete Modem (unpackaged)	49.1 gm	51.0 gm
Temperature		
Temperature Range	Operating -10°C to 55 ^{o}C Storage -30°C to 75°C	
Relative Humidity		
Maximum operating humidity at 50°C (non-condensing)	up to 95% Non-condensing	
Recommended Operating Conditions		
Maximum Supply Input Voltage	5.25 v	
Minimum Supply Input Voltage	4.75 v	
Recommended Supply Voltage	5 v	
Supply Voltage Range	4.75 to 5.25 v DC	
Moisture and Dust Resistance		
Do not immerse or expose to excessive moisture. The case is not to be considered dustproof.		
Thermal Shock	**Merlin G100**	**Merlin G200**
Non-Operating	-50 ^{o}C to +20 ^{o}C, +70 ^{o}C to +20 ^{o}C; less than 5 min	-20^{0}C to 55^{0}C

Vibration		
Sinusoidal	3.0 mm displacement, 2 to 9 Hz; 1 m/s^2, 9 to 350 Hz	147 m/s^2, 15g peak amplitude, 10Hz-2000 Hz
Random	0.1 m^2/s^3, 2 to 200 Hz	0.96 m^2/s^3, 5 Hz-20Hz, -3db/0ct, 20 Hz-500Hz
Transport	Packaged ASTM D999	N/A
Mechanical Shock	N/A	semi sine 50 g 11ms
Emissions		
Electromagnetic Emissions	Radiated spurious FCC part 24 / Part 15 Class \ BGSM 11.10 Section 12.2EN 55022 Class B	EMC: ETSI EN 301489-1
Electromagnetic Immunity	As per ETSI ETS 300 342-1	N/A
Electrostatic Discharge (ESD) for PC Connector	To Contacts 2 KV To Antenna Port 8 KV To Case 10 KV	ESD IEC 61000-4-2 To contacts: 8kv To antenna port: 8kv To audio jack: 8kv To case: 8kv
Transmit Power		
GSM Power Class 1 GSM Power Class 4	• DCS 1800 / PCS1900 • GSM 900	
Connectors		
Antenna	RADIALL SMT microminiature 50 ohm coaxial connector (PN R199-005801)	HUBER + SUHNER SMT MMCX 50 ohm coaxial connector (PN 82 MMCX - S50-0-2)
Audio	No audio jack	HOSIDEN audio jack (PN HSJ1816-019010)
PC Card Connector	ITT CANNON 68 pin connector (PN 127040-2414 5925)	ITT CANNON 68 pin connector (PN 127040-2414 5925)
SIM Connector	ITT CANNON (PN CCM04)	JAE SIM Socket (PN SF 2W006S4KE3000)

Merlin Physical Appearance

Merlin G100.

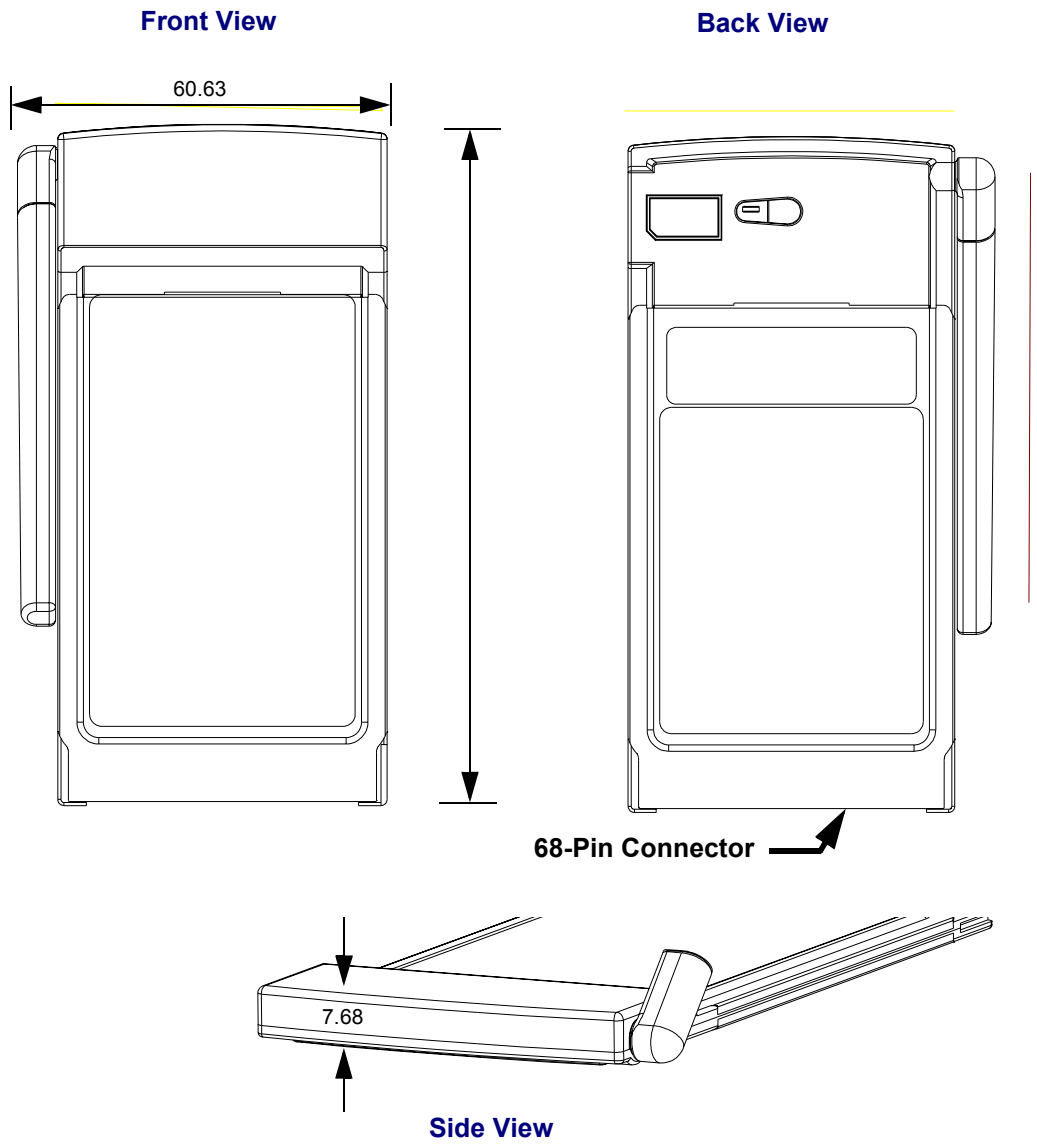


Figure 1: Mechanical View of MerlinG100

Merlin G200

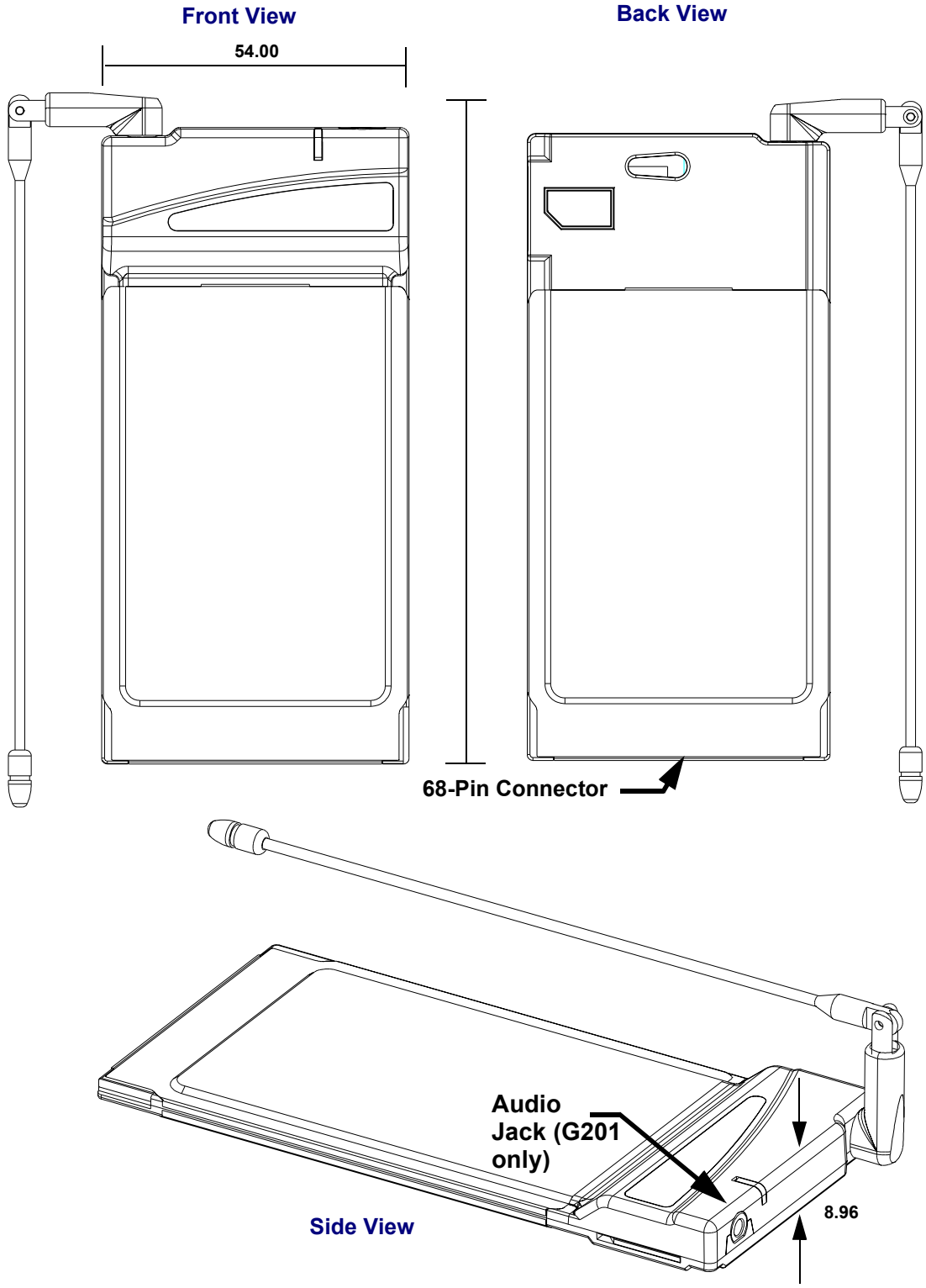


Figure 2: Mechanical View of Merlin G200 Series

PC Card Connector Pin Assignment

Table 4 below contains the pinout information of the 68-pin Merlin PC Card connector.

Table 4: Merlin GPRS PC Card Pin Assignment

Pin #	Signal Name	Direction
1	GND	Power
2	D3	Supported
3	D4	Supported
4	D5	Supported
5	D6	Supported
6	D7	Supported
7	CE#1	Supported
8	A10	Not Connected
9	OE#	Supported
10	A11	Not Connected
11	A9	Supported
12	A8	Supported
13	A13	Not Connected
14	A14	Not Connected
15	WE#	Supported
16	IREQ#	Supported
17	VCC	Card is configured as a 5V card.
18	VPP1	Not Connected
19	A16	Not Connected
20	A15	Not Connected
21	A12	Not Connected
22	A7	Supported
23	A6	Supported
24	A5	Supported
25	A4	Supported
26	A3	Supported
27	A2	Supported
28	A1	Supported
29	A0	Supported

30	D0	Supported
31	D1	Supported
32	D2	Supported
33	IOIS16#	Pulled High
34	GND	Power
35	GND	Power
36	CD#1	Connected to Card Ground
37	D11	Not Connected
38	D12	Not Connected
39	D13	Not Connected
40	D14	Not Connected
41	D15	Not Connected
42	CE2#	Supported
43	VS1#	Not Connected (SELECTS VCC = 5V FOR CARD)
44	IORD#	Supported
45	IOWR#	Supported
46	A17	Not Connected
47	A18	Not Connected
48	A19	Not Connected
49	A20	Not Connected
50	A21	Not Connected
51	VCC	POWER, Card is configured as a 5V card
52	VPP2	Not Connected
53	A22	Not Connected
54	A23	Not Connected
55	A24	Not Connected
56	A25	Not Connected
57	VS2#	Not Connected (SELECTS VCC = 5V FOR CARD)
58	RESET	Supported
59	WAIT#	Supported
60	INPACK#	Pulled High
61	REG#	Supported
62	BVD2/SPKR#	Pulled High, No Audio
63	BVD1/STSCHG#	Pulled High

64	D8	Not Connected
65	D9	Not Connected
66	D10	Not Connected
67	CD2#	Connected To Card Ground
68	GND	Connected To Card Ground

Interfaces

Merlin Hardware Interface

The modem is electronically configured as a 5-Volt 8-bit I/O memory card. The supported pins on the 68 position interface connector are driven by a LVTTL interface IC that includes 5V tolerant inputs and runs off a 3.1V power supply. Signals driven by this card will reach 3.1V but can accept 5V logic levels on inputs.

Air Interface

Table 5: Air Interface Data Rates

Coding Scheme	Data Rates per Time Slot (Kbps)	Maximum Data Rate (8 Time Slots)
CS1	9.05	72.4
CS2	13.4	107.2

Table 6: Radio Channel Frequency

Radio Channel Frequency			
Bands	**Channel**	**Tx**	**Rx**
P-GSM 900	$1 \leq n \leq 124$	Freq(n)=890+0.2*n	Freq(n)=935+0.2*n
E-GSM 900	$0 \leq n \leq 124$ $975 \leq n \leq 1023$	Freq(n)=890+0.2*n Freq(n)=890+0.2*(n-1024)	Freq(n)=935+0.2*n Freq(n)=935+0.2*(n-1024)
DCS 1800	$512 \leq n \leq 885$	Freq(n)=1710.2+0.2*(n-512)	Freq(n)=1805.2+0.2*(n-512)
PCS 1900	$512 \leq n \leq 810$	Freq(n)=1850.2+0.2*(n-512)	Freq(n)=1930.2+0.2*(n-512)

Table 7: Radio Power Index

Radio Power Index		
Bands	**Index**	**Power**
GSM 900	5-19	2dB Incremental steps
PCS 1900/DCS 1800	0-15	2dB Incremental steps

Table 8: PCS Gain Index

0 - 25	0 = min gain, 25 = max gain

Modes

The Merlin GPRS PCS PC Card supports both memory mode and I/O mode.

Memory Mode

When the Merlin GPRS PCS PC Card is inserted into a PC card host, the card will power up in memory mode. In this mode, the host will read CIS from the attribute memory on the card and then configure the card for I/O mode and assign the card a COM port. This process is automatic and transparent to the user.

The Merlin GPRS PCS PC Card does not provide the host with any additional RAM or FLASH storage.

I/O Mode

Once the GPRS PCS PC Card has been configured and the COM port assigned, the card will then be in 8-bit I/O mode. The information that the host will read from CIS memory will indicate that the device is a modem card with a serial port interface containing a UART type of 16550. The combination of the base addresses and IRQs, in the order that the modem will accept, are listed below in **Table 9: Base Addresses and IRQs**.

Table 9: Base Addresses and IRQs

Base Address	IRQ	Comment
3F8	4	Only level interrupts are supported
2F8	3	Only level interrupts are supported
3E8	4	Only level interrupts are supported
2E8	3	Only level interrupts are supported
Any base address	7- 0 and 15 - 8	Only level interrupts are supported

Expedite G301 OEM Module Specifications

The Expedite G301 is a tri-band GSM/GPRS radio module designed to be integrated by third party developers into a finished product.

Expedite General Specifications

Table 10: Technical Specification for Expedite G301 Module

Physical Dimension and Weight	Specifications
Length	50.0 ± 0.30 mm
Width	37.0 ± 0.30 mm
Thickness	5.0 mm (maximum)
Temperature	
Temperature Range	Operating -10^{0}C to +60^{0}C Storage -30°C to 75°C
Relative Humidity	
Maximum operating humidity at 50°C (non-condensing)	Up to 95% Non-condensing
Recommended Operating Conditions	
Maximum Supply Input Voltage	4.5 V
Minimum Supply Input Voltage	3.4 V
Supply Voltage Range	3.4 to 4.5 VDC
Moisture and Dust Resistance	
Do not immerse or expose to excessive moisture. The case is not to be considered dust proof.	
Vibration	
Sinusoidal	3.0 mm displacement, 2 to 9 Hz; 1 m/s^2, 9 to 350 Hz
Random	0.1 m^2 /s^3, 2 to 200 Hz
Transport	Packaged ASTM D999
Emissions	
Electromagnetic Emissions	Meets radiated spurious FCC part 24 / Part 15 Class \ BGSM 11.10 Section 12.2EN 55022 Class B

Electromagnetic Immunity	As per ETSI ETS 300 342-1
Data Rates	
Host Interface Baud Rate	The module supports as a minimum, asynchronous data transmission of the following rate and format: Baud Rate: 9600, 19200, 57600, 115200 Data Bits: 8 Parity: None Stop Bits: 1
Transmit Power	
GSM Power Class 1 GSM Power Class 4	• DCS 1800 / PCS1900 • GSM 900

Expedite Physical Appearance

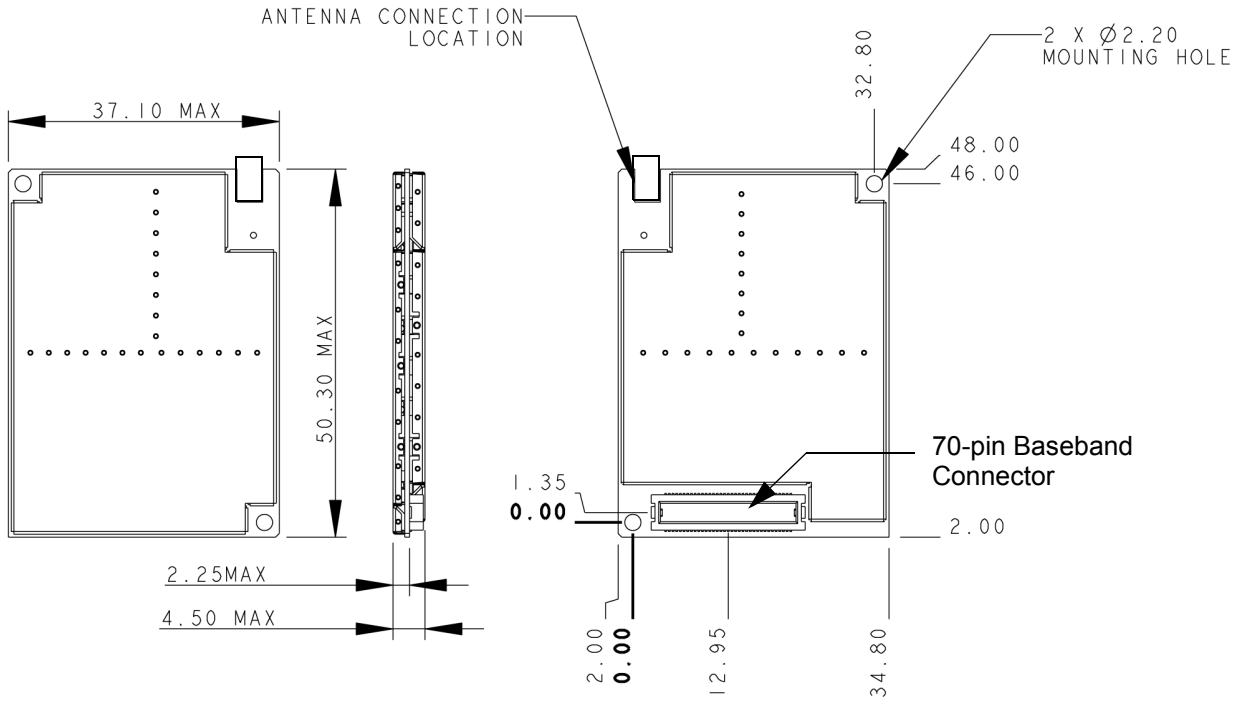


Figure 3 Expedite G301 Mechanical Dimensions

Interfaces

Expedite Host Interface Signals

The Expedite interfaces to a host via a 70 pin baseband connector. Table 11 describes the signals on the connector.

Table 11: Expedite Host Interface Signals

Signal	Pin	Description	Direction
GND	6, 9, 14, 15, 16, 17, 26, 27, 42, 60, 61, 66	Ground	SUPPLY
VCC	28, 29, 30, 31	Power Supply (except Power Amplifier)	SUPPLY
VBAT_PA	18, 19, 20, 21, 22, 23, 24, 25	Power Amplifier Supply	SUPPLY
MDM_RDY	59	Indicates to host that Modem is ready to communicate	OUT
PWR_ON	58	Dual Function pin. Used to turn modem on (and off in the second mode).	IN
SM_IND	57	Sleep Mode Indicator. A high signal indicates that the modem is in sleep mode.	OUT
WAKE_UP	63	An edge triggered interrupt pin to wake up the modem from sleep mode.	IN
PUL_PWREN	69	Pulse-Power-Enable. Selects between pulse mode modem turn on and solid mode turn on. A high on this pin will select pulse mode.	IN
RESET_N	70	Active low input to perform a hardware reset on the modem. Internally pulled up on Modem.	IN
TX_STAT	68	Transmit status. Active high signal indicating to host that the modem's radio is transmitting.	OUT
DTM	56	Data To Modem. Asynchronous serial data to modem.	IN
DFM	55	Data From Modem. Asynchronous serial data from modem.	OUT
DTR	54	Data Terminal Ready. Active High signal indicating to the modem that the host terminal is active.	IN
DSR	53	Data Set Ready. Active high signal indicating to the host that the modem terminal is active.	OUT
CTS	52	Clear To Send. Active high signal indicating to the host that the modem can receive characters.	OUT
RTS	51	Ready To Send. Active high signal indicating to the modem that the host can receive characters.	IN
GPIO1	49	General Purpose Input/Output 1	BiDir
GPIO2	50	General Purpose Input/Output 2	BiDir
GPIO3	47	General Purpose Input/Output 3	BiDir

GPIO4	46	General Purpose Input/Output 4	BiDir
GPIO5	45	General Purpose Input/Output 5	BiDir
GPIO6	44	General Purpose Input/Output 6	BiDir
ADC_IN_1	5	Analog to Digital Converter. The modem can monitor a voltage on this pin.	IN
VCC_SIM	36	Subscriber Identity Module Supply. Used to supply the power to an off-board SIM.	SUPPLY
DATA_SIM	34	SIM data line.	BiDir
RST_SIM	39	SIM reset line.	OUT
CLK_SIM	32	SIM clock line.	OUT
SIM_IN	33	SIM detect line. Active high signal indicating to the modem that a SIM is present	IN
MIC_INP	2	Differential Microphone Input (+) for voice communications.	IN
MIC_INN	4	Differential Microphone Input (-) for voice communications.	IN
SPKR_OUTP	3	Differential Speaker Output (+) for voice communications.	OUT
SPKR_OUTN	1	Differential Speaker Output (-) for voice communications.	OUT
BUZZER	8	Buzzer control signal from modem.	OUT
RTS_2	38	Ready to Send for the secondary serial port on the modem.	IN
DFM_2	43	Data to Modem for the secondary serial port on the modem.	OUT
DTM_2	40	Data from Modem for the secondary serial port on the modem.	IN
CTS_2	41	Clear to Send for the secondary serial port on the modem.	OUT
Pins numbers not mentioned in the table should be left unconnected.			

Modem Power-On and Wake up Strategy

The Expedite G301 is designed so that the host has full control of powering up and powering down the unit, both by hardware and software. There are two schemes available to perform this function to accommodate different host preferences.

The first mode is called “pulsed power-on” and is selected by the host holding the PUL_PWREN signal high. Note that there is an internal 47kΩ pull-up resistor to 2.5V on this signal and it can be left unconnected on the host side. The second mode is called “solid power-on” and is selected by the host holding the PUL_PWREN signal low.

There is also a WAKE_UP signal which is used to wake the modem up from a sleep state. This signal is rising edge interrupt triggered. The host can determine if the modem is in sleep mode by polling the SM_IND signal which will be asserted high when the modem is asleep.

The MDM_RDY signal is asserted high when the modem is capable of communicating with the host. MDM_RDY should always be used by the host to enable buffers that are used for inputs to the modem. In the event that MDM_RDY is deasserted, the modem is not capable of sending or receiving data on either of it's serial ports.

A description of each power on mode is given below.

Pulsed Power-On

With the PUL_PWREN pin in a high state, the modem must be powered on by providing an active high pulse of minimum 600mS to the PWR_ON pin. Once MDM_RDY goes high, PWR_ON can drop and the modem will stay on.

This mode of operation will allow the modem to be shut down by a software AT command (ATH4). When the command is issued, the processor will deregister from the network and perform any power down activities required and then will drive MDM_RDY low before powering off.

Solid Power-On

With the PUL_PWREN pin in a low state, and the PWR_ON signal is driven high, the modem will turn on. The PWR_ON signal must remain high to keep the modem on.

This mode of operation will not permit a software shutdown.

If the modem is to be operated with this method, care must be taken to perform the necessary network activities (eg. De-registration) before shutting the modem off.

Serial Ports

The Expedite module has two serial ports (primary and secondary) used to communicate with the host and other peripheral devices. The primary serial port consists of the DTR, DSR, RTS, CTS, DTM, and DFM signals. It operates at baud rates of 9600 to 115200, has 8 data bits, no parity bit, and 1 stop bit per character. The inputs (DTR, RTS, and DTM) are buffered from the host allowing for a voltage to be present on these lines even when the modem is off. Note that all other inputs to the modem, with the exception of ADC_IN need to be externally buffered so as not to present a voltage when the modem is off.

When the modem goes to sleep, typically on a sleep schedule, it will deassert it's CTS line to indicate to the host that it cannot accept characters. Hardware flow control support is obligatory so that the host does not accidentally send characters while the modem is asleep. The sleep schedule will be determined by each network carrier, but typically the modem will not sleep for more than 2 seconds at a time.

All network traffic will travel on the primary serial port.

GPIO

The Expedite provides 6 separate GPIO's that can be individually programmed via software AT commands.

The GPIO's are not buffered from the host and therefore no voltage may be present on these lines when the modem is off. The MDM_RDY signal should be used to enable host side buffers.

Analog to Digital Converter (ADC)

The Expedite provides an Analog to Digital Converter port that can be used to monitor battery voltage. It can monitor a voltage from 500mV to 6V

Audio Port

The Expedite design provides the connections for a differential microphone and speaker as well as a buzzer. Testing has shown that for optimal performance, a differential configuration should be used. This will eliminate common mode noise that inherently exists in a GSM system especially during the transmit bursts. The microphone circuit should incorporate an RC low pass filter designed to reduce noise in the 900 MHz and higher bands.

The buzzer output is a single-ended output with limited drive capability. An external transistor buffer is suggested to drive the buzzer.

Subscriber Identity Module Support

The Expedite G301 supports a 3.3V SIM as described in ETSI 11.12. The relevant signals are brought out on the 70 pin connector.

The ETSI specification dictates that the system be made aware if the SIM is disconnected during operation. This function is handled by the SIM_IN signal. This line should be asserted high when a SIM is present. The SIM_IN signal is pulled low on the Expedite module by a 4.7kΩ resistor so that when a SIM is not present the line will be low. Care should be taken not to use a weak pull-up for the SIM_IN signal. If the module will be integrated into a system in which the SIM cannot be removed without powering down the modem, the SIM_IN signal can be tied to the VSIM rail.

Electrostatic Discharge and Electromagnetic Interference

The modem does not protect itself from ESD. It is the responsibility of the host to ensure that there will not be any harmful discharges to the modem.

With regard to EMI, the modem will meet FCC part 15 for North American markets, and ETSI EN 301 489-1 for European markets.

Expedite Electrical Specifications

Power Supply

Table 12: GSM 900 Mhz Mode:

Specification	Conditions	VBAT_PA		VCC		
		MIN	MAX	MIN	MAX	TOTAL
Power Supply Requirement		3.4V	4.5V	3.4V[1]	4.7	
Current Draw (Average)	1 slot RX / 1 slot TX					390mA
	3 slot RX / 2 slot TX					560mA
Current Draw (Tx average over burst)						1700mA
Current draw (Rx)						150mA
Current Draw in Sleep Mode (average including brief wakeup periods)						15mA
Current Draw in Sleep Mode (instantaneous)						5mA
Current Draw (Modem Off)	Vcc, Vpa present					100uA

1. Vcc can drop as low as 3.0 Volts. However, the interface voltages will be out of regulation below 3.4V.

Table 13: DCS 1800Mhz Mode:

Specification	Conditions	VBAT_PA		VCC		
		MIN	MAX	MIN	MAX	TOTAL
Power Supply Requirement		3.4V	4.5V	3.4V	4.7	
Current Draw (Average)	1 slot RX / 1 slot TX					300mA
	3 slot RX / 2 slot TX					400mA
Current Draw (Rx)						150mA
Current Draw (Tx average over burst)*						1400mA

Current Draw in Sleep Mode (average including brief wakeup periods)						15mA
Current Draw in Sleep Mode (instantaneous)						5mA
Current Draw (Modem Off)	Vcc, Vpa present					100uA

Table 14: PCS 1900MHz Mode:

Specification	Conditions	VBAT_PA		VCC		
		MIN	MAX	MIN	MAX	TOTAL
Power Supply Requirement		3.4V	4.5V	3.4V	4.7	
Current Draw (Average)	1 slot RX / 1 slot TX					300mA
	3 slot RX / 2 slot TX					400mA
Current Draw (Tx average over burst)*						1400mA
Current Draw (Rx)						150mA
Current Draw in Sleep Mode (average including brief wakeup periods)						15mA
Current Draw in Sleep Mode (instantaneous)						5mA
Current Draw (Modem Off)	Vcc, Vpa present					100uA

Interface Signals

Table 15: Interface Signals

	Parameter	Min	Typical	Max
Primary Serial Port				
	V_{OH}	3.0V		3.4

	V_{OL}	GND		0.2V
	V_{IH}	2.3V		5.5V
	V_{IL}	GND		0.8V
	BAUD RATE	9600		115200
	Data Bits		8	
	Parity Check		N	
	Stop Bit		1	

SECONDARY SERIAL PORT				
	V_{OH}	3.0V		3.4V
	V_{OL}	GND		0.2V
	V_{IH}	2.3V		3.5V
	V_{IL}	GND		0.8V
	BAUD RATE		9600	

GPIO				
	V_{OH}	3.0V		3.4V
	V_{OL}	GND		0.2V
	V_{IH}	2.3V		3.5V
	V_{IL}	GND		0.8V
	Idrive			4mA
	Input Impedance	TBD		
	Input Capacitance			9pF

SIM				
	As per ETSI 11.12			

ADC Port				
	Voltage Range	500mV		6V

	Resolution (10-bit)		5mV	
	Time Between Samples	TBD		
	Input Impedance	400 kOhm		
	Input Capacitance			6 pF
	Modem Off Impedance	TBD		

Analog Voice Port			
Speaker			

	Max. Output Swing (differential)			1.56Vpp
	Nominal Output Swing (differential)			1.0954 Vpp
	Nominal Reference Level (differential)		1.0954	
	Minimum Load Resistance RL (differential)	15 Ohm		
	Max. Load Capacitance CL (differential)			100pF

Microphone			

	Max. Input Voltage Range			1.578Vpp
	Nominal Reference Level		1.0954Vpp	
	Input PGA Gain		0 to 22.5dB	
	Input Resistance		124 kOhm	

BUZZER			

	Max Output Swing			0.789 Vpp
	Output Bias Voltage		1.15V	
	Minimum Load Resistance	1 kOhm		
	Maximum Load Capacitance			150pF

MANUAL RESET INPUT			

	V_{IH}	2.3V		
	V_{IL}			0.8V
	Pulse Width	1uS		
	Glitch Rejection		100nS	
	Pull up value on Modem	32kOhm	63kOhm	100kOhm

POWER UP AND WAKEUP				
PUL_PWREN				
	V_{IH}	0.7 * Vcc		
	V_{IL}			0.3 *Vcc
PWR_ON				
	V_{IH}	0.7 * Vcc		
	V_{IL}			0.3 *Vcc
WAKEUP				
	V_{IH}	1.5V		
	V_{IL}			0.8V
SM_IND				
	V_{OH}	3.0V		3.4V
	V_{OL}	GND		0.2V
TRANSMIT STATUS INDICATOR				
	V_{OH}	3.0V		3.4V
	V_{OL}	GND		0.2V

Power-on and Wake-up Timing Characteristics

Table 16: Power-On and Wake-up Characteristics

Symbol	Parameter/Conditions	Min	Typ	Max	Units
T_{WAKEUP}	Wake-up Pulse width from Sleep-mode	10	-	-	mS
$T_{POWERUP}$	Power-up Pulse width from Modem Power Off	600	-	-	mS
$T_{MODEMOFF}$	Modem Power Control to Modem Power Off	30	-	-	nS
T_{RDY_PWR}	Modem Ready Signal Low to Power Off	1	-	-	uS

T_{RESET}	Reset Pulse timing	TBD			mS

Will be reduced to <200ms.

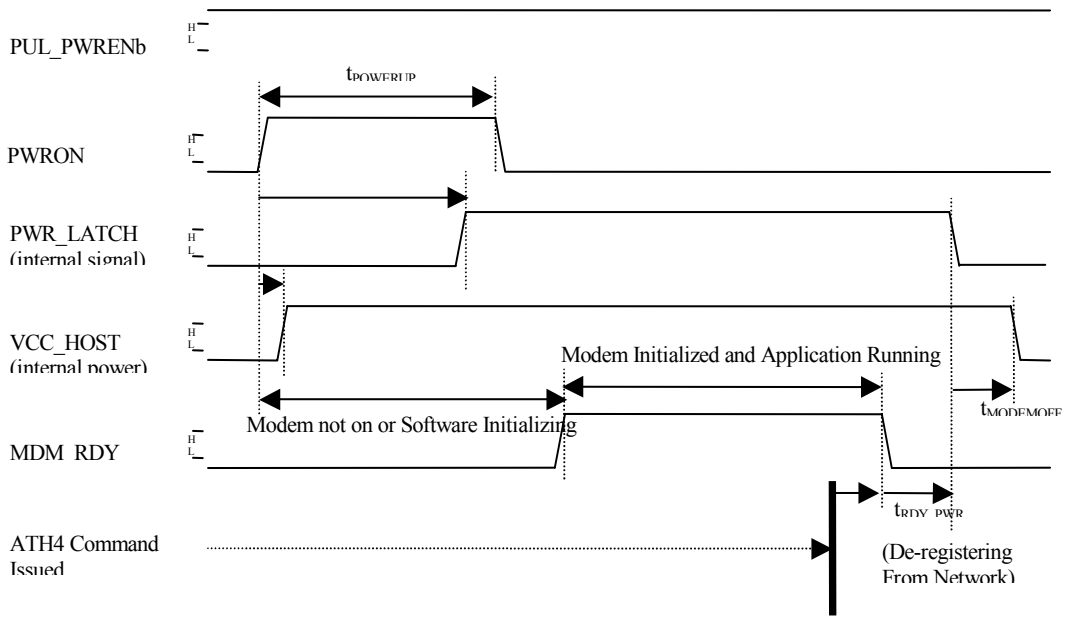
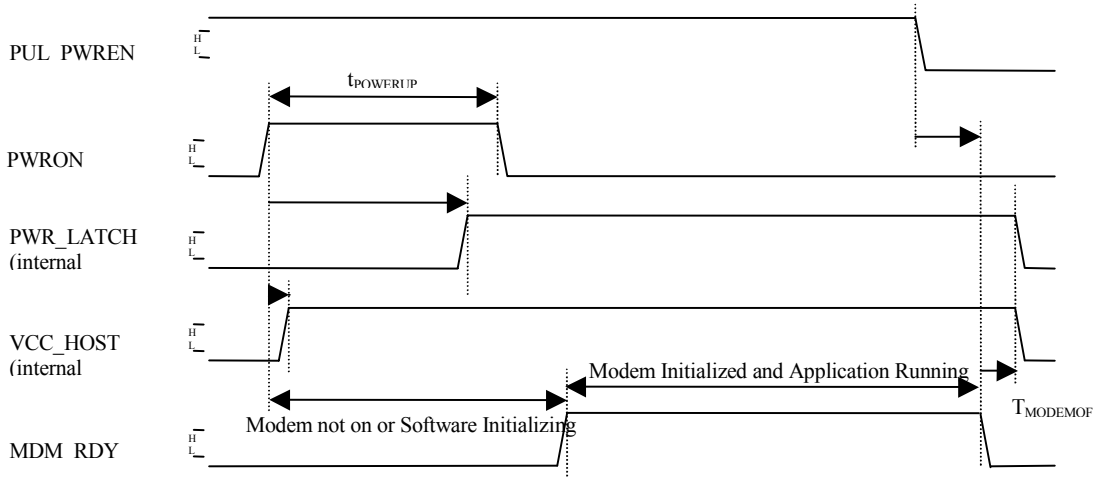


Figure 4 Pulsed Power-on, ATH4 Command Shutdown



* ATH4 Command Not Issued (Method Not Preferred)

Figure 5 ATH4 Command Not Issued (Method not Preferred)

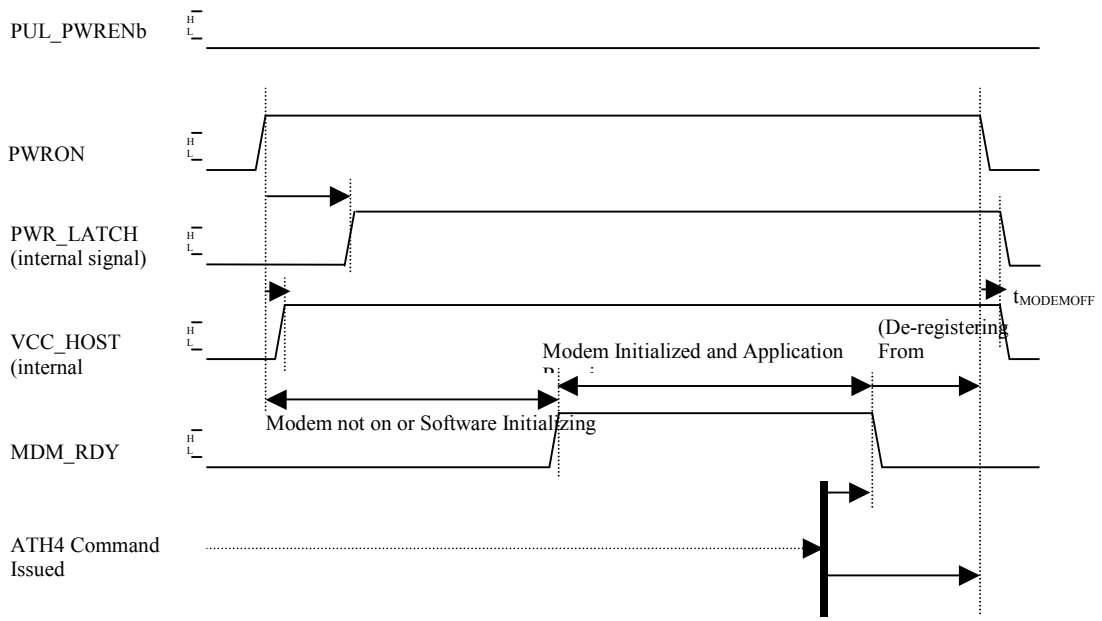


Figure 6 Power Enable-On, ATH4 Command Shutdown

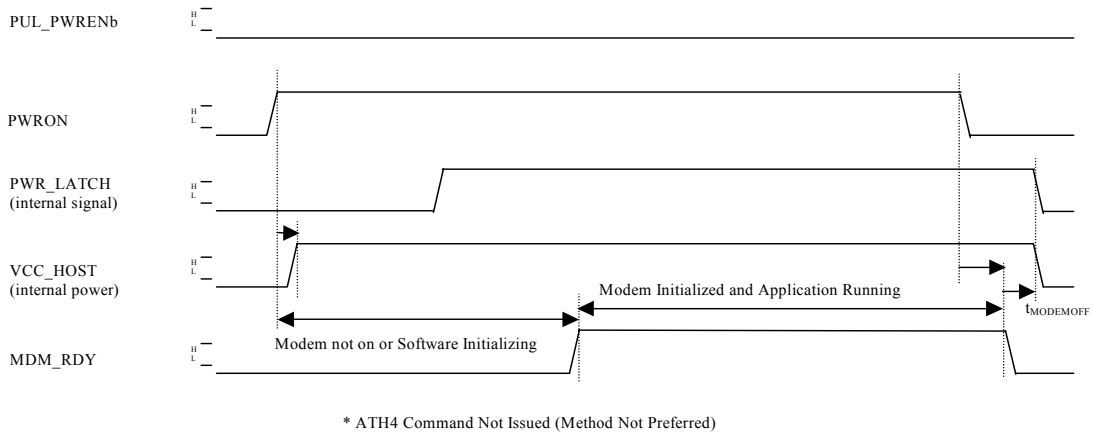


Figure 7 Power Enable On, Power Enable Shutdown

Baseband Connector on Expedite

The following sections detail the baseband connector. All baseband connectors meet UL 94V0 flammability requirements.The specifics of the connector are provided below.

Baseband Connector Part Numbers*

Novatel Part Number	21823060
CSC Part Number	CSC70P01RB-TR
SMK Part Number	CPB7270-1211

* For reference only – refer to approved parts list for current information. M Type, “Plug”, appears visually as a female.

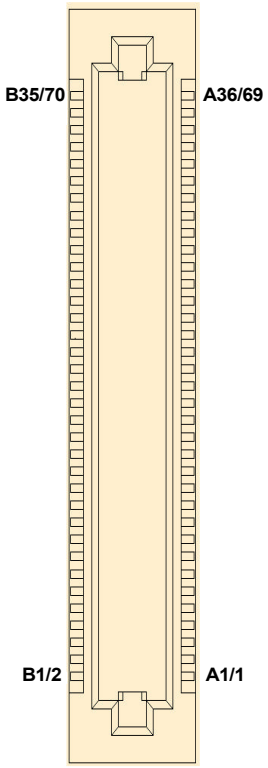
Baseband Mating Connector on the Host

The recommended mating connector is:

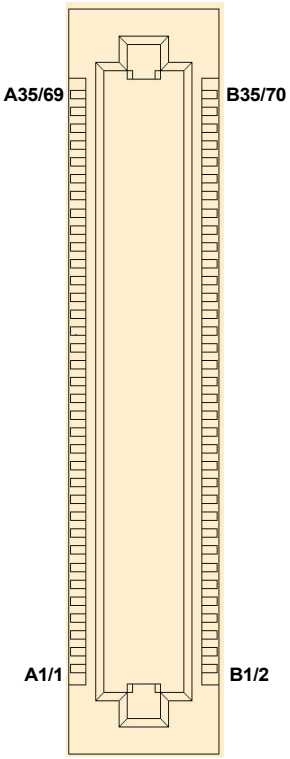
Novatel Part Number	21823061
CSC Part Number	CSC70S01RB-TR
SMK Part Number	CPB7170-0111

Baseband Connector Pin Numbering

Pin Numbering Convention - Plug
(MODULE CONNECTOR – TOP VIEW)



Pin Numbering Convention - Socket
(HOST CONNECTOR – TOP VIEW)



Antenna Port

The antenna port is an MMCX type coaxial connector with 50 ohm impedance.

Antenna Connector

The antenna connector is an MMCX type coaxial connector with 50 ohm impedance.

Novatel Part Number: 21723118

Vendor Part Number: Huber and Suhner – 82MMCX-S50-0-2 6506

Mating Antenna Connector

The mating antenna connector is the appropriate MMCX plug. An example is an AEP 8905-1521-003 connector with a RG316 cable.

Mounting Features

Two mounting holes are provided on the Expedite G301. The mounting holes are compatible with M2 metric screws.

Double-sided adhesive tape can also be used as an option to mount the module. However, the mechanical design is left up to the integrator to ensure that the mechanical mounting and restraint is adequate for the application.

Air Interface

Table 17: Air Interface Data Rates

Coding Scheme	Data Rates per Time Slot (Kbps)	Maximum Data Rate (8 Time Slots)
CS1	9.05	72.4
CS2	13.4	107.2
CS3	15.6	124.8
CS4	21.4	171.2

Table 18: Radio Channel Frequency

Radio Channel Frequency			
Bands	**Channel**	**Tx**	**Rx**
P-GSM 900	$1 \leq n \leq 124$	Freq(n)=890+0.2*n	Freq(n)=935+0.2*n
E-GSM 900	$0 \leq n \leq 124$ $975 \leq n \leq 1023$	Freq(n)=890+0.2*n Freq(n)=890+0.2*(n-1024)	Freq(n)=935+0.2*n Freq(n)=935+0.2*(n-1024)

DCS 1800	512 ≤ n ≤ 885	Freq(n)=1710.2+0.2*(n-512)	Freq(n)=1805.2+0.2*(n-512)
PCS 1900	512 ≤ n ≤ 810	Freq(n)=1850.2+0.2*(n-512)	Freq(n)=1930.2+0.2*(n-512)

Table 19: Radio Power Index

Radio Power Index		
Bands	**Index**	**Power**
GSM 900	5-19	2dB incremental steps
PCS 1900/DCS 1800	0-15	2dB incremental steps

Table 20: PCS Gain Index

0 - 25	0 = min gain, 25 = max gain

Subscriber Identification Module (SIM)

Table 21: SIM Card Specifications

Physical Dimension and Weight	
Size	Width: 25mm (1.0”) Length: 15 mm (0.60”) Thickness: 0.76mm (0.30”)
Mechanical: Storage, Transportation and Operational	
Temperature	-25°C to 70°C *May exceed occasional peaks of up to 85°C.*

Table 22: SIM Card Contacts

Contact Number	Signal	Voltage	Used
1	Supply Voltage	2.7 to 3.3 VDC	Yes
2	Reset	0.0 to 3.0 VDC	Yes
3	Clock	0.0 to 3.0 VDC	Yes
4	No Connection	NC	No

5	Ground	0.0	Yes
6	Programming VPP	NC or VCC	Yes
7	Data I/O	0.0 to 3.0 VDC	Yes
8	No Connection	NC	No

Modes of Operation

The following modes of operation are listed and described below:

- Sleep
- SMS Messaging
- Circuit Switched
- GPRS Data
- Standby

Sleep

SLEEP mode provides the user with enhanced power savings by suspending unused services while powering down other portions of the device. This power savings mode occurs automatically and is transparent to the user. SLEEP mode can have a considerable effect on the useful operating intervals between recharging. The modem draws its power from the host thus affecting the host's operational time.

SMS Messaging

SMS Messaging utilizes a very small portion of the data stream to send text-based messages to units actively connected to the network. SMS Messages can be received in either Standby, GPRS Data or Circuit switched modes. This feature provides a method of sending text messages between network devices or other devices connected via the Internet. SMS messages are limited to 160 bytes of data.

Circuit Switched

A circuit switched session is initiated through a dial command (user initiated) or an answer command (remote initiated). In both cases the modem sets up and maintains a continuous data connection between the modem and the remote. This connection is maintained regardless of whether data is being sent or received. The session can be terminated by the ATH command or through DTR control.

During a circuit switched session the modem will not enter sleep mode.

GPRS Data

The GPRS data connection provides the most cost effective and efficient way to send data over a GSM Network. The modem can chain together multiple slots to increase its throughput, the charges are applied only to the intervals when sending data thus the

dead time, typical in a circuit switched call, are eliminated. The GPRS session is originated by dialing a dialup number, at which time an IP address is assigned to the modem.

Standby

When not in sleep mode or either of the data modes (Circuit switched or GPRS), the modem will actively scan for channels, listening for paging information and maintaining its connection with the network. Standby mode is automatically entered when the unit is powered up and will be activated whenever the modem leaves a data mode. Periodically, the modem must scan for channels, maintain its link with the network, or handoff from one channel to another.

Application Information

Application information about using the Expedite G301 modem to embed GPRS data capability into OEM products, please visit

http://www.nvtl.com/oem/index.html

Application notes can be obtained on-line at:

http://www.nvtl.com/pcproducts/g100.html

For integration assistance, please contact the Custom Engineering Solutions Group at

http://www.nvtl.com/prodserv/oem_custom.html

Chapter 3: AT Commands

AT Commands allow communications software to control and direct the modem. The term AT is derived from the word **AT**tention, meaning to get the modem's attention. AT Commands are issued by an intelligent device to a modem to perform a specific function. For example, AT Commands can be used to initiate a call, answer a call or to simply transmit data.

The ETSI specification created a complete set of commands to interface with the terminal adapter or modem as well as specifying certain commands from ITU 25. To make the AT Command interface easier to understand and provide faster customer integration, a number of the standard AT Commands have been implemented to substitute some of the more specialized ETSI commands. All commands relevant to the control and operation of the modem have been implemented.

This chapter will provide the following information:

- Merlin AT Commands listed by functions
- AT Command explanations, including a description, syntax, parameters, response and an example. For more information please see **"AT Command Set by Name" on page 53**.
- The prefix AT obtains synchronization, identifies the character parameters, and indicates that a command may be in the following characters.
- AT Commands **are not** case sensitive; use upper or lower case letters in the command syntax.

The symbol <cr> represents an AT command's terminating character, used to send the AT command to the modem. By default, this terminating character is set to the carriage return character assigned to the "Enter" key on your keyboard.

Topics Included in this Chapter

AT Command Set by Function 44

AT Command Set by Name 53

CME ERROR Codes for GSM 07.07 Commands. 142

CMS Error Codes for GSM 07.05 Commands 143

AT Command Set by Function

Table 4: Generic AT Commands below, lists by function, the generic AT Commands that can be used with Merlin modems. The general format of the command line is: **<prefix><command><cr>**.

This list does not include commands used for calibration.

Simply move the mouse over the command to link to a detailed explanation.

Table 4: Generic AT Commands

Generic AT Command	Reference ETSI 07.07,PCCA STD-101	Response
A/	Re-issues last AT command given	AGAIN
+++	ESC from Data mode to command mode	ESCAPE
ATA	Answer incoming call	ANSWER
ATD[<n>][mgsm>]	Mobile Originated call to dial table number	DIAL
ATD[<mem><loc>][<mgsm>]	Originate call to phone number in memory	<MEM>DIAL FROM MEMORY
ATD[<ploc>][<mgsm>]	Originate call to phone number in current memory	DIAL FROM LOCATION
ATD[<str>][<mgsm>]	Originate call to phone number in memory which corresponds to alphanumeric field	<STR>DIAL USING STRING
ATDL	Redial last telephone number used	DIAL LAST NUMBER
ATE	Set command echo mode	ECHO MODE
ATH	Disconnect existing connection	HANG-UP (DISCONNECT)
ATI	Display product identification information	DISPLAY IDENTITY
ATI0	Request IMEI (International Mobile Equipment Identifier) number.	IMEI: 001018-00-565563-5-00 IMEI OK
ATL	Set monitor speaker loudness	SET SPEAKER LOUDNESS
ATM	Set monitor speaker mode	SET SPEAKER MODE
ATO	Switch from command mode to data mode	OPEN DATA MODE

ATP	Select pulse dialing	SELECT PULSE MODE
ATQ	Set Result code presentation mode	SET RESULT FORMAT
ATS0	Set number of rings before automatically answering the call	AUTO-ANSWER THRESH-OLD
ATS2	Modem goes from off-line to on-line data state.	ESCAPRE CHARACTER SELECTION
ATS3	Set command line termination character	COMMAND LINE TERMINA-TOR
ATS4	Set response formatting character	RESPONSE FORMATTING CHARACTER
ATS5	Set command line editing character	COMMAND LINE EDITING CHARACTER
ATS6	Set pause before blind dialing	PAUSE BEFORE DIALING
ATS7	Set number of seconds to wait for connection completion	CONNECTION TIMEOUT
ATS8	Set number of seconds to wait when comma dial modifier used	COMMA CONNECTION TIMEOUT
ATS10	Set disconnect delay after indicating the absence of data carrier	DATA IDLE TIMEOUT
ATS12	The Escape sequence guard time selection register, S-Register 12, is not actively used and will report a “0” when queried. Normally the guard time is used to discriminate between valid and invalid occurrences of the escape sequence.	ESCAPE SEQUENCE GUARD SELECTION
ATT	Select tone dialing	SET TONE DIALING
ATV	Set result code format mode	SET RESULT CODE FOR-MAT MODE
ATX	Set connect result code format and call monitoring	SET CONNECT CODE AND CALL MONITORING
ATZ	Set all current parameters to user defined profile	SET CONFIGURATION TO USER DEFINED PROFILE
AT&C	Set DCD function mode	SET DCD MODE
AT&D	Set DTR function mode	SET DTR MODE
AT&F	Set all current parameters to manufacturer defaults	RESTORE FACTORY DEFAULTS
AT&V	Display current configuration	DISPLAY CONFIGURATION
AT&W	Store current parameter to user defined profile	SAVE CONFIGURATION
AT+DR	V.42bis data compression reporting control	DATA COMPRESSION REPORTING CONTROL
AT+DS	V.42bis data compression control	DATA COMPRESSION CONTROL
AT+GCAP	Request complete TA capabilities list	CAPABILITES LIST

AT+GMI	Request manufacturer identification	MANUFACTURER IDENTIFICATION
AT+GMM	Request TA model identification	MODEL IDENTIFICATION
AT+GMR	Request TA revision identification	REVISION IDENTIFICATION
AT+GOI	Request global object identification	GLOBAL IDENTIFICATION
AT+GSN	Request TA serial number identification (IMEI)	SERIAL NUMBER IDENTIFICATION
AT+ICF	Set TE-TA control character framing	CONTROL CHARACTER FRAMING
AT+IFC	Set TE-TA local data flow control	LOCAL DATA FLOW CONTROL
AT+IPR	Set fixed local rate	FIXED LOCAL RATE

Table 5: Call Control Features AT Commands below, lists by function, the AT Commands specific to accessing and troubleshooting the call control features used on Merlin modems.

This list does not include commands used for calibration.

Table 5: Call Control Features AT Commands

Call Control AT Command	Reference ETSI 07.07	Response
AT+CACM	Accumulated call meter (ACM) reset of query	ACCUMULATED CALL METER
AT+CAMM	Accumulated call meter maximum (acm-max) set or query	ACCUMULATED CALL METER MAXIMUM
AT+CAOC	Advice of charge	ADVICE OF CHARGE
AT+CBST	Select bearer service type	BEARER SERVICE TYPE
AT+CCFC	Call forwarding number and conditions control	CALL FORWARDING
AT+CCUG	Closed user group control	CLOSED USER GROUP
AT+CCWA	Call waiting control	CALL WAITING
AT+CEER	Extended error report	EXTENDED ERROR REPORT
AT+CGMI	Request manufacturer identification	MANUFACTURER IDENTIFICATION
AT+CGMM	Request model identification	MODEL IDENTIFICATION
AT+CGMR	Request revision identification	REVISION IDENTIFICATION
AT+CGSN	Request product serial number identification (identical with +gsn)	SERIAL NUMBER IDENTIFICATION
AT+CGOI	Global Identity Request	Identifier of device type.
AT+CSCS	Select TE character set	TE CHARACTER SET
AT+CSSN	Enables presentation of supplementary service notification result codes	SUPPLEMENTARY SERVICE NOTIFICATION
AT+CSTA	Select type of address	SELECT TYPE OF ADDRESS
AT+CHLD	Call hold and multiparty	CALL HOLD AND MULTIPARTY
AT+CIMI	Request international mobile subscriber identityl	INTERNATIONAL MOBILE SUBSCRIBER IDENTITY

AT+CLCC	List current calls of ME	LIST CURRENT CALLS
AT+CLCK	Facility lock	FACILITY LOCK
AT+CLIP	Calling line identification presentation	CALLING LINE IDENTIFICATION PRESENTATION
AT+CLIR	Calling line identification restriction	CALLING LINE IDENTIFICATION RESTRICTION
AT+CMEE	Report mobile equipment error	MOBILE EQUIPMENT ERROR
AT+COLP	Connected line identification presentation	CONNECTED LINE IDENTIFICATION PRESENTATION
AT+COPN	Read operator name	OPERATOR NAME
AT+COPS	Operator selection	OPERATOR SELECTION
AT+CPAS	Mobile equipment activity status	MOBIL EQUIPMENT ACTIVITY STATUS
AT+CPBF	Find phone book entries	PHONEBOOK ENTRIES
AT+CPBR	Read current phone book entries	READ PHONEBOOK ENTRIES
AT+CPBS	Select phone book memory storage	PHONEBOOK MEMORY STORAGE
AT+CPBW	Write phone book entry	WRITE PHONEBOOK ENTRY
AT+CPIN	Enter PIN	ENTER PIN
AT+CPWD	Change password	CHANGE PASSWORD
AT+CR	Service reporting control	SERVICE REPORTING
AT+CRC	Set cellular result codes for incoming call indication	CELLULAR RESULT CODES
AT+CREG	Network registration	NETWORK REGISTRATION
AT+CRLP	Select radio link protocol parameter for original non-transparent data call	RADIO LINK PROTOCOL
AT+CSQ	Signal quality report	SIGNAL QUALITY
AT+FCLASS	Fax: Select, Read or Test Service Class	FAX CLASS
AT+FMI	Fax: Report Manufactured ID	FAX MANUFACTURER ID
AT+FMM	Fax: Report Model ID	FAX MODEL ID
AT+FMR	Fax: Report Revision ID	FAX REVISION ID
AT+VTD	Tone durationD	TMF DURATION
AT+VTS	DTMF and tone generation (<tone> in {0-9, *, #, a, b, c, d})	DTMF SIGNAL
AT+CUSD	Unstructured supplementary service data	UNSTRUCTURED SUPPLEMENTARY SERVICE DATA

AT+CPOL	Preferred operator list	PREFERRED OPERATOR LIST
AT+CNUM	Subscriber number	SUBSCRIBER NUMBER
AT+CMUT	Mute control	MUTE
AT+CLVL	Loudspeaker volume	SPEAKER VOLUME
AT+CFUN	Set phone functionality	PHONE FUNCTIONALITY
AT+CMUX (not enabled)	Multiplexor control	MULTIPLEXOR CONTROL
AT+CSIM	Generic sim access	GENERIC SIM ACCESS
AT+CBC (not fully supported)	Battery charge	BATTERY CHARGE
AT+CCLK (not supported)	Clock	CLOCK
AT+CALM	Alert sound mode	ALERT SOUND MODE
AT+CRSL	Ringer sound level	RINGER SOUND LEVEL
AT+CPUC	Price per unit currency table	PRICE PER UNIT CURRENCY
AT+CCWE	Call meter maximum event	CALL METER MAXIMUM EVENT

Table 6: SMS Specific At Commands below, lists by function, the AT Commands specific to accessing and troubleshooting the SMS feature used on Merlin modems.

This list does not include commands used for calibration.

Table 6: SMS Specific At Commands

SMS AT Command	Reference ETSI 07.05	Response
AT+CMGD	Delete sms message	DELETE SMS MESSAGE
AT+CMGF	Select sms message formatT	SMS MESSAGE FORMA
AT+CMGL	List sms messages from preferred store	LIST SMS MESSAGES FROM PREFERRED STORE
AT+CMGR	Read SMS message	READ SMS MESSAGE
AT+CMGW	Write SMS message to memory	WRITE SMS MESSAGE TO MEMORY
AT+CMSS	Send SMS message from storage	SEND SMS MESSAGE FROM STORAGE
AT+CNMI	New SMS message indications	NEW SMS MESSAGE INDICA-TIONS
AT+CPMS	Preferred SMS message storage	PREFERRED SMS MES-SAGE STORAGE
AT+CRES	Restore SMS settings	RESTORE SMS SETTINGS
AT+CSAS	Save SMS settings	SAVE SMS SETTINGS
AT+CSCA	Sms service center address	SMS SERVICE CENTER ADDRESS
AT+CSCB	Select cell broadcast SMS messages	SELECT CELL BROADCAST SMS MESSAGES
AT+CSDH	Show SMS text mode parameters	SHOW SMS TEXT MODE PARAMETERS
AT+CSMP	Set SMS text mode parameters	SET SMS TEXT MODE PARAMETERS
AT+CSMS	Select message service	SELECT MESSAGE SERVICE

Table 7: GPRS Specific AT Commands below, lists by function, the AT Commands specific to accessing and troubleshooting the issues specific to GPRS communications.

This list does not include commands used for calibration.

Table 7: GPRS Specific AT Commands

GPRS AT Command	Reference ETSI 07.07	Response
AT+CGDCONT	Define PDP context	PDP CONTEXT DEFINITION
AT+CGQREQ	Quality of service profile (requested)	REQUEST QOS PROFILE
AT+CGQMIN	Quality of service profile (minimum acceptable)	QUALITY OF SERVICE PROFILE
AT+CGACT	Context activation	PDP CONTEXT CONTROL
AT+CGATT	GPRS attach or detach	GPRS ATTACH OR DEATTACH
AT+CGPADDR	Show PDP address	SHOW PDP ADDRESS
AT+CGCLASS	GPRS mobile station class	GPRS MOBILE STATION CLASS
AT+CGEREP	Control unsolicited GPRS event reporting	UNSOLICITED EVENT REPORTING CTRL
AT+CGREG	Network registration status	REGISTRATION STATUS
AT+CGSMS	Select service for MO SMS messages	SERVICE FOR MO SMS MSG'S

Table 8: Novatel Wireless Specific AT Commands below, lists by function, the AT Commands specific to accessing and troubleshooting the issues specific to TTP communications.

This list does not include commands used for calibration.

Table 8: Novatel Wireless Specific AT Commands

Novatel Wireless AT Command	Reference ETSI 07.07	Response
AT+CLTS	Get local timestamp	LOCAL TIMESTAMP
AT+CEXTHS	External headset control	EXTERNAL HEADSET
AT+CEXTBUT	External headset button unsolicited result code reporting	EXTERNAL HEADSET BUT-TON
AT+CSMINS	Unsolicited sim removal/insertion result code reporting	SIM REMOVAL/INSERTION ALERT
AT+CLDTMF	Local DTMF generationL	OCAL DTMF GENERATION
AT+CDRIND	Unsolicited indication of a call drop or GPRS context termi-nation	CALL DROP INDICATION

AT Command Set by Name

Each of the following sections discusses an individual AT command and its five subsections listed below:

Description: describes the command and defines any conditions required to use the command

Syntax: **lists the syntax the command requires**

Parameters: **lists any parameters and values available to the command**

Response: **lists and defines any responses the command may return**

Example: (optional) provides examples of the command

A/

Description: REPEAT LAST COMMAND

This command repeats the last command sent to the modem.

Syntax: **A/<cr>**

Parameters: **None**

Response: **Returns the command response from the previous command.**

Example: **AT12<cr>**

Novatel Wireless, Inc.

OK

A/<cr>

Novatel Wireless, Inc.

OK

+++

Description: ESCAPE SEQUENCE

This command is used to change the modem from data mode to command mode. This command is not a Hayes-compatible command as the guard time interval is not required. It is a public domain method (TIES) and is only enabled with define VG_TIES_ESC_SEQUENCE.

If the modem receives the characters +++AT followed by a carriage return (<cr>) within a 0.5 second time span, the modem interrupts the data flow on the AT command interface, switches to command mode and interprets all characters received before the next command line termination character as commands.

This command can only be issued in data mode.

This command is not a Hayes-compatible command. It is a public domain method (TIES) and is only enabled with define VG_TIES_ESC_SEQUENCE.

Syntax: **+++<cr>**

Parameters: **None**

Response: **This command will return the string OK.**

Example: **+++AT <cr>**

ATA

Description: ANSWER

This command sets the modem to answer the next call. The modem sends an off-hook signal to the remote station. Any additional commands on the same command line are ignored. The modem switches to data mode and after call is released, returns to command mode.

This command can be stopped by receiving a character during execution, except during some states of connection establishment such as handshaking.

Syntax: **ATA<cr>**

Parameters: **None**

Response: **If the connection is successful the modem will return the string:**

CONNECT<text>

then switches to data mode. The <text> is only displayed if the command ATX has been set to a value greater than 0.

When the modem releases the call and returns to command mode, it returns the string:

OK

If no connection is made, the modem will return the string:

NO CARRIER

Example: **ATA<cr>**

ATD[<n>][mgsm>]

Description: DIAL NUMBER

This command will instruct the modem to originate a call to a dialable number. The modem attempts to set up an outgoing call.

This command can be stopped by receiving a character during execution, except during some states of connection establishment such as handshaking.

Syntax: **ATD[<n>][<mgsm>]<cr>**

Parameters:

n is the string of dialing digits and the optional V.25ter modifiers. The valid dialing digits are:

`0-9, * , #, +, A, B, C`

and the V.25ter modifiers which are ignored:

mgsm is a string of GSM modifiers, where:

I is overrides the current Calling Line Identification Restriction (CLIR) setting for the call

G,g displays the Closed User Group (CUG) information, set with the command `+CCUG`

; signifies the call is a voice call and instructs the modem to return to the command mode.

Response: **If there is no dial tone, the modem will return the string:**

NO DIALTONE

where the command `ATX` has been set to 2 or 4.

If there is an error and it is related to the mobile equipment's (ME) functionality, the modem will return the string:

+CME ERROR: <error>

If the connection is busy, the modem will return the string:

BUSY

where the command `ATX` has been set to 3 or 4.

If the connection cannot be established, the modem will return the string:

NO CARRIER

If the connection is successful and is non-voice call, the modem switches to data state and the modem will return the string:

CONNECT<text>

where <text> is only displayed if the command `ATX` has been set to a value greater than 0.

If connection successful and is a voice call, the modem will return the string:

OK

When the modem releases the call and returns to command mode, it returns the string:

OK

Example:

ATD9,555-1212<cr>	**DIAL 9, PAUSE, DIAL 5551212**
ATD555-1234;<cr>	**DIAL 5551234**
ATD555-09871G<cr>	**DIAL 5550987, OVERRIDE CLIR, DISPLAY CUG**

ATD[<mem><loc>][<mgsm>]

Description: DIAL NUMBER FROM SIM PHONE BOOK MEMORY

This command will instruct the modem to originate a call to a dialable number using reference to a number stored in the SIM's phone book memories.

Syntax: **ATD[<mem><loc>][<mgsm>]**

Parameters:

mem is the phone book at the designated memory location. There is no <mem> for emergency calls (EN). It is comprised of the following phone book parameters:

FD	SIM fix phone-phone book
LD	SIM last-phone-phone book
DC	Mobile Equipment (ME) dialed calls list
ON	SIM (or ME) own numbers (MSISDNs) list
SM	SIM phone book

loc is an integer referring to a memory location that is in a range of locations available in the phone book referenced. This must be used with the mem parameter.

mgsm is a string of GSM modifiers, where:

I is overrides the current Calling Line Identification Restriction (CLIR) setting for the call

G,g displays the Closed User Group (CUG) information, set with the command `+CCUG`

; signifies the call is a voice call and instructs the modem to return to the command mode.

Response: **If there is no dial tone, the modem will return the string:**

NO DIALTONE

where the command `ATX` has been set to 2 or 4.

If there is an error and it is related to the mobile equipment's (ME) functionality, the modem will return the string:

+CME ERROR: <error>

If the connection is busy, the modem will return the string:

BUSY

where the command `ATX` has been set to 3 or 4.

If the connection cannot be established, the modem will return the string:

NO CARRIER

If the connection is successful and is non-voice call, the modem switches to data state and the modem will return the string:

CONNECT<text>

where <text> is only displayed if the command `ATX` has been set to a value greater than 0.

If connection successful and is a voice call, the modem will return the string:

OK

When the modem releases the call and returns to command mode, it returns the string:

OK

Example:

ATDFD1<cr>	**DATA CALL TO FD PHONE BOOK ENTRY**
ATDLD3<cr>	**DATA CALL TO LD PHONE BOOK ENTRY**
ATDDC2I;<cr>	**VOICE CALL TO DC PHONE BOOK ENTRY 2 NO CLIR**

ATD[<ploc>][<mgsm>]

Description: DIAL NUMBER FROM INTERNAL MEMORY

This command will instruct the modem to originate a call to a dialable number

Syntax: **ATD[<ploc>][<mgsm>]<cr>**

Parameters:

ploc is an integer referring to a mobile equipment phone number stored at the specified location in the modem's internal memory.

mgsm is a string of GSM modifiers, where:

- I overrides the current Calling Line Identification Restriction (CLIR) setting for the call
- G,g displays the Closed User Group (CUG) information, set with the command `+CCUG`
- ; signifies the call is a voice call and instructs the modem to return to the command mode.

Response: **If there is no dial tone, the modem will return the string:**

NO DIALTONE

where the command `ATX` has been set to 2 or 4.

If there is an error and it is related to the mobile equipment's (ME) functionality, the modem will return the string:

+CME ERROR: <error>

If the connection is busy, the modem will return the string:

BUSY

where the command `ATX` has been set to 3 or 4.

If the connection cannot be established, the modem will return the string:

NO CARRIER

If the connection is successful and is non-voice call, the modem switches to data state and the modem will return the string:

CONNECT<text>

where <text> is only displayed if the command `ATX` has been set to a value greater than 0.

If connection successful and is a voice call, the modem will return the string:

OK

When the modem releases the call and returns to command mode, it returns the string:

OK

Example: **ATD2<cr>**

ATD[<str>][<mgsm>]

Description: DIAL NUMBR FROM NAME SEARCH

This command will instruct the modem to originate a call to a dialable number.

Syntax: **ATD[<str>][<mgsm>]<cr>**

Parameters:

str is a string that is searched for in the alphanumeric fields of the phone books, located in all available memory types (i.e. SIM, Mobile Equipment Phone Book, etc.).

mgsm is a string of GSM modifiers, where:

- I is overrides the current Calling Line Identification Restriction (CLIR) setting for the call
- G,g displays the Closed User Group (CUG) information, set with the command `+CCUG`
- ; signifies the call is a voice call and instructs the modem to return to the command mode.

Response: **If there is no dial tone, the modem will return the string:**

NO DIALTONE

where the command `ATX` has been set to 2 or 4.

If there is an error and it is related to the mobile equipment's (ME) functionality, the modem will return the string:

+CME ERROR: <error>

If the connection is busy, the modem will return the string:

BUSY

where the command `ATX` has been set to 3 or 4.

If the connection cannot be established, the modem will return the string:

NO CARRIER

If the connection is successful and is non-voice call, the modem switches to data state and the modem will return the string:

CONNECT<text>

where <text> is only displayed if the command `ATX` has been set to a value greater than 0.

If connection successful and is a voice call, the modem will return the string:

OK

When the modem releases the call and returns to command mode, it returns the string:

OK

Example: **ATDBobR<cr>**

ATDL

Description: DIAL LAST NUMBER

This command will instruct the modem to originate a call to the last telephone number used by the modem. The modem attempts to set up an outgoing call.

This command can be stopped by receiving a character during execution, except during some states of connection establishment such as handshaking.

Syntax: **ATDL[;]**

Parameters: **; which signifies the call is a voice call and instructs the modem to return to the command mode.**

Response: **If there is no dial tone, the modem will return the string:**

NO DIALTONE

where the command `ATX` has been set to 2 or 4.

If there is no last number to dial or the number is invalid, the modem will return the string:

+CME ERROR: <error>

If the connection is busy, the modem will return the string:

BUSY

where the command `ATX` has been set to 3 or 4.

If the connection cannot be established, the modem will return the string:

NO CARRIER

If the connection is successful and is non-voice call, the modem switches to data state and the modem will return the string:

CONNECT<text>

where <text> is only displayed if the command ATX has been set to a value greater than 0.

If connection successful and is a voice call, the modem will return the string:

OK

When the modem releases the call and returns to command mode, it returns the string:

OK

Example:	Input	Response
	ATDL	Connect (Data Call)
	ATDL;	(No signal given as this is a voice call)

ATE

Description: ECHO MODE

This command sets the echo mode of the modem, that is, whether or not the modem echoes characters received from terminal while the modem is in command mode.

Syntax: **ATE[<n>]**

Parameters: **n = 0 or 1**

0 turns echo mode off

1 turns echo mode on

Response: **This command will return the string OK.**

Example: **ATE1<cr> All further data entered is ecohed**

OK

ATE0<cr> All further data entered is ecohed

OK

ATH

Description: HANG-UP (DISCONNECT)

This command instructs the modem to disconnect from the current connection and terminate the call.

Syntax: **ATH[0]**

Parameters: **0 This parameter is the default, as well as the only parameter, and does not necessarily have to be typed with the command.**

Response: **This command will return the string OK, after the Data Carrier Detect (DCD) is turned off, if it was previously on.**

Example: **ATH<cr> OK**

ATI

Description: MANUFACTURING IDENTITY

This command will instruct the modem to display the informational text, contained in the modem's firmware, such as the manufacturer's name.

Syntax: **ATI or ATI5**

Parameters: **None**

Response: **This command will return information on its manufacturer. For example:**

Novatel Wireless, Inc.

GPRS PC Card 56600

Software Version: PN160-0300

Date: May 23 2001, Time: 14:17:39

Example: **ATI<cr>**

Novatel Wireless, Inc.

GPRS PC Card 56600

Software Version: PN160-0300

Date: May 23 2001, Time: 14:17:39

OK

ATI0

Description: IMIE IDENTITY

Request IMEI (International Mobile Equipment Identifier) number.

Syntax: **ATI0<cr>**

Parameters: **None**

Response: **IMEI: 001018-00-565563-5-00 IMEI OK**

Example: **ATI0**

ATL

Description: SET SPEAKER LOUDNESS

This command will set the modem's speaker circuit volume. When the modem is installed in a computer, it will use the computer's default speaker.

This command is ignored when the modem is connected to a GSM network.

Syntax: **ATL[<n>]**

Parameters: **0, 1, 2, 3**

where:

0 sets the speaker volume to very low

1 sets the speaker volume to low

2 sets the speaker volume to medium

3 sets the speaker volume to high

Response: **This command will return the string OK.**

Example: **ATL3<cr>**

ATM

Description: ENABLE MODEM SPEAKER

This command turns the modem's speaker circuit on or off. When the modem is installed in a computer, it will use the computer's default speaker.

This command is ignored when the modem is connected to a GSM network.

Syntax: **ATM[<n>]**

Parameters: **0, 1, 2**

where:

0 turns the speaker off

1 turns the speaker on until the modem informs the terminating equipment that a carrier has been detected

2 turns the speaker on while the modem is off-hook

Response: **OK**

Example: **ATM1<cr> OK**

ATO

Description: OPEN DATA MODE

This command switches the modem from command mode to data mode. This command is generally used to return the modem to data mode after the user has issued the command +++AT and worked in the modem's command mode.

Syntax: **ATO[0]**

Parameters: **0 This parameter is the default, as well as the only parameter, and does not necessarily have to be typed with the command.**

Response: **If connection is not successfully resumed, the modem will return the string:**

NO CARRIER

If connection is successfully resumed, the modem will return the string:

CONNECT<text>

where <text> is only displayed if the command ATX has been set to a value greater than 0.

Example: **ATO<cr> <Data Field to and from Modem>**

ATP

Description: PULSE DIAL MODE

This command is used to instruct the modem to dial the next telephone number using pulse dialing. This command is a legacy command and is ignored when the modem is connected to a GSM network.

Syntax: **ATP<cr>**

Parameters: **None**

Response: **This command will return the string OK.**

Example: **ATP<cr>**

ATQ

Description: QUIET MODE

This command is used to specify whether or not the modem will sent result codes to the terminating equipment. Text sent from the modem to the terminating equipment using the `ATI` command will not be affected.

Syntax: **ATQ[<n>]**

Parameters: **0, 1**

0 instructs the modem to send the result codes; this is the default.

1 instructs the modem to suppress the result codes and not transmit them to the terminating equipment.

Response: **If this command has been set to 0, the modem's response will be OK. If this command has been set to 1, there will be <u>no response</u> from the modem.**

Example: **ATQ0<cr>**

ATS0

Description: LISTEN MODE

This command sets the number of rings the modem will wait before it will answer the incoming call. This command sets the modem's S-register 0.

Syntax: **ATS0[=<n>][?]**

Parameters: **=<n>, ?**

<n> is a number between 1 and 255 that represents the number of rings the modem will wait before answering the incoming call. This command sets the S-register 0 to the number specified in <n>. If this command is set to 0, the modem will never answer the incoming call.

? will query the S-register and return the register's current value

Response: **If the user has typed the command ATS0?, the modem will return the current value of the register and the string OK. For example:**

5

OK

If the user has typed the command **ATS0=<n>**, the modem will only return the string **OK**.

Example: **ATS0=5<cr>** answer after 5 rings

OK

ATS2

Description: ESCAPE CHARACTER SELECTION

The escape sequence consists of three repetitions of the escape code character, defined by S-Register 2 (default value: decimal 43(+)). The escape sequence causes the modem to go to the off-line command state from the on-line data state. After this escape sequence, the modem can accept user's AT Commands.

Syntax: **ATS2=<n><cr>**

Parameters: **<n> is the decimal value of the ASCII character used as the "escape" character**

Response: **OK**

Example: **ATS2=43<cr>**

OK

ATS3

Description: COMMAND TERMINATION CHARACTER

This command sets the character that will be used as the command line termination character. The terminating character may be changed using this command. This command sets the modem's S-register 3.

Syntax: **ATS3[=<n>][?]**

Parameters: **=<n>, ?**

=<n> is the ASCII code number that represents the character to be used as the command line termination character. This command sets S-register 3 to the number specified in <n>. The valid values for this parameter range from 0 to 127 and the default for this S-register is 13, which is the carriage return character.

? will query the S-register and return the register's current value.

Response: **If the user has typed the command ATS3?, the modem will return the current value of the register and the string OK. For example:**

13

OK

If you the user has typed the command **ATS3=<n>**, the modem will only return the string **OK**.

Example: **ATS3=23<cr>**

ATS3?<cr>

ATS4

Description: EOL CHARACTER SELECTION

This command sets the character that will be used as the modem's response string end-of-line character. This command sets the modem's S-register 4.

Syntax: **ATS4[=<n>][?]**

Parameters: **=<n>, ?**

where:

=<n> is the ASCII code number that represents the character to be used as the modem's response string end-of-line character. This command sets S-register 4 to the number specified in <n>. The valid values for this parameter range from 0 to 127 and the default for this S-register is 10, which is the line feed character.

? will query the S-register and return the register's current value.

Response: **If the user has typed the command ATS4?, the modem will return the current value of the register and the string OK. For example:**

10

OK

If the user has typed the command **ATS4=<n>**, the modem will only return the string **OK**.

Example: **ATS4=32<cr>**

ATS4?<cr>

ATS5

Description: BACKSPACE CHARACTER

This command sets the character that will be used by the command line as the backspace character; when the command line receives this character, it will erase the character immediately preceding the cursor. This command sets the modem's S-register 5.

Syntax: **ATS5[=<n>][?]**

Parameters: **=<n>, ?**

=<n> is the ASCII code number that represents the character to be used as the backspace character. This command sets S-register 5 to the number specified in <n>. The valid values for this parameter range from 0 to 127 and the default for this S-register is 8, which is the backspace character assigned to the Backspace key on your keyboard.

? will query the S-register and return the register's current value.

Response: **If the user has typed the command ATS5?, the modem will return the current value of the register and the string OK. For example:**

8

OK

If the user has typed the command **ATS5=<n>**, the modem will only return the string **OK**.

Example: **ATS5=110<cr>**

ATS5?<cr>

ATS6

Description: CONNECTION HOLD OFF TIMER

This command sets the number of seconds the modem will wait before it will begin blind dialing (dialing without checking for a dial tone). This command sets the modem's S-register 6.

This command is ignored when the modem is connected to a GSM network.

Syntax: **ATS6[=<n>][?]**

Parameters: **=<n>, ?**

=<n> is a number between 0 and 255 that represents the number of seconds the modem will wait before blind dialing an outbound call. This command sets S-register 6 to the number specified in <n>. The default value for this register is 2.

? will query the S-register and return the register's current value.

Response: **If the user has typed the command ATS6?, the modem will return the current value of the register and the string OK. For example:**

4

OK

If the user has typed the command **ATS6=<n>**, the modem will only return the string **OK**.

Example: **ATS6=4<cr>**

ATS7

Description: CONNECTION TIMEOUT

This command sets the number of seconds the modem will wait for the connection to complete during an inbound or outgoing call, before it stops attempting to connect. This command sets the modem's S-register 7.

Syntax: **ATS7[=<n>][?]**

Parameters: **=<n>, ?**

=<n> is a number between 0 and 255 that represents the number of seconds the modem will wait before stopping the connection attempt. This command sets S-register 7 to the number specified in <n>. The default value for this register is 60.

? will query the S-register and return the register's current value.

Response: **If the user has typed the command ATS7?, the modem will return the current value of the register and the string OK. For example:**

4

OK

If the user has typed the command **ATS7=<n>**, the modem will only return the string **OK**.

Example: **ATS7=4<cr>**

ATS8

Description: COMMA DIAL MODIFIER

This command sets the value of the **comma dial modifier**, in seconds. The comma dial modifier is placed in-between the digits of the telephone number you wish to call to provide a pause. This might be used when dialing 9 to get an outside telephone line. This command sets the modem's S-register 8.

This command is ignored when the modem is connected to a GSM network.

Syntax: **ATS8[=<n>][?]**

Parameters: **=<n>, ?**

=<n> is a number between 1 and 255 that represents the number of seconds the modem will wait to dial the remaining digits in the telephone number. This command sets S-register 8 to the number specified in <n>. If this command is set to 0, the there will be no pause when the comma (,) is encountered. The default is set to 2.

? will query the S-register and return the register's current value.

Response: **If the user has typed the command ATS8?, the modem will return the current value of the register and the string OK. For example:**

2

OK

If the user has typed the command **ATS8=<n>**, the modem will only return the string **OK**.

Example: **ATS8=2<cr>**

ATS10

Description: DATA CARRIER TIMEOUT

This command sets the amount of time, in $^{1}/_{10}{}^{th}$ secs, the modem will wait before returning on-hook, if it can no longer detect the data carrier. This command sets the modem's S-register 10.

Syntax: **ATS10[=<n>][?]**

Parameters: **=<n>, ?**

=<n> is a number between 1 and 255 that represents the number in $^{1}/_{10}{}^{th}$ secs the modem will wait before going on-hook, if it no longer detects a data carrier. This command sets S-register 10 to the number specified in <n>. The default value for this register is 15.

? will query the S-register and return the register's current value.

Response: **If the user has typed the command ATS10?, the modem will return the current value of the register and the string OK. For example:**

25

OK

If the user has typed the command **ATS10=<n>**, the modem will only return the string **OK**.

Example: **ATS10=25<cr>**

ATS12

Description: ESCAPE SEQUENCE GUARD SELECTION

The Escape sequence guard time selection register, S-Register 12, is not actively used and will report a "0" when queried. Normally the guard time is used to discriminate between valid and invalid occurrences of the escape sequence. The duration between escape codes must also be within the guard time. After the modem recognizes a valid escape sequence, an "OK" result code is returned. If an escape sequence is valid, the modem will exit data mode and enter command mode. The ATO command is used to go back to on-line data state.

Syntax: **ATS12=<n><cr>**

Parameters: **<n> Regardless of the value entered, 0 will always be used.**

Response: **OK**

Example: **ATS12=10<cr>**

ATT

Description: TONE DIALING

This command is used to instruct the modem to dial the next telephone number using tone dialing. **This command is a legacy command and is ignored when the modem is connected to a GSM network.**

Syntax: **ATT<cr>**

Parameters: **None**

Response: **This command will return the string OK.**

Example: **ATT<cr> OK**

ATV

Description: VERBOSE

This command displays the modem's result codes in terse or verbose form.

In terse form, all result codes are represented by an error code number and all text messages have only a carriage return (<cr>) character appended to them.

In verbose form, all result codes are returned as words or sentences and all text messages have a carriage return-line feed (<cr><lf>) character pair before and after the text message.

Syntax: **ATV[<n>]**

Parameters: **0, 1**

0 will set the response format to terse

1 will set the response format to verbose

Response: **If the command has been set to 0, it will return the response:**

0

If the command has been set to **1**, it will return the response:

OK

Example: **ATV=1<cr> OK**

ATX

Description: ACCESS CONTROL

This command will specify whether or not the modem will attempt to detect a dial tone and busy signal, and what type of result code is returned.

Syntax: **ATX[<n>]**

Parameters: **0, 1, 2, 3, 4**

where:

0 will set the modem to not detect the dial tone or the busy signal and return the result code **CONNECT**.

1 will set the modem to not detect the dial tone or the busy signal and return the result code **CONNECT<additional session-specific text>**.

2 will set the modem to detect the dial tone, but not the busy signal. It will also return the result code **CONNECT<additional session-specific text>**.

3 will set the modem not to detect the dial tone, but detect the busy signal. It will also return the result code **CONNECT<additional session-specific text>**.

4 will set the modem to detect both the dial tone and the busy signal and return the result code **CONNECT<additional session-specific text>**.

Response: **This command will return the string OK.**

Example: **ATX4<cr>**

ATZ

Description: RESET PARAMETERS TO SAVED SETTINGS

This command uses the user-defined modem settings profile stored in the non-volatile memory as the active profile. If the user-defined profile is invalid, the modem will use the factory default settings. Any additional commands on the same command line are ignored. This command uses the profile created by the AT&W command.

Syntax: **ATZ[0]**

Parameters: **0 This parameter is the default, as well as the only parameter, and does not necessarily have to be typed with the command.**

Response: **This command will return the string OK.**

AT&C

Description: DATA CARRIER DETECT (DCD) MODE

This command sets the data carrier detect mode.

Syntax: **AT&C[<n>]**

Parameters: **0, 1**

0 sets the data carrier detect so it is always on

1 sets the data carrier detect so it is only on in the presence of a data carrier

Response: **This command will return the string OK.**

Example: **AT&C1<cr>**

AT&D

Description: DATA TERMINAL READY (DTR) CONTROL

This command defines how the modem responds, while in data mode, to the data terminal ready (DTR) circuit changing state from ON to OFF.

Syntax: **AT&D[<n>]**

Parameters: **0, 1, 2**

0 instructs the modem to ignore the data terminal ready state

1 instructs the modem to change to command mode, while remaining connected to the call

2 instructs the modem to disconnect from the call and then change to command mode. While the data terminal ready state is set to **off**, the modem's auto-answer function is also off.

Response: **This command will return the string OK.**

Example: **AT&D2<cr>**

AT&F

Description: RESTORE FACTORY DEFAULT SETTINGS

This command will return all the modem settings to their factory default setting.

Syntax: **AT&F[0]**

Parameters: **0 This parameter is the default, as well as the only parameter, and does not necessarily have to be typed with the command.**

Response: **<cr>hello<cr><LF><LF>OK**

Example: **AT&F0<cr>**

AT&V

Description: VIEW ACTIVE PROFILE

This command will display the active profile settings on the terminating equipment.

Syntax: **AT&V[0]**

Parameters: **0 This parameter is the default, as well as the only parameter, and does not necessarily have to be typed with the command.**

Response: **The response will be a listing of the current configuration followed by the string** OK**. For example**

```
ACTIVE PROFILE :
E1 L1 M1 Q0 V1 X4 &C1 &D2
S0:0 S2:43 S3:13 S4:10 S5:8 S6:2 S7:60 S8:2 S10:15 S12:
+CBST: 7,0,1
+CSMS: 0
+CRLP: 61,61,48,6,0,3
+CRC: 0
+CR: 0
+FCLASS: 0
+IFC: 2,2
+IMODE: 0
+ICF: 3,3
+DR: 0
+CMGF: 0
+CSDH: 0
+CNMI: 2,1,0,0,0
+ILRR: 0
+IPR: 115200
+DS: 3,0,512,20
+CMEE: 0
+CREG: 0
+CCUG: 0,0,0
+CLIP: 0
+COLP: 0
+CCWA: 0
+CAOC: 1
+CLIR: 0
+CSCA: "+44385016005",145
+CSMP: 17,167

OK
```

Example: **AT&V<cr>**

AT&W

Description: SAVE MODEM PROFILE (SETTINGS)

This command stores the active modem settings profile in the modem's non-volatile memory. This stored profile can later be retrieved using the ATZ command.

Syntax: **AT&W[0]**

Parameters: **None**

Response: **This command will return the string OK.**

Example: **AT&W0<cr>**

AT+CACM

Description: ACCUMULATED CALL METER (RESET OR QUERY)

This command reads or resets the Advice of Charge related accumulated call meter (ACM) value in SIM file EF(ACM). ACM contains the total number of home units for both the current and preceding calls.

Syntax: **AT+CACM=[<password>] (Reset)**

Parameters: **passwd SIM PIN2**

Response: **<acm> string type; three bytes of the current ACM value in hexadecimal format (e.g. "00001E" indicates decimal value 30)**

Example:	**Input**	**Response**
Query	**AT+CACM?**	**00037F**
Reset	**AT+CACM=opensesame**	**OK**
Test	**AT+CACM=?**	**OK**

AT+CALM

Description: ALERT SOUND MODE

This command sets the sound actions to to alert the user. This can be used to enable or disable the sound utilized to alert the user. Available in Command mode only.

Syntax: **AT+CALM=<mode>**

Parameters: **0 Normal Mode**

<mode>	0	normal mode
	1	silent mode (all sounds from ME are prevented)

Response: **OK**

Example:

Query	**+CALM: <mode>+CME ERROR: <err>**
Test	**+CALM: (list of supported <mode>s)+CME ERROR: <err>**

AT+CAMM

Description: ACCUMULATED CALL METER MAXIMUM

This command sets the Advice of Charge related accumulated call meter maximum value in SIM file EF(ACMmax). ACMmax contains the maximum number of home units allowed to be consumed by the subscriber.

Syntax: **AT+CAMM=[<ACMMAX>[,<PASSWD>]]**

Parameters:

ACMMAX	**string type; three bytes, 000001-FFFFFF, of the max. ACM value in hexa-decimal format (e.g. "00001E" indicates decimal value 30). A value of 000000 will disable ACMmax feature.**
PASSWD	SIM PIN2

Example:

	Input	**Response**
Query	**AT+CAMM?**	**00037F**
Set	**AT+CAMM=000400**	**OK**
Test	**AT+CAMM=?**	**OK**

AT+CAOC

Description: ADVICE OF CHANGE

This command, when active, sends an unsolicited result code when the current call meter (CCM) value changes, this will not be reported more than once every 10 secs.

Syntax: **AT+CAOC=<mode>**

Parameters: **0, 1**

0 query CCM value

1 deactivate the unsolicited reporting of CCM value
2 activate the unsolicited reporting of CCM value

Example:

	Input	**Response**
Query	**AT+CAOC?**	**Current mode OK**
Set	**AT+CAOC=1**	**OK**
Test	**AT+CAOC=?**	**List of possible selectlons**

AT+CBC

Description: BATTERY CHARGE STATUS INDICATION

This command is used to indicate battery charge status.

Syntax: **AT+CBC**

Parameters: **None**

Response:

<bcs> battery connection status

0	ME is powered by the battery
1	ME has a battery connected, but is not powered by it
2	ME does not have a battery connected
3	Recognized power fault, calls inhibited

<bcl> battery connection level

0	battery is exhausted, or ME does not have a battery connected
1..100	battery has 1 to 100 % of capacity remaining

Example: **Test Response: +CBC: (list of supported <bcs>s),(list of supported <bcl>s)**

AT+CBST

Description: Bearer Service Type

This command selects the bearer service <name> with data rate <speed>, and the connection element <ce> to be used when data calls are originated.

Syntax: **AT+CBST=[<speed>] [,<name>[,<ce>]]]**

Parameters:

<speed>	0	autobalancing
	1	300 bps (V.21)
	2	1200 bps(V.22)
	3	1200/75 bps (V.23)
	4	2400 bps (V22bis)
	5	2400 bps(V.26ter)
	6	4800 bps(V.32)
	7	9600 bps (V.32)
	12	9600 bps (V.34)
	14	14400 bps (V.34)
	65	300 bps (V.110)
	66	1200 bps (V.110 or X.31 flag stuffing)
	68	2400 bps (V.110 or X.31 flag stuffing)
	70	4800 bps (V.110 or X.31 flag stuffing)
	71	9600 bps (V.110 or X.31 flag stuffing)
	75	14400 bps (V.110 or X.31 flag stuffing)
<name>	0	asynchronous modem
	2	PAD access (asynchronous)
<ce>	0	transparent
	1	non-transparent

Example:	**Query**	**Response**
Query	**AT+CBST?**	**Current mode OK**
Set	**AT+CBST=7,2,0**	**OK**
Test	**AT+CBST=?**	**List of possible selectlon**

AT+CCFC

Description: CALL FORWARD

This command controls the call forwarding supplementary service. Registration, erasure, activation, deactivation, and status query are supported. Only <reas> and <mode> should be entered with mode (0-2,4).

Syntax: **AT+CCFC = <reas>, <mode>[, <number> [, <type> [,<class> [, <subaddr> [,<satype> [,<time>]]]]]]**

Parameters:

<reas>	0	unconditional
	1	mobile busy
	2	no reply
	3	not reachable
	4	all call forwarding (0-3)
	5	all conditional call forwarding (1-3)
<mode>	0	disable
	1	enable
	2	query status
	3	registration
	4	erasure
<number>	string type phone number of forwarding address in format specified by <type> asynchronous modem	
<type>	type of address in integer format; default 145 when dialing string includes international access code character "+", otherwise 129	
<subaddr>	string type subaddress of format specified by <satype>	
<satype>	type of subaddress in integer; default 128	
<class>	1	voice
	2	data
	4	fax
	7	all classes
<time>	time, rounded to a multiple of 5 secs	

<status>	0	not active
	1	active

Response: **If <mode><>2 and command successful**

OK

If there is a network error:

+CCFC: 0, 0

If <mode>=2 and command successful (only in connection with <reas> 0 – 3)

For registered call forward numbers:

+CCFC: <status>, <class1>[, <number>, <type> [, <time>]] [<cr><LF>+CCFC: ....]

OK

If no call forward numbers are registered (and therefore all classes are inactive):

+CCFC: <status>, <class>

OK

where <status>=0 and <class>=7

If error is related to ME functionality:

+CME ERROR: <err>

Example:	**Input**	**Output**
Query	**AT+CCFC?**	**Current mode OK**
Set	**AT+CCFC=0,1,,,,,,**	**OK**
Test	**AT+CCFC=?**	**List of possible selectlon**

AT+CCLK

Description: CLOCK SETTING, TIME OF DAY, DATE

This command is used to set the local time for the device as well as determining the current time. ME does not support time zone indication.

Syntax: **AT+CCLK=<time>**

Parameters:

<time> string type value; format is "yy/MM/dd,hh:mm:ss"; where characters indicate year (two last digits), month, day, hour, minutes and seconds.

e.i 22:10:00 GMT equals to "94/05/06,22:10:00"

Response:

Query	**+CCLK: <time>+CME ERROR: <err>**
Test	**OK**

AT+CCUG

Description: CLOSER USER GROUP

This command sets the Closed User Group supplementary service parameters as a default adjustment for all following calls.

Syntax: **AT+CCUG=[<n>] [,<index>[,<info>]]]**

Parameters:

<speed>	0	disable CUG
	1	enable CUG
	71	9600 bps (V.110 or X.31 flag stuffing)
<index>	0...9	CUG index
	10	no index (preferred CUG taken from subscriber data)
<info>	0	no information
	1	suppress OA (Outgoing Access)
	2	suppress preferential CUG
	3	suppress OA and preferential CUG

Response: **+CCUG: <n>,<index>,<info>**

OK

If error is related to ME functionality:

+CME ERROR: <err>

Example:	**Input**	**Output**
Query	**AT+CCUG?**	**Current mode OK**
Set	**AT+CCUG=0,1,,,,,,**	**OK**
Test	**AT+CCUG=?**	**List of possible selections**

AT+CCWA

Description: CALL WAITING

This command controls the Call Waiting supplementary service. Activation, deactivation and status query are supported.

Syntax: **AT+CCWA=[<n>] [,<mode>[,<class>]]]**

Parameters:

Parameters:

<n>	0	disable unsolicited result code
	1	enable presentation of an unsolicited result code
	71	9600 bps (V.110 or X.31 flag stuffing)
<mode>	when <mode> parameter not given, network is not interrogated	
	0	disable
	1	enable
	2	query status
<class>	is a sum of integers each representing a class of information	
	1	voice (telephony)
	2	data (bearer service)
	4	fax (teleservice)
	7	default (equals to all classes)
<status>	0	not active
	1	enable

Example:	**Input**	**Output**
Query	**AT+CCWA?**	**Current selection OK**
Set	**AT+CCWA=1,1,1,1**	**OK**
Test	**AT+CCWA=?**	**List of possible selections**

Unsolicited Response: When the presentation Call Waiting at the MODEM is enabled (and Call Waiting is enabled) and a terminating call set up has attempted during an established call, an unsolicited result code is returned:

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

<number>	string type phone number of calling address in format specified by <type>
<type>	type of address octet in integer format; 145 when dialing string includes international access code character "+", otherwise 129
<alpha>	optional string type alphanumeric representation of <number> corresponding to the entry found in a phone book

AT+CCWE

Description: CALL METER MAXIMUM EVENT

GSM 07.07 specifies 30 seconds. However, the default setting is 5 seconds. Shortly before the ACM (Accumulated Call Meter) maximum value is reached, an unsolicited result code +CCWV will be sent, if enabled by this command. The warning is issued when 5 seconds call time remains. It is also issued when starting a call if less than 5 s call time remains.

Syntax: **AT+CCWE=<mode>**

Parameters:

<mode>	0	Disable call meter warning event
	1	Enable call meter warning event

Response: **OK or +CME ERROR: <err>Unsolicited result codes supported:+CCWV Shortly before the ACM (Accumulated Call Meter) maximum value is reached, an unsolicited result code +CCWV will be sent, if enabled by this command. The warning is issued when 5 seconds call time remains. It is also issued when starting a call if less than 5 s call time remains.**

Query AT+CCWE? Current selection OK

Test AT+CCWE? list of possible selections

AT+CDRIND

Description: CALL DROP – GPRS PDP CONTEXT TERMINATION INDICATION

This unsolicited result code is useful with Class B operation and the software Multiplexer. The unsolicited result code will be sent after the “NO CARRIER” result code.

Syntax: **AT+CDRIND=<n>**

Parameters:

<n>	0	Unsolicited result code disabled
	1	Unsolicited result code enabled

Response: **OK**

Status Query Response AT+CDRIND: Current selection OK

Unsolicited result code: AT+CDRIND: list of possible selections

<n>	0	Unsolicited result code disabled
	1	Unsolicited result code enabled
<channel>	0	CS voice
	1	CS Data/Fax
	2	GPRS (PPP)

Query	AT+CDRIND?	Current selection OK
Test	AT+CDRIND=?	List of possible selections
Set	AT+CDRIND=0	OK

AT+CEER

Description: EXTENDED ERROR REPORTING

Returns an extended report of the reason for the last call release.

Syntax: **AT+CEER**

Parameters: **None**

Response: **+CEER: <report> OK**

Example:	**Input**	**Output**
Query	AT+CEER	Current extended error report OK
Test	AT+CEER=?	OK

AT+CEXTBUT

Description: EXTERNAL HEADSET BUTTON

This command sets the modem to either deliver an indication of a button being pressed or not. This can be performed on a polling basis or under interrupt control (unsolicited). The default setting is 0.

Syntax: **AT+CEXTBUT=<n>**

Parameters:

<n>	0	Disable unsolicited result code
	1	Enable unsolicited result code

Response: **OK**

Status Query Response	AT+CEXTBUT: <n>,<pressed>		
Unsolicited result code	:AT+CEXTBUT: <pressed>		
	<n>	0	Unsolicited result code disabled
		1	Unsolicited result code enabled
	<pressed>	0	Headset button not pressed
		1	Headset button pressed

Query	AT+CEXTBUT?	Current selection OK
Test	AT+CEXTBUT=?	List of possible selections
Set	AT+CEXTBUT=0	OK

AT+CEXTHS

Description: EXTERNAL HEADSET

This command sets the alert mechanism and also permits polling for the current state of the headset jack, either present or absent.

Syntax: **AT+CEXTHS=<n>**

Parameters:

<n>	0	Disable unsolicited result code
	1	Enable unsolicited result code

Response: **OK**

Status Query Response **+CEXTHS: <n>,<attach>**

<n>	0	Unsolicited result code disabled
	1	Unsolicited result code enabled
<attach>	0	unattached external headset
	1	attached external headset

Unsolicited result code: **+CEXTHS: <attach>**

Query	AT+CEXTHS?	Current selection OK
Test	AT+CEXTHS=?	List of possible selections
Set	AT+CEXTHS=0	OK

AT+CFUN

Description: SET FUNCTIONALITY LEVEL

Sets the current functionality of the device. Typically used on phones and voice applications. Support for this command will be hardware dependant. For UPGRADE_SYSTEM_2, settings above 1 are not supported.

Syntax: **AT+CFUN=<fun>[,<rst>]**

Parameters:

<fun>	0	minimum functionality
	1	full functionality (Default)
	2	disable phone transmit RF circuits only
	3	disable phone receive RF circuits only
	4	disable phone both transmit and receive RF circuits
	5..127	reserved for manufacturers as intermediate states between full and minimum functionality
<rst>	0	do not reset the ME before setting it to <fun> power level

Response:

Query	AT+CFUN?	Current selection OK
Test	AT+CFUN=?	List of possible selections
Set	AT+CFUN=1	OK

AT+CGACT

Description: PDP CONTEXT ACTIVATE / DEACTIVATE

This execution command is used to activate or deactivate the specified PDP context(s).

Syntax: **AT+CGACT=[<state>[,<cid>[,<cid>[,...]]]]**

Parameters:

<cid> a numeric parameter which specifies a particular PDP context definition (see +CGDCONT command). The following parameters are defined in GSM 03.60 -

<state> indicates the state of PDP context activation

0 – deactivated

1 – activated

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

Response: **AT+CGACT?+CGACT: <cid>,<state>[<cr><LF>+CGACT: <cid>,<state>[...]]**

AT+CGAPNR

This command reads APNs from the store. The command can be provided with an absolute APN index to read or an index range for a group of APNs to fetch.

Description: Read records from the APN store.

Syntax: **AT+CGAPNR:<index1>,[<index2>]**

Parameters: **<index1> index of APN record to read or start index of read list**

<index2> stop index of record list

Response: **User specifies index of record to read or range of records to display. Returns the data contained within the specified APN record(s). Entries that are invalid are not shown.**

+CGAPNR:<index>,<apn>,<usage>,<description>,<user>,<password>,

OK

Example: **AT+CGAPNR=<index1>,[<index2>]**

Test: AT+CGAPNR=? Returns the parameter for the read operation.

AT+CGAPNW

This command writes or deletes an APN specified by a given index number. The user provides the description of the APN to write. The minimum description features an index in the case of a delete event or an index and an APN in the case of a write event.

Description: Write/delete record from the APN store.

Syntax: **AT+CGAPNW:<index>[<apn>,[<....>]]**

Parameters: **<index> index of APN records to read**

<apn> APN string

<usage> usage for this APN (1=General IP, 2=WAP)

<description> description string

<user> user name string

<password> password string

Response: **Writes supplied data to the specified APN record in the store. If only the index field is supplied, the specified record is deleted.**

OK

A CME error if the index is invalid or entered data is invalid:

+CME ERROR:invalid index

ERROR

+CME ERROR: invalid input value.

ERROR

Example: **AT+CGAPNW:<index>[<apn>,[<usage>,[<description>[<user>,<password>]]]]]**

AT+CGATT

Description: GPRS ATTACHED OR DEATTACHED

This execution command is used to attach to, or detach the MT from, the GPRS service.

Syntax: **AT+CGATT= [<state>]**

Parameters: **<state> indicates the GPRS attach state**

0 – attached

1 – detached

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

Response: **+CGATT:<state>**

Query	AT+CGATT?	OK
Test	AT+CGATT=?	
Set	AT+CGATT=0	

AT+CGCLASS

Description: GPRS MOBILE STATION CLASS

Class A and B are not supported by this GPRS solution. Class C is only supported for <class> values of “CG” and “CC”

Syntax: **AT+CGCLASS= [<class>]**

Parameters: **<class> a string parameter which indicates the GPRS mobile class (in descending order of functionality)**

A	class A (highest)
B	class B
CG	class C in GPRS only mode
CC	class C in circuit switched only mode (lowest)

Response: **+CGCLASS: <class>**

AT+CGDCONT

Description: PDP CONTEXT DEFINED

This set command specifies PDP context parameter values for a PDP context identified by the (local) context identification parameter <cid>.

Define the PDP context and APN address.

Syntax: **AT+CGDCONT=[<cid>[,<PDP_type>[,<APN>[,<PDP_addr>[,<d_comp>[,<h_comp>[,<pd1>[,…[,pdN]]]]]]]]]**

Parameters:

<cid> (PDP Context Identifier) a numeric parameter which specifies a particular PDP context definition. The parameter is local to the TE-MT interface and is used in other PDP context-related commands. The range of permitted values (minimum value = 1) is returned by the test form of the command.

<PDP_type> (Packet Data Protocol type) a string parameter which specifies the type of packet data protocol X25 ITU-T/CCITT X.25 layer 3 IP Internet Protocol (IETF STD 5) OSPIH Internet Hosted Octet Stream Protocol PPP Point to Point Protocol (IETF STD 51)

<APN> (Access Point Name) a string parameter which is a logical name that is used to select the GGSN or the external packet data network. If the value is null or omitted, then the subscription value will be requested.

<PDP_addr> a string parameter that identifies the MT in the address space applicable to the PDP. If the value is null or omitted, then a value may be provided by the TE during the PDP startup procedure or, failing that, a dynamic address will be requested. The read form of the command will continue to return the null string even if an address has been allocated during the PDP startup procedure. The allocated address may be read using the +CGPADDR command.

<d_comp> a numeric parameter that controls PDP data compression.

0 off (default if value is omitted)

1 on Other values are reserved

At present only one data compression algorithm (V.42bis) is provided in SNDCP. If and when other algorithms become available, a command will be provided to select one or more of these.

<h_comp> a numeric parameter that controls PDP header compression.

0 off (default if value is omitted)

1 on (other values are reserved)

<pd1>,...<pdN> zero to N string parameters whose meanings are specific to the <PDP_type>. For PDP type OSP:IHOSS the following parameters are defined:

<pd1> = <host> the fully formed domain name extended hostname of the Internet host

<pd2> = <port> the TCP or UDP port on the Internet host

<pd3> = <protocol> the protocol to be used over IP on the Internet - "TCP" or "UDP

Example: **AT+CGDCONT?** **+CGDCONT: <cid>,<PDP_type>,<APN>,<PDP_addr>,<data_comp>,<head_comp>[,<pd1>[,...[,pdN]]] [<cr><LF>+CGDCONT: <cid>,<PDP_type>,<APN>,<PDP_addr>,<data_comp>,<head_comp>[,<pd1>[,...[,pdN]]]**

AT+CGEREP

Description: UNSOLICITED EVENT REPORTING CONTROL

Syntax: **AT+CGEREP=[<mode>[,<bfr>]]**

Parameters:

<mode>	0	buffer unsolicited result codes in the MT; if MT result code buffer is full, the oldest ones can be discarded. No codes are forwarded to the TE.
	1	discard unsolicited result codes when MT-TE link is reserved (e.g. in online data mode); otherwise forward them directly to the TE
	2	buffer unsolicited result codes in the MT when MT?TE link is reserved (e.g. in online data mode) and flush them to the TE when MT-TE link becomes available; otherwise forward them directly to the TE
<bfr>	0	MT buffer of unsolicited result codes defined within this command is cleared when <mode> 1 or 2 is entered
	1	MT buffer of unsolicited result codes defined within this command is flushed to the TE when <mode> 1 or 2 is entered (OK response shall be given before flushing the codes)

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

+CGEV: ME DEACT <PDP_type>,<PDP_addr>[,<cid>]
+CGEV: NW DETACH
+CGEV: ME DETACH
+CGEV: ME CLASS <class>

<PDP_type> Packet Data Protocol type (see +CGDCONT command)

<PDP_addr> Packet Data Protocol address (see +CGDCONT command}

<cid> Context Id (see +CGDCONT command).

Note: <cid> only given if known to the MT.

<class> GPRS mobile class (see +CGCLASS command)

Query AT+CGEREP? OK

Test	AT+CGEREP=?
Set	AT+CGEREP=0

AT+CGMI

Description: MANUFACTURERS IDENTITY REQUEST

Returns manufacturer identification text. Identical to the command AT+GMI.

Syntax: **AT+CGMI**

Parameters: **NONE**

Response: **Manufacturer's ID**

Example:	**Input**	**Output**
Query	**AT+CGMI**	**Novatel Wireless, Inc. OK**
Test	**AT+CGMI=?**	**OK**

AT+CGMM

Description: MODEL IDENTITY REQUEST

Returns product model identification text. Identical to the command AT+GMM.

Syntax: **AT+CGMM**

Parameters: **None**

Response: **<model identity>**

Example:	**Input**	**Output**
Query	**AT+CGMM**	**GPRS PC Card 1900 OK**
Test	**AT+CGMM=?**	**OK**

AT+CGMR

Description: REVISION IDENTITY REQUEST

Returns product software version identification text. Identical to the command AT+GMR.

Syntax: **AT+CGMR**

Parameters: **None**

Response: **<software revision text>**

Example: **Input** **Output**

Query	**AT+CGMR?**	**Software Version: PN160-0300** **Date: May 23 2001, Time: 14:17:39. OK**
Test	**AT+CGMR=?**	**OK**

AT+CGOI

Description: GLOBAL IDENTITY REQUEST

Reports one or more lines of information text which permit the user to identify the device, based on the ISO system for registering unique object identifiers. Identical to the command AT+GOI.

Syntax: **AT+CGOI**

Parameters: **None**

Response: **Identifier of device type.**

AT+CGPADDR

Description: SHOW PDP ADDRESS

This command dictates the behavior of PPP in the ME but not the behavior of any other GPRS-enabled foreground layer, e.g. browser.

Syntax: **AT+CGPADDR=[<cid>[,<cid>[,...]]]**

Parameters:

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

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

Response: **+CGPADDR: <cid>,<PDP_addr>[<cr><LF>+CGPADDR: <cid>,<PDP_addr>**

AT+CGQMIN

Description: QUALITY OF SERVICE PROFILE (MINIMUM ACCEPTABLE)

Get current quality of service profile. This reports the minimum quality standard that will be used by the device / network.

Syntax: **AT+CGQMIN=[<cid>[,<precedence>[,<delay>[,<reliability>[,<peak>[,<mean>]]**

<cid>	a numeric parameter which specifies a particular PDP context definition (see +CGDCONT command). The following parameters are defined in GSM 03.60
<precedence>	a numeric parameter which specifies the precedence class
<delay>	a numeric parameter which specifies the delay class
<reliability>	a numeric parameter which specifies the reliability class
<peak>	a numeric parameter which specifies the peak throughput class
<mean>	a numeric parameter which specifies the mean throughput class

Response: **AT+CGQMIN?+CGQMIN: <cid>,<precedence>,<delay>,<reliability>,<peak>,<mean>[<cr><LF>**

+CGQMIN: <cid>,<precedence>,<delay>,<reliability>,<peak>,<mean>[...]]

Query	AT+CGQMIN?	Current selection OK
Test	AT+CGQMIN=?	List of possible selections
Set	AT+CGQMIN=<n>	OK

AT+CGQREQ

Description: REQUEST QUALITY OF SERVICE PROFILE

Request quality of service from carrier.

Syntax: **AT+CGQREQ=[<cid>[,<precedence>[,<delay>[,<reliability.>[,<peak>[,<mean>]]]]]]**

Parameters:

<cid>	a numeric parameter which specifies a particular PDP context definition (see +CGDCONT command). The following parameters are defined in GSM 03.60 -
<precedence>	a numeric parameter which specifies the precedence class
<delay>	a numeric parameter which specifies the delay class
<reliability>	a numeric parameter which specifies the reliability class
<peak>	a numeric parameter which specifies the peak throughput class

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

Response: **+CGQREQ:<cid>,<precedence>,<delay>,<reliability>,<peak>,<mean>[<cr><LF>+CGQREQ: <cid>,<precedence>,<delay>,<reliability>,<peak>,<mean>[...]]**

AT+CGREG

Description: GPRS NETWORK REGISTRATION STATUS

This set command returns the status of an unsolicited result code.

Syntax: **AT+CGREG=[<n>]**

Parameters:

<n>	0	disable network registration unsolicited result code
	1	enable network registration unsolicited result code +CGREG: <stat>
	2	enable network registration and location information unsolicited result code +CGREG: <stat>[,<lac>,<ci>]

Response: **(Read Response)**

+CGREG: <n>,<stat>[,<lac>,<ci>]

+CME ERROR: <err>

<n>	0	disable network registration unsolicited result code
	1	enable network registration unsolicited result code +CGREG: <stat>
	2	enable network registration and location information unsolicited result code +CGREG: <stat>[,<lac>,<ci>]
<stat>	0	device is not registered, ME is not currently searching a new operator to register to
	1	device is registered
<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

Query	AT+CGREG?	Current selection OK
Test	AT+CGREG=?	List of possible selections
Set	AT+CGREG=<n>	OK

AT+CGSMS

Description: SERVICE SELECTION FOR MO SMS MESSAGES

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

Syntax: **AT+CGSMS=[<service>]**

Parameters:

<service>		a numeric parameter which indicates the service or service preference to be used. The circuit switched service route is the default method.
	0	GPRS
	1	circuit switched
	2	GPRS preferred (use CSD if GPRS not available)
	2	CSD preferred (use GPRS if CSD not available)

Response: **(Read Response)**

+CGSMS: [<service>]<cr> +CME ERROR: <err> <service> see above.

<n>	0	disable network registration unsolicited result code
	1	enable network registration unsolicited result code +CGREG: <stat>
	2	enable network registration and location information unsolicited result code +CGREG: <stat>[,<lac>,<ci>]
<stat>	0	device is not registered, ME is not currently searching a new operator to register to
	1	device is registered
<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

AT+CGSN

Description: SERIAL NUMBER REQUEST

Reports the device serial number. Identical to the command AT+GSN.

Syntax: **AT+CGSN**

Parameters: **None**

Example:	**Input**	**Output**
Query	**AT+CGSN**	**01234567890123. OK**
Test	**AT+CGSN=?**	**OK**

AT+CHLD

Description: CALL HOLD

Controls the supplementary services Call Hold, MultiParty and Explicit Call Transfer. Calls can be put on hold, recovered, released, added to conversation, and transferred. This supplementary service is only applicable to teleservice 11 (Speech: Telephony).

Syntax: **AT+CHLD=[<n>]**

n	0	Terminate all held calls or UDUB (User Determined User Busy) for a waiting call
	1	Terminate all active calls (if any) and accept the other call (waiting call or held call)
	1X	Terminate the active call number X (X= 1-7)
	2	Place all active calls on hold (if any) and accept the other call (waiting call or held call) as the active call
	2X	Place all active calls except call X (X= 1-7) on hold
	3	Add the held call to the active calls

Example:

	Input	Output
Query	**AT+CHLD?**	**1 OK**
SET	**AT+CHLD=1**	**OK**
Test	**AT+CHLD=?**	**List of supported <n>s OK**

AT+CIMI

Description: INTERNATIONAL MOBILE SUBSCRIBER IDENTITY REQUEST

Returns international mobile subscriber identity for identifying the individual SIM which is attached to the device.

Syntax: **AT+CIMI**

Parameters: **None**

Response: **International Mobile Subscriber Identity**

Example:

	Input	Output
Query	**AT+CIMI?**	**1234567890123455566**
		OK
Test	**AT+CIMI=?**	**OK**

AT+CLCC

Description: CURRENT CALL LIST

Returns a list of current calls.

Syntax: **AT+CLCC**

Parameters: **None**

```
[+CLCC:<id1>,<dir>,<stat>,<mode>,<mpty>[,<number>,
<type>[,<alpha>]]
```

<idx>		integer type; call identification number as described in GSM 02.30[19] sub clause 4.5.5.1; this number can be used in +CHLD command operations.
<dir>	0	mobile originated (MO) call
	1	mobile terminated (MO) call
<stat>		state of call:
	0	active
	1	held
	2	dialing (MO call)
	3	alerting (MO call)
	4	incoming (MT call)
	5	waiting (MT call)
<mode>	bearer/tele service:	
	0	voice
	1	data
	2	fax
	9	unknown
<mpty>	0	call is not one of multiparty (conference) call parties
	1	call is one of multiparty (conference) call parties
<number>		string type phone number in format specified by <type>
<type>		type of address octet in integer format; 145 when dialing string includes international access code character "+", otherwise 129
<alpha>		string type alphanumeric representation of <number> corresponding to the entry found in phone book

Example:	**Input**	**Output**
Query	**AT+CLCC**	**LIST FORMATTED AS ABOVE**
		OK
Test	**AT+CLCC=?**	**OK**

AT+CLCK

Description: FACILITY LOCK

This command is used to lock, unlock or interrogate an ME or a network facility. A password is normally needed to perform such actions. When querying the status of a network service (<mode>=2) the response line for 'not active' case (<status>=0) should be returned only if service is not active for any <class>.

Syntax: **AT+CLCK = <fac>, <mode>[,<passwd>[,<class>]]**

Parameters:

<fac>	"PS"	PH-SIM (lock PHone to SIM card) (ME asks password when other than current SIM card inserted; ME may remember certain amount of previously used cards thus not requiring password when they are inserted).
	"SC"	SIM (lock SIM card) (SIM asks password in ME power-up and when this lock command issued).
	"AO"	BAOC (Barr All Outgoing Calls) (refer GSM02.88[6] clause 1)
	"O"	BOIC (Barr Outgoing International Calls) (refer GSM02.88[6] clause 1)
	"OX"	BOIC-exHC (Barr Outgoing International Calls except to Home Country) (refer GSM02.88[6] clause 1)
	"AI"	BAIC (Barr All Incoming Calls) (refer GSM02.88[6] clause 2)
	"IR"	BIC-Roam (Barr Incoming Calls when Roaming outside the home country) (refer GSM02.88 [6] clause 2)
	"AB"	All Barring services (refer GSM02.30[19]) (applicable only for <mode>=0)
	"AG"	All out Going barring services (refer GSM02.30[19]) (applicable only for <mode>=0)
	"AC"	All in Coming barring services (refer GSM02.30[19]) (applicable only for <mode>=0)
	"PN"	Network Personalization (refer GSM 02.22[33])
	"PU"	network sUbset Personalization (refer GSM 02.22[33])
	"PP"	service Provider Personalization (refer GSM 02.22[33])
	"PC"	Corporate Personalization (refer GSM 02.22[33])
<mode>	0	unlock
	1	lock

	2	query status
<passwd>		password
<class>	1	voice
	2	data
	4	fax
	7	all classes (default)
<status>	0	off
	1	on

Response: **If <mode><>2 and command is successful**

OK

If <mode>=2 and command is successful

+CLCK: <status>[,<class1>[<cr><LF>

+CLCK: <status>, class2....]] OK

If error is related to ME functionality:

+CME ERROR: <err>

Example:	**Input**	**Output**
Query	**AT+CLCK?**	**129**
		OK
Test	**AT+CLCK=?**	**LIST OF SUPPORTED (<fac>s) OK**

AT+CLDTMF

Description: GENERATE LOCAL DTMF TONE

Syntax: **AT+CLDTMF=<n>,<dtmf-string>**

Parameters:

<n>	Duration of all DTMF tones in <dtmf-string> in 1/10 seconds.
<dtmf-string>	As a max length of 20 characters of form <dtmf>, must be entered between double quotes (“ “) and consists of combinations of the following separated by commas.
<dtmf>	A single ASCII characters in the set 0-9,#,*,A-D. This is interpreted as a sequence of DTMF tones whose duration is set by <n>.

Response: **OK+CME ERROR**

<err> AT+CLDTMF, without any parameters will abort any DTMF tone currently being generated and any DTMF tone sequence

Query:	AT+CLDTMF=?	Current State OK
Set:	AT+CLDTMF=<n>	A list of possible selections
Test:	AT+CLDTMF=	

AT+CLIP

Description: CALLING LINE IDENTIFICATION PRESENTATION

TA enables or disables the presentation of the CLI at the TE. It has no effect on the execution of the supplementary service CLIP in the network. When the presentation of the CLI at the TE is enabled (and calling subscriber allows), an unsolicited result code is returned after every RING (or +CRING: <type>) at a mobile terminating call.

Syntax: **AT+CLIP=<n>**

Parameters:

<n>	0	suppress unsolicited result codes
	1	display unsolicited result codes

Response: **+CLIP: <number>, <type>**

<number>	string type phone number of calling address in format specified by <type>
<type>	type of address octet in integer format; 145 when dialing string includes international access code character "+", otherwise 129

Example:	**Input**	**Output**
Query	**AT+CLIP?**	**List of supported N's**
Test	**AT+CLIP=?**	**List of supported N's**

AT+CLIR

Description: CALLING LINE IDENTIFICATION RESTRICTION

TA restricts or enables the presentation of the CLI to the called party when originating a call. The command overrides the CLIR subscription (default is restricted or allowed) when temporary mode is provisioned as a default adjustment for all following outgoing calls. This adjustment can be revoked by using the opposite command.

Syntax: **AT+CLIR=<n>**

Parameters: **<n> parameter sets the adjustment for outgoing calls**

<n>	0	presentation indicator is used according to the subscription of the CLIR service
	1	CLIR invocation
	2	CLIR suppression

<m> parameter shows the subscriber CLIR service status in the network

<m>	0	CLIR not provisioned
	1	CLIR provisioned in permanent mode
	2	unknown (e.g. no network, etc.)
	3	CLIR temporary mode presentation restricted
	4	CLIR temporary mode presentation allowed

Response: **+CLIR: <n>, <m> OK**

Example:	**Input**	**Output**
Test	**AT+CLIR=?**	**List of supported n's**

AT+CLTS

Description: GET LOCAL TIME STAMP

Query the master time source (local) for the current time.

Syntax: **AT+CLTS**

Parameters: **None**

Response:

<tds>	time-string format: "yy/MM/dd,hh:mm:ss±zz" where characters indicate year (last two digits), month, day, hours, minutes, seconds and time zone.

AT+CLVL

Description: LOUDSPEAKER VOLUME SETTING

Sets the local loudspeaker volume level. If no loudspeaker provisions exist, this command does nothing.

Syntax: **AT+CLVL=<level>**

Parameters:

<level>	integer type value with manufacturer specific range (smallest value represents the lowest sound level)

Response:

Query +CLVL: <level>+CME ERROR: <err>

Test +CLVL: (list of supported <level>s)+CME ERROR: <err>

AT+CMEE

Description: REPORT MOBILE EQUIPMENT ERROR

Modem disables or enables the use of result code +CME ERROR: <err> as an indication of an error relating to the functionality of the mobile equipment.

Syntax: **AT+CMEE=<n>**

Parameters:

<n>	0	disable result code
	1	enable result code and use numeric values
	2	enable result code and use verbose value

Response: **<n> OK**

Example:	**Input**	**Output**
Query	**AT+CMEE?**	**<n>**
		OK
Test	**AT+CMEE=?**	**List of supported <n>s**
		OK

AT+CMGD

Description: DELETE SMS MESSAGE

Deletes message from preferred message storage location.

Syntax: **AT+CMGD=<index>**

Parameters:

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

Response: **OK**

Example:	**Input**	**Output**
Test	**AT+CMGD=?**	**OK**

AT+CMGF

Description: SMS MESSAGE FORMAT

Sets parameter to dictate which input and output format of messages to use.

Syntax: **AT+CMGF = [<mode>]**

Parameters:

<mode>	0	PDU mode
	1	text mode

Response: **OK**

Example:	**Input**	**Output**
Query	**AT+CMGF?**	**+CMGF: <mode> OK**
Test	**AT+CMGF=?**	**+CMGF: list of supported <mode>s OK**

AT+CMGL

Description: LIST SMS MESSAGES

Returns messages with status value <stat> from message storage <mem1> to the TE. If status of the message is 'received unread', status in the storage changes to 'received read'.

Syntax: **AT+CMGL [=<stat>]**

Parameters:

<stat>	Text Mode	“REC UNREAD” Received unread message (default)	
		“REC READ” Received read messages.	
		"STO UNSENT" Stored unsent messages	
		"STO SENT" Stored sent messages	
		"ALL" All messages	
	PDU Mode	0	Received unread messages (default)
		1	Received read messages
		2	Stored unsent messages
		3	Stored sent messages
		4	All messages

Response:

1. If text mode (+CMGF=1) and command successful: for SMS-SUBMITs and/or SMS-DELIVERs:**+CMGL: <index>,<stat>,<oa/da>,[<alpha>],[<scts>][,<tooa/toda>,<length>]<cr><LF><data>[<cr><LF>+CMGL: <index>,<stat>,<da/oa>,[<alpha>],[<scts>][,<tooa/toda>,<length>]<cr><LF><data>[...]] OK**
2. If PDU mode (+CMGF=0) and command successful: **+CMGL: <index>,<stat>,[<alpha>],<length><cr><LF><pdu>[<cr><LF>+CMGL: <index>,<stat>,[alpha],<length><cr><LF><pdu>[...]] OK**
3. If error is related to ME functionality: **+CMS ERROR: <err>**

<alpha>	string type alphanumeric representation of <da> or <oa> corresponding to the entry found in MT phone book; implementation of this feature is manufacturer specific
<da>	GSM 03.40 TP-Destination-Address, Address-Value field in string format; BCD numbers (or GSM default alphabet characters) are converted to characters; type of address given by <toda>
<data>	In the case of SMS: GSM 03.40 TP-User-Data in text mode responses; format: if <dcs> indicates that GSM 03.38 default alphabet is used and <fo> indicates that GSM 03.40 TP-User-Data-Header-Indication is not set: ME/TA converts GSM alphabet into current TE character set according to rules of Annex A if <dcs> indicates that 8-bit or UCS2 data coding scheme is used, or <fo> indicates that GSM 03.40 TP-User-Data-Header-Indication is set: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number (e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)) In the case of CBS: GSM 03.41 CBM Content of Message in text mode responses; format: if <dcs> indicates that GSM 03.38 default alphabet is used: ME/TA converts GSM alphabet into current TE character set according to rules of Annex A. if <dcs> indicates that 8-bit or UCS2 data coding scheme is used: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number.
<length>	integer type value indicating in the text mode (+CMGF=1) the length of the message body <data> (or <cdata>) in characters; or in PDU mode (+CMGF=0), the length of the actual TP data unit in octets (i.e. the RP layer SMSC address octets are not counted in the length)
<index>	integer type; value in the range of location numbers supported by the associated memory
<oa>	GSM 03.40 TP-Originating-Address, Address-Value field in string format; BCD numbers (or GSM default alphabet characters) are converted to characters; type of address given by <tooa>
<pdu>	In the case of SMS: GSM 04.11 SC address followed by GSM 03.40 TPDU in hexadecimal format: ME/TA converts each octet of TP data unit into two IRA character long hexadecimal number (e.g. octet with

	integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)). In the case of CBS: GSM 03.41 TPDU in hexadecimal format.
<scts>	GSM 03.40 TP-Service-Center-Time-Stamp in time-string format (refer <dt>)
<toda>	GSM 04.11 TP-Destination-Address Type-of-Address octet in integer format (when first character of <da> is + (IRA 43) default is 145, otherwise default is 129)
<tooa>	GSM 04.11 TP-Originating-Address Type-of-Address octet in integer format (default refer<toda>)

Example:	**Input**	**Output**
Test	**AT+CMGL=?**	**+CMGF: list of supported <stats>s OK**

AT+CMGR

Description: READ SMS MESSAGE

Returns SMS message with location value <index> from message storage <mem1> to the TE. If status of the message is 'received unread', status in the storage changes to 'received read'.

Syntax: **AT+CMGR=<index>**

Parameters:

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

Response:

1. If text mode (+CMGF=1) and command successful: for SMS-DELIVER:

   +CMGR: <stat>,<oa>,[<alpha>],<scts> [,<tooa>,<fo>,<pid>,<dcs>,<sca>,<tosca>,<length>]<cr><LF><data>for SMS-SUBMIT:+CMGR: <stat>,<da>,[<alpha>] [,<toda>,<fo>,<pid>,<dcs>,[<vp>],<sca>,<tosca>,<length>]<cr><LF><data >

2. If PDU mode (+CMGF=0) and command successful:

   +CMGR: <stat>,[<alpha>],<length><cr><LF><pdu> OK

3. If error is related to ME functionality:

   +CMS ERROR: <err>

<alpha>	The string type alphanumeric representation of <da> or <oa> corresponding to the entry found in MT phone book; implementation of this feature is manufacturer specific.
<da>	GSM 03.40 TP-Destination-Address, Address-Value field in string format; BCD numbers (or GSM default alphabet characters) are converted to characters; type of address given by <toda>.
<data>	In the case of SMS: GSM 03.40 TP-User-Data in text mode responses; format: if <dcs> indicates that GSM 03.38 default alphabet is used and <fo> indicates that GSM 03.40 TP-User-Data-Header-Indication is not set: ME/TA converts GSM alphabet into current TE character set according to rules of Annex A. If <dcs> indicates that 8-bit or UCS2 data coding scheme is used, or <fo> indicates that GSM 03.40 TP-User-Data-Header-Indication is set: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number (e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)) In the case of CBS: GSM 03.41 CBM Content of Message in text mode responses; format: If <dcs> indicates that GSM 03.38 default alphabet is used: ME/TA converts GSM alphabet into current TE character set according to rules of Annex A. If <dcs> indicates that 8-bit or UCS2 data coding scheme is used: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number.
<dcs>	Depending on the command or result code: GSM 03.38 SMS Data Coding Scheme (default 0), or Cell Broadcast Data Coding Scheme in integer format.
<fo>	Depending on the command or result code: first octet of GSM 03.40 SMS-DELIVER, SMS-SUBMIT (default 17), SMS-STATUS-REPORT, or SMS-COMMAND (default 2) in integer format.
<length>	Integer type value indicating in the text mode (+CMGF=1) the length of the message body <data> (or <cdata>) in characters; or in PDU mode (+CMGF=0), the length of the actual TP data unit in octets (i.e. the RP layer SMSC address octets are not counted in the length).
<mid>	GSM 03.41 CBM Message Identifier in integer format.

<oa>	GSM 03.40 TP-Originating-Address, Address-Value field in string format; BCD numbers (or GSM default alphabet characters) are converted to characters; type of address given by <tooa>.		
<pdu>	In the case of SMS: GSM 04.11 SC address followed by GSM 03.40 TPDU in hexadecimal format: ME/TA converts each octet of TP data unit into two IRA character long hexadecimal number (e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65). In the case of CBS: GSM 03.41 TPDU in hexadecimal format.		
<sca>	GSM 04.11 RP SC address Address Value field in string format; BCD numbers (or GSM default alphabet characters) are converted to characters; type of address given by <tosca>.		
<stat>	0	“REC UNREAD”	Received unread messages
	1	“REC READ”	Received read messages
	2	“STO UNSENT”	Stored unsent messages
	3	“STO SENT”	Stored sent messages
	4	“ALL”	All messages
<toda>	GSM 04.11 TP-Destination-Address Type-of-Address octet in integer format (when first character of <da> is + (IRA 43) default is 145, otherwise default is 129)		
<tooa>	GSM 04.11 TP-Originating-Address Type-of-Address octet in integer format (default refer<toda>).		
<tosca>	GSM 04.11 RP SC address Type-of-Address octet in integer format (default refer <toda>).		
<vp>	depending on SMS-SUBMIT <fo> setting: GSM 03.40 TP-Validity-Period either in integer format (default 167) or in time-string format (refer <dt>)		

Example:	**Input**	**Output**
Test	**AT+CMGR=?**	**+CMGR: list of supported <index>s OK**

AT+CMGW

Description: WRITE SMS MESSAGE TO MEMORY

Transmits SMS message from terminal to memory storage. Memory location of the stored message is returned. By default message status will be set to 'stored unsent', but parameter allows other status values to be given.

Syntax:

TEXT MODE: **AT+CMGS=[<oa/da>[,<tooa/toda>]]<cr> MESSAGE TEXT <ctrlZ>**

PDU MODE: **AT+CMGW==<length><cr> PDU IS GIVEN <ctrlZ>**

SENDS MESSAGE **<ctrlZ>**

EXITS WITHOUT SENDING **<esc>**

Parameters:

<oa>	GSM 03.40 TP-Originating-Address, Address-Value field in string format; BCD numbers (or GSM default alphabet characters) are converted to characters; type of address given by <tooa>
<da>	GSM 03.40 TP-Destination-Address, Address-Value field in string format; BCD numbers (or GSM default alphabet characters) are converted to characters; type of address given by <toda>
<tooa>	GSM 04.11 TP-Originating-Address Type-of-Address octet in integer format (default refer <toda>).
<toda>	GSM 04.11 TP-Destination-Address Type-of-Address octet in integer format (when first character of <da> is + (IRA 43) default is 145, otherwise default is 129)
<length>	Integer type value indicating in the text mode (+CMGF=1) the length of the message body <data> (or <cdata>) in characters; or in PDU mode (+CMGF=0), the length of the actual TP data unit in octets (i.e. the RP layer SMSC address octets are not counted in the length)
<pdu>	In the case of SMS: GSM 04.11 SC address followed by GSM 03.40 TPDU in hexadecimal format: ME/TA converts each octet of TP data unit into two IRA character long hexadecimal number (e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)). In the case of CBS: GSM 03.41 TPDU in hexadecimal format.
<index>	Index of message in selected storage <mem2>

Response: **If writing is successful: +CMGW: <index> OK**

If error is related to ME functionality: **+CMS ERROR: <err>**

Example:	**Input**	**Output**
Test	**AT+CMGW=?**	**OK**

AT+CMSS

Description: SEND STORED SMS MESSAGE

Sends message with location value <index> from message storage <mem2> to the network (SMS-SUBMIT). If new recipient address <da> is given, it shall be used instead of the one stored with the message. Reference value <mr> is returned to the TE on successful message delivery. Values can be used to identify message upon unsolicited delivery status report result code.

Syntax: **AT+CMSS=<index>[,<da>[,<toda>]]**

Parameters:

<index>	integer type; value in the range of location numbers supported by the associated memory
<da>	GSM 03.40 TP-Destination-Address, Address-Value field in string format; BCD numbers (or GSM default alphabet characters) are converted to characters; type of address given by <toda>
<toda>	GSM 04.11 TP-Destination-Address Type-of-Address octet in integer format (when first character of <da> is + (IRA 43) default is 145, otherwise default is 129)
<mr>	GSM 03.40 TP-Message-Reference in integer format

Response: **If text mode(+CMGF=1) and sending successful: +CMGS: <mr> OK**

If PDU mode(+CMGF=0) and sending successful: **+CMGS: <mr> OK**

If error is related to ME functionality: **+CMS ERROR: <err>**

Example:	**Input**	**Output**
Test	**AT+CMSS=?**	**OK**

AT+CMUT

Description: This command is used to enable and disable the uplink voice muting during a voice call.

Syntax: **AT+CMUT=<n>**

Parameters:

<n>	0	mute off
	1	mute on

Response:

Query **+CMUT: <n>+CME ERROR: <err>**

Test **+CMUT: (list of supported <n>s)**

AT+CMUX

Description: This command is used to enable/disable the GSM 07.10 multiplexing protocol control channel.

Syntax: **AT+CMUX=<mode>**

Parameters:

<mode>	0	Basic option (i.e. No multiplexer in operation)
	1	Advanced option (GSM 07.10 multiplexer)
	2	Proprietary option (manufacturer specific multiplexer)

Response:

Query +CMUX: <mode>+CME ERROR: <err>

Test +CMUX: (list of supported <mode>s)

AT+CNMI

Description: SMS MESSAGE ARRIVAL INDICATION

Selects the procedure for receiving of new messages from the network. Indicates to the TE when TE is active, e.g. DTR signal is ON. If TE is inactive (e.g. DTR signal is OFF), message receiving should be done as specified in GSM 03.38.

Syntax: **AT+CNMI = [<mode>[,<mt>[,<bm>[,<ds>[,<bfr>]]]]]**

Parameters:

<mode>	0	Buffer unsolicited result codes in the TA. If TA result code buffer is full, indications can be buffered in some other place or the oldest indications may be discarded and replaced with the new received indications.
	1	Discard indication and reject new received message unsolicited result codes when TA-TE link is reserved (e.g. in on-line data mode). Otherwise forward them directly to the TE.
	2	Buffer unsolicited result codes in the TA when TA-TE link is reserved (e.g. in on-line data mode) and flush them to the TE after reservation. Otherwise forward them directly to the TE.
	3	Forward unsolicited result codes directly to the TE. TA-TE link specific in band technique used to embed result codes and data when TA is in on-line data mode.
<mt>		The rules for storing received SMs depend on its data coding scheme (refer GSM 03.38 [2], preferred memory storage (+CPMS) setting and this value:
	0	No SMS-DELIVER indications are routed to the TE.
	1	If SMS-DELIVER is stored into ME/TA, indication of the memory location is routed to the TE using unsolicited result code: +CMTI: <mem>,<index>
	2	SMS-DELIVERs (except class 2) are routed directly to the TE using unsolicited result code: +CMT: [<alpha>],<length><cr><LF><pdu> (PDU mode enabled) or +CMT: <oa>, [<alpha>],<scts> [,<tooa>,<fo>,<pid>,<dcs>,<sca>,<tosca>,<length>] <cr><LF><data> (text mode enabled; about

		parameters in italics, refer command Show Text Mode Parameters +CSDH). Class 2 messages result in indication as defined in <mt>=1.
	3	Class 3 SMS-DELIVERs are routed directly to TE using unsolicited result codes defined in <mt>=2. Messages of other classes result in indication as defined in <mt>=1.
<bm>		The rules for storing received CBMs depend on its data coding scheme (refer GSM 03.38 [2]), the setting of Select CBM Types (+CSCB) and the following values:
	0	No CBM indications are routed to the TE.
	2	New CBMs are routed directly to the TE using unsolicited result code: +CBM: <length><cr><LF><pdu> (PDU mode enabled) or +CBM: <sn>,<mid>,<dcs>,<page>,<pages><cr><LF><data> (text mode enabled).
<ds>	0	No SMS-STATUS-REPORTs are routed to the TE.
	1	SMS-STATUS-REPORTs are routed to the TE using unsolicited result code: +CDS: <length><cr><LF><pdu> (PDU mode enabled) or +CDS: <fo>,<mr>,[<ra>],[<tora>],<scts>,<dt>,<st> (text mode enabled)
<bfr>	0	TA buffer of unsolicited result codes defined within this command is flushed to the TE when <mode> 1...3 is entered (OK response shall be given before flushing the codes).
	1	TA buffer of unsolicited result codes defined within this command is cleared when <mode> 1...3 is entered.

Response: **OK**

Unsolicited Response:

+CMTI: <mem>,<index>	Indication that new message has been received
+CMT: ,<length><cr><LF><pdu>	Short message is output directly
+CBM: <length><cr><LF><pdu>	Cell broadcast message is output directly

Example:	**Input**	**Output**
Test	**AT+CNMI=?**	**OK**

AT+CNUM

Description: SUBSCRIBER NUMBER

This is a query command is used to retrieve the current subscriber number and associated information.

Syntax: **AT+CNUM**

<alphax> optional alphanumeric string associated with

<numberx> used character set should be the one selected with command Select TE Character Set +CSCS

<numberx> string type phone number of format specified by <typex>

<typex> type of address octet in integer format (refer GSM 04.08 [8] subclause 10.5.4.7)

<speed> as defined by the +CBST command

<service> service related to the phone number

0 asynchronous modem

1 synchronous modem

2 PAD Access (asynchronous)

3 Packet Access (synchronous)

4 Voice

5 Fax

<itc> information transfer capability

0 3.1 kHz

AT+COLP

Description: CONNECTED LINE IDENTIFICATION PRESENTATION

TA enables or disables the presentation of the COL(Connected Line) at the TE for a mobile originated call. It has no effect on the execution of the supplementary service COLR in the network. Intermediate result code is returned from TA to TE before any +CR or V.25ter responses.

Syntax: **AT+COLP=[<n>]**

Parameters:

<n>	0	disable
	1	enable
<m>	0	COLP not provisioned
	1	COLP provisioned
	2	Unknown (e.i no network)

Response: **+COLP:,NUMBER>,<TYPE>[,SUBADDR>,SATYPE>[,<ALPHA>]]**

<number>	string type phone number of format specified by <type>
<type>	type of address octet in integer format; 145 when dialing string includes international access code character "+", otherwise 1
<subaddr>	string type sub address of format specified by <satype>
<satype>	type of sub address octet in integer format (refer GSM 04.08 [8] sub clause 10.5.4.8)
<alpha>	optional string type alphanumeric representation of <number> corresponding to the entry found in phone book

Example:	**Input**	**Response**
Query	**AT+COLP?**	**+COLP:<n>,<m> OK**
Test	**AT+COLP=?**	**+COLP:(List of supported <n>s) OK**

AT+COPN

Description: READ OPERATOR NAME

Execute command returns the list of operator names from the ME. Each operator code that has an alphanumeric equivalent in the ME memory shall be returned.

Syntax: **AT+COPN**

Parameters: **<numeric*n*>: string type;operator in numeric format**

<alpha*n*>: string type;operator in long alphanumeric format

Response: **+COPN: <numeric1>, <alpha>**

[<CR><LF>+COPN: <numeric2>, <alpha2>[...]]

AT+COPS

Description: OPERATOR SELECTION

SET forces an attempt to select and register the GSM network operator. If the selected operator is not available, no other operator shall be selected (except <mode>=4). The selected operator name format shall apply to further read commands (+COPS?).

QUERY returns a list of quadruplets, each representing an operator present in the network. The formats may be unavailable, in this case the field should be empty. The list of operators shall be in order: home network, networks referenced in SIM, and other networks.

Syntax: **AT+COPS = <mode>[, <format>[, <oper>]]**

Parameters:

<oper>		operator in format as per <mode>
<mode>	0	automatic mode; <oper> field is ignored
	1	manual operator selection; <oper> field shall be present
	2	manual de-register from network
	3	set only <format> (for read command +COPS?) – not shown in Read command response
	4	manual/automatic selected; if manual selection fails, automatic mode (<mode>=0) is entered
<format>	0	long format alphanumeric <oper>;can be up to 16 characters long
	1	short format alphanumeric <oper>
	2	numeric <oper>; GSM Location Area Identification number

Response: **+COPS: (<stat>, <oper>, <oper>)s [,,(<mode>s),(<format>s)]**

<stat>	0	unknown
	1	operator available
	2	operator current
	3	operator forbidden
<oper>		operator in format as per <mode>
<mode>	0	automatic mode; <oper> field is ignored
	1	manual operator selection; <oper> field
	2	manual de-register from network
	3	set only <format> (for read command +COPS?) – not shown in Read command response

	4	manual/automatic selected; if manual selection fails, automatic mode (<mode>=0) is entered
<format>	0	long format alphanumeric <oper>;can be up to 16 characters long
	1	short format alphanumeric <oper>
	2	numeric <oper>; GSM Location Area Identification number

Example:	**Input**	**Response**
Query	**AT+COPS?**	**List of supported <stat>, <oper>,<mode>,<format> OK**
Test	**AT+COPS=?**	**+COPS: <mode>[,<format>[,<oper>]] OK**

AT+CPAS

Description: MOBILE EQUIPMENT ACTIVITY STATUS

Returns the current equipment activity status.

Syntax: **AT+CPAS**

Parameters: **None**

Response: **+CPAS: <pas> OK**

0	ready
2	unknown (ME is not guaranteed to respond to instructions)
3	incoming call (ringing)
4	call in progress or call hold

Example:	**Input**	**Response**
Test	**AT+CPAS=?**	**4 OK**

AT+CPBF

Description: PHONE BOOK, FIND ENTRIES

Returns phone book entries (from the current phone book memory storage selected with +CPBS) containing alphanumeric string <findtext>.

Syntax: **AT+CPBF=<findtext>**

Parameters: **Findtex - An ASCII string which may or may not be contained in the phone book.**

Response: **[+CPBF: <index1>,<number>,<type>,<text>[[...]<cr><LF>**

+CBPF: <index2>,<number>,<type>,<text>] OK]<index1>

<index1>	integer type values in the range of location numbers of phone book memory

<index2>	integer type values in the range of location numbers of phone book memory
<number>	string type phone number of format <type>
<type>	type of address octet in integer format ; 145 when dialling string includes international access code character “+“, otherwise 129
<findtext>	string type field of maximum length <tlength>
<text>	string type field of maximum length <tlength>
<nlength>	integer type value indicating the maximum length of field <number>
<tlength>	integer type value indicating the maximum length of field <text>

Example:	**Input**	**Response**
Query	**AT+CPBF=?**	**OK**
Test	**+CPBF: [<nlength)],[<tlength>]**	**OK**

AT+CPBR

Description: PHONE BOOK READ

Returns phone book entries in location number range <index1>... <index2> from the current phone book memory storage selected with +CPBS. If <index2> is left out, only location <index1> is returned.

Syntax: **AT+CPBR = <index1>[, <index2>]**

Parameters:

<index1>	read as of this location number
<index2>	read to this location number
<number>	phone number
<type>	type of number
<text>	text for phone number

Response: **+CPBR: <index1>, <number>, <type>, <text>[<cr><LF>+CPBR: .....+CPBR: <index2>, <number>, <type>, <text>] OK**

Example:	**Input**	**Response**
Test	**AT+CPBR=?**	**+CPBR: (<index>s), <nlength>, <tlength> OK**

AT+CPBS

Description: PHONE BOOK STORAGE SELECTIONS

Selects current phone book memory storage, which is used by other phone book commands.

Syntax: **AT+CPBS=<storage>**

Parameters:

<storage>	DC	Modem dialed calls list (+CPBW may not be applicable for this storage)
	FD	SIM fix dialing-phone book
	LD	SIM last-dialing-phone book
	ON	SIM (or ME) own numbers (MSISDNs) list
	SM	SIM phone book

Example:	**Input**	**Response**
Query	**AT+CPBS?**	**<storage> OK**
Test	**AT+CPBS=?**	**list of supported <storage>s OK**

AT+CPBW

Description: PHONE BOOK WRITE ENTRY

This command writes phone book entry in location number <index> in the current phone book memory storage selected with +CPBS. Entry fields written are phone number <number> (in the format <type>) and text <text> associated with the number. If those fields are omitted, phone book entry is deleted. If <index> is limited, but <number> is given, entry is written to the first free location in the phone book.

Syntax: **AT+CPBW = [<index>], [<number>, [<type>, [<text>]]]**

Parameters:

<nlength>	max. length of phone number
<tlength>	max. length of text for number
<index>	location number
<number>	phone number
<type>	type of number; e.g. 145 when dialing string includes international access code character "+", otherwise 129
<text>	text for phone number

Response: **+CPBW: (<index>s),<nlength>,(<typ>s),<tlength> OK**

Example:	**Input**	**Response**
Test	**AT+CPBW+?**	**(<index>s),<nlength>,(<typ>s),<tlength>** **OK**

The following characters in <text> must be entered via the escape sequence:

GSM Char	Seq.	Seq.(hex)	Note
\	\5C	5C 35 43	(backslash)
“	\22	5C 32 32	(string delimiter)
BSP	\08	5C 30 38	(backspace)
NULL	\00	5C 30 30	(GSM null)

‘0’ (GSM null) may cause problems for application layer software when reading string lengths.

AT+CPIN

Description: ENTER PIN

Stores a password which is necessary before it can be operated (SIM PIN, SIM PUK, PH?SIM PIN, etc.). If the PIN is to be entered twice, the TA shall automatically repeat the PIN. If no PIN request is pending, no action is taken and an error message, +CME ERROR, is returned to TE. If the PIN required is SIM PUK or SIM PUK2, the second pin is required. This second pin, <newpin>, is used to replace the old pin in the SIM.

Syntax: **AT+CPIN=<pin>[, <new pin>]**

Parameters:

<pin>	string type; password
<new pin>	string type; If the PIN required is SIM PUK or SIM PUK2: new password

Response: **+CPIN: <code> OK**

READY	no further entry needed
SIM PIN	ME is waiting for SIM PIN
SIM PUK	ME is waiting for SIM PUK
PH_SIM PIN	ME is waiting for phone to SIM card (antitheft)
PH_SIM PUK	ME is waiting for SIM PUK (antitheft)
SIM PIN2	PIN2, e.g. for editing the FDN book possible only if preceding command was acknowledged with +CME ERROR:17

SIM PUK2	possible only if preceding command was acknowledged with error +CME ERROR:18.

Example:

	Input	Response
Query	**AT+CPIN?**	**<code> OK**
Test	**AT+CPIN=?**	**OK**

AT+CPMS

Description: PREFERRED SMS MESSAGE STORAGE

Selects memory storages <mem1>, <mem2> and <mem3> to be used for reading, writing.

Syntax: **AT+CPMS = <mem1>[,<mem2>[,<mem3>]]**

Parameters:

<mem1>	Messages to be read and deleted from this memory storage "SM" SIM message storage
<mem2>	Messages will be written and sent to this memory storage "SM" SIM message storage
<mem3>	Received messages will be placed in this memory storage if routing to PC is not set "+CNMI") "SM" SIM message storage
<usedx>	Number of messages currently in <memx>
<totalx>	Number of messages storable in <memx>

Response: **+CPMS: <used1>,<total1>,<used2>,<total2>,<used3>,<total3> OK**

Example:

	Input	Response
Test:	**AT+CPMS=?**	list of supported **<mem1>s OK**
		list of supported **<mem2>s OK**
		list of supported **<mem3>s OK**
Query:	**AT+CPMS=?**	**CPMS:<mem1>,<used1>,<total1>,<mem2>,<used2>,<total2>,<mem3>,<used3>,<total3>OK**

AT+CPOL

Description: PREFERRED OPERATOR LIST

This command is used to edit the SIM preferred list of networks. Execute command writes an entry in the SIM list of preferred operators. 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.

Syntax: **AT+CPOL=[<index>][,<format>[,<oper>]]**

Parameters:

<index>	integer type: order number of operator in SIM preferred operator list	
<format>	0	long format alphanumeric <oper>
	1	short format alphanumeric <oper>
	2	numeric <oper><oper>string type:
<format>	indicates whether alphanumeric or numeric format used (see +COPS command)	

Response:

Query **AT+CPOL <index1>,<format>,<oper1>[<CR><LF>+CPOL: <index2>,<format>,<oper2>[...]]+CME ERROR: <err>**

Test **AT+CPOL? (list of supported <index>s),(list of supported <format>s)**

AT+CPUC

Description: PRICE PER UNIT AND CURRENCY TABLE SETTING

This command sets the conversion from minutes of use to the local currency cost.

Syntax: **AT+CPUC=<currency>,<ppu>[,<passwd>]**

Parameters:

<currency>	string type; three-character currency code (e.g. "GBP", "DEM"); character set as specified by command Select TE Character Set +CSCS
<currency>	string type; price per unit; dot is used as a decimal separator (e.g. "2.66")
<passwd>	string type; SIM PIN2

Response: **OK**

Query **AT+CPUC <currency>,<ppu>+CME ERROR: <err>**

Test **AT+CPUC? <err>**

AT+CPWD

Description: PASSWORD CHANGE

Sets a new password for the facility lock function.

Syntax: **AT+CPWD = <fac>, [<oldpwd>], <newpwd>**

Parameters:

<fac>	SC	SIM (lock SIM card) (SIM asks password in ME power-up and when this lock command issued)

AO	BAOC (Barr All Outgoing Calls) (refer GSM02.88[6] clause 1)
OI	BOIC (Barr Outgoing International Calls) (refer GSM02.88[6] clause 1)
OX	BOIC-exHC (Barr Outgoing International Calls except to Home Country) (refer GSM02.88[6] clause 1)
AI	BAIC (Barr All Incoming Calls) (refer GSM02.88[6] clause 2)
IR	BIC-Roam (Barr Incoming Calls when Roaming outside the home country) (refer GSM02.88 [6] clause 2)
AB	All Barring services (refer GSM02.30[19]) (applicable only for <mode>=0)
AG	All outGoing barring services (refer GSM02.30[19]) (applicable only for <mode>=0)
AC	All inComing barring services (refer GSM02.30[19]) (applicable only for <mode>=0)
P2	SIM PIN2<oldpwd> password specified for the facility from the user interface or with command. If an old password has not yet been set, <oldpwd> is not to enter.

<newpwd>	new password
<pwdlength>	integer max. length of password

Response: **+CPWD: (<fac>, <pwdlength>)s OK**

Example:	**Input**	**Response**
Test	**AT+CPWD=?**	**list of supported <fac>s,<pwdlength>s OK**

AT+CR

Description: REPORTING CONTROL

Controls whether or not intermediate result code +CR: <serv> is returned from the TA to the TE at a call set up. If enabled, an intermediate result code is transmitted at the point during connect negotiation at which the TA has determined which speed and quality of service will be used, before any error control or data compression reports are transmitted, and before any final result code (e.g. CONNECT) is transmitted.

Syntax: **AT+CR=<mode>**

Parameters:

0	disable
1	enable

Response: **+CR:<serv>**

ASYNC	asynchronous transparent
SYNC	synchronous transparent
REL ASYNC	asynchronous non-transparent
REL SYNC	synchronous non-transparent

Example:

	Input	**Response**
Query	**AT+CR?**	**<mode> OK**
Test	**AT+CR=?**	**+CR:(0-1) OK**

AT+CRC

Description: RESULT CODES, SET CELLULAR CODES FOR INCOMING CALL INDICATION

Controls whether or not the extended format of incoming call indication is used.

When enabled, an incoming call is indicated to the TE with unsolicited result code +CRING: <type> instead of the normal RING.

ASYNC	asynchronous transparent
SYNC	synchronous transparent
REL ASYNC	asynchronous non-transparent
REL SYNC	synchronous non-transparent
FAX	facsimile
VOICE	voice

Syntax: **AT+CRC=<mode>**

Parameters:

<mode>	0	disable extended format
	1	enable extended format

Response: **OK**

Example:	**Input**	**Response**
Query	**AT+CRC?**	**129 OK**
Test	**AT+CRC=?**	**129,145 OK**

AT+CREG

Description: REGISTRATION INDICATION

Returns the status of result code presentation and an integer <stat> which shows whether the network has currently indicated the registration of the ME. Location information elements <lac> and <ci> are returned only when <n>=2 and ME is registered in the network.

Syntax: **AT+CREG=[<n>]**

Parameters:

<n>	0	disable network registration unsolicited result code
	1	enable network registration unsolicited result code +CREG: <stat>
<stat>	0	not registered, ME is not currently searching a new operator to register to
	1	registered, home network
	2	not registered, but ME is currently searching a new operator to register to
	3	registration denied
	4	unknown
	5	registered, roaming

Response: **+CREG: <n>,<stat> OK**

Example:	**Input**	**Response**
Query	**AT+CREG?**	**<n>,<stat> OK**
Test	**AT+CREG=?**	**list of supported <n>s OK**

AT+CRES

Description: RESTORE MESSAGE SERVICE SETTINGS

This command restores SMS settings for +CMGF, +CNMI, +CSDH from non-volatile memory to active memory.

Syntax: **AT+CRES[=<profile>]<CR>**

Parameters:

<profile>	manufacturer specific profile number where settings are to be stored

Response:

Test	**AT+CRESAS=?<CR>**	**list of supported <profile>s OK**

AT+CRLP

Description: RADIO LINK PROTOCOL SELECT

Sets radio link protocol (RLP) parameters used when non-transparent data calls are setup, returns values supported. RLP versions 0 and 1 share the same parameter set. TA returns only one line for this set (where <verx> is not present).

Syntax: **AT+CRLP=[<iws>[,<mws>[,<T1>[,<N2>[,<ver>[,<T4>]]]]]]**

Parameters:

<iws>	0 6l 255	Interworking window size (IWF to MS)
<mws>	0 6l 255	Mobile window cesiums to IWF)
<T1>	0 48 255	acknowledgment timer T1 in 10 ms units)
<N2>	0 6 255	retransmission attempts N2
<verx>	0-1	RLP version number in integer format; when version indication is not present it shall equal 0. Versions 0 and 1 share the same parameter set.
<T4>	0-3-255	Re-sequencing period in integer format, in units of 10 ms. This is NOT used for RLP versions 0 and 1.

Response: **+CRLP: <iws>,<mws>,<T1>,<N2>,<ver1>,<T4>**

Example:	**Input**	**Response**
Query	**AT+CRLP?**	**returns current settings for RLP version. RLP versions 0 and 1 share the same parameter set. TA returns only one line for this set (where <verx> is not present)**
Test	**AT+CRLP=?**	**list of possible settings. OK**

AT+CRSL

Description: RINGER SOUND LEVEL

This command sets the ring volume for a phone or voice device.

Syntax: **AT+CRSL=<level>**

Parameters:

<level> integer type value with manufacturer specific range (smallest value represents the lowest sound level)

Response:

Query **+CRSL: <level>+CME ERROR: <err>**

Test **+CRSL: (list of supported <level>s)+CME ERROR: <err>**

AT+CSAS

Description: RESTORE MESSAGE SERVICE SETTINGS

Restores SMS settings for +CMGF, +CNMI, +CSDH from non-volatile memory to active memory.

Syntax: **AT+CSAS[=<profile>]**

Parameters: **<profile>manufacturer specific profile number where settings are to be stored**

Response: **OK**

Example:	**Input**	**Response**
Test	**AT+CSAS=?**	**list of supported <profile>s OK**

AT+CSCA

Description: SMS SERVICE CENTER ADDRESS

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

This command writes the parameters in the NON-VOLATILE memory.

Syntax: **AT+CSCA = <sca>[,<tosca>]**

Parameters:

<sca> GSM 04.11 RP SC address Address-Value field in string format; BCD numbers (or GSM default alphabet characters) are converted to characters; type of address given by <tosca>

	<tosca>	Service center address format GSM 04.11 RP SC address Type-of-Address octet in integer format default refer <toda>)

Response: **OK**

Example:	**Input**	**Response**
Query	**AT+CSCA?**	**+CSCA:<sca>,<tosca> OK**
Test	**AT+CSCA=?**	**OK**

AT+CSCB

Description: CELL BROADCAST MESSAGE SELECTION

Selects which types of cell broadcast messages that are to be received by the device.

The command writes the parameters in NON-VOLATILE memory.

Syntax: **AT+CSCB=[<mode>[,mids>[,<dcss>]]]**

Parameters:

<mode>	0	message types specified in <mids> and <dcss> are accepted
	1	message types specified in <mids> and <dcss> are not accepted
<mids>		string type; all different possible combinations of CBM message identifiers (refer <mid>) (default is empty string); e.g. "0,1,5,320-478,922".
<dcss>		string type; all different possible combinations of CBM data coding schemes (refer <dcs>) (default is empty string); e.g. "0-3,5".

Response: **+CSCB: <mode>,<mids>,<dcss> OK**

Example:	**Input**	**Response**
Query	**AT+CSCB?**	**+CSCB: <mode>,<mids>,<dcss> OK**
Test	**AT+CSCB=?**	**list of supported <mode>s OK**

AT+CSCS

Description: SELECT CHARACTER SET

Sets which character set <chset> is used by the TE. The TA can then convert character strings correctly between the TE and ME character sets.

Syntax: **AT+CSCS=[<chset>]**

Parameters: **CHSET GSM**

Response: **OK**

Example:	**Input**	**Response**
Query	**AT+CSCS?**	**GSM OK**
Test	**AT+CSCS=?**	**(GSM) OK**

AT+CSDH

Description: SHOW SMS TEXT MODE PARAMETERS

Determines whether detailed header information is shown in text mode result codes.

Syntax: **AT+CSDH=<show>**

Parameters:

<show>	0	do not show header values defined in commands +CSCA and +CSMP (<sca>, <tosca>, <fo>, <vp>, <pid> and <dcs>) nor <length>, <toda> or <tooa> in +CMT, +CMGL, +CMGR result codes in text mode
	1	show the values in result codes

Response: **OK**

Example:	**Input**	**Response**
Query	**AT+CSDH?**	**+CSDH: <show> OK**
Test	**AT+CSDH=?**	**list of supported <show>s OK**

AT+CSIM

Description: GENERIC SIM ACCESS

This command used to send a command to the SIM card/module and return the appropriate response.

Syntax: **AT+CSIM=<length>,<command>**

Parameters:

<length>	integer type: length of characters sent to the TE in <command> or <response> (i.e. twice the number of octets in the raw data)
<command>	hex format: GSM 11.11 SIM command sent from the ME to the SIM

Response: **+CSIM: <command>,<response>**

+CME ERROR: <err>

hex format: GSM 11.11 response from SIM to <command>

AT+CSMINS

Description: SIM REMOVAL/INSERTION ALERT

This command is used to set the method for reporting the transitions of inserting and extracting the SIM from the carrier. It can also be used to determine the current status of the SIM presence.

Syntax: **AT+CSMINS=<n>**

Parameters:

<n> 0 Disable unsolicited result code1Enable unsolicited result code.

Response:

<n> 0 Disable unsolicited result code

1 Enable unsolicited result code

Query: AT+CSMINS?<n>, <inserted>Unsolicited result code:+CSMINS: <inserted>

Test: AT+CSMINS=? <inserted> 0 - SIM change inserted - removed

1 - SIM change removed - inserted

AT+CSMP

Description: SET SMS TEXT MODE PARAMETERS

This command selects values for additional parameters needed when SM is sent to the network or placed in a storage when text mode is selected (+CMGF=1). It is possible to set the validity period starting from when the SM is received by the SMSC (<vp> is in range 0... 255) or define the absolute time of the validity period termination (<vp> is a string).

This command writes the parameters to the NON-VOLATILE memory.

Syntax: **AT+CSMP=[<fo>[<vp>[,pid>[,<dcs>]]]]**

Parameters:

<fo> depending on the command or result code: first octet of GSM 03.40 SMS-DELIVER, SMS-SUBMIT (default 17), SMS-STATUS-REPORT, or SMS-COMMAND (default 2) in integer format

	<vp>	depending on SMS-SUBMIT <fo> setting: GSM 03.40 TP-Validity-Period either in integer format (default 167) or in time-string format (refer <dt>)

Response: **OK**

Example:	**Input**	**Response**
Query	**AT+CSMP?**	**+CSMP: <fo>,<vp> OK**
Test	**AT+CSMP=?**	**+CSMP: list of supported <fo>s and <vp>s OK**

AT+CSMS

Description: SELECT MESSAGE SERVICE

Select the type of SMS service.

Syntax: **AT+CSMS= <service>**

Parameters:

<service>	0	GSM 03.40 and 03.41 (the syntax of SMS AT commands is compatible with GSM 07.05 Phase 2 version 4.7.0; Phase 2+ features which do not require new command syntax may be supported (e.g. correct routing of messages with new Phase 2+ data coding schemes))
	128	SMS PDU mode - TPDU only used for sending/ receiving SMSs.

Response: **+CSMS: <mt>,<mo>,<bm> OK**

Mobile Terminated Messages:

<mt>	0	Type not supported
	1	Type supported

Mobile Originated Messages

<mo>	0	Type not supported
	1	Type supported

Broadcast Type Messages:

<bm>	0	Type not supported
	1	Type supported

Example:	**Input**	**Response**
Query	**AT+CSMS?**	**As above**
Test	**AT+CSMS=?**	**list of supported <services>s OK**

AT+CSQ

Description: SIGNAL QUALITY REPORT

Execution command returns received signal strength indication and channel bit error rate from the modem. Test command returns values supported by the modem.

Syntax: **AT+CSQ<cr>**

Parameters: **None**

Response: **+CSQ: <rssi>,<ber>**

RSSI (in dBm) = (<rssi> X 2) –113 (FOR 0<= <rssi> <=31)

RSSI (in dBm) = -51 (FOR 31<= <rssi> <=98)

(FOR 99<= <rssi>) rssi is not known or not detectable

BER 0...7 as RXQUAL values in the table in GSM 05.08 [20] sub clause 8.2.4

BER 99 not known or not detectable

Example:	**Input**	**Response**
Test	**AT+CSQ=?**	**list of RSSI and BLER OK**

AT+CSSN

Description: SUPPLEMENTARY SERVICE NOTIFICATION

AT+CSTA

Description: SELECT TYPE OF ADDRESS

Selects the type of number for further dialing commands (ATD) according to GSM specifications. The data services software only supports default settings.

Syntax: **AT+CSTA=[<type>]**

Parameters:

Type	129	Type Unknown
	145	Type International

Response: **OK**

Example:	**Input**	**Response**
Test	**AT+CSTA?**	**129 OK**
Query	**AT+CSTA=?**	**(129,145) OK**

AT+CUSD

Description: UNSTRUCTURED SUPPLEMENTARY SERVICE DATA

This command sets the Unstructured response format as well as being used to query the device with regards to the current session status.

Syntax: **AT+CUSD=[<n>[,<str>[,<dcs>]]]**

Parameters:

<n>	0	disable result code presentation in the TA
	1	enable result code presentation in the TA
	2	cancel session<str>string type: USSD string (see GSM 07.07 for use)
<dcs>		integer type: GSM 03.38 Cell Broadcast Data Coding Scheme
<m>	0	no further user action required
	0	further user action required
	1	USSD terminated by network
	2	other local client has responded
	3	operation not supportednetwork time out

Response:

Query: **AT+CUSD?** **<n>+CME ERROR: <err>**

Test: **AT+CUSD=?** **(list of supported <n>s)**

AT+DR

Description: DATA COMPRESSION REPORTING CONTROL

This command defines whether or not the result codes for the V.42bis compression will be returned.

Syntax: **AT+DR=[<n>][?]**

Parameters: **=[0, 1, ?], [?]**

0	disables the compression result code reporting
1	enables the compression result code reporting
?	queries the command and returns its current setting or displays the valid values for the commands parameters

Response: **AT+DR=[<n>], where value is 0 or 1, the command will return the string OK.**

AT+DR?, the command will return the strings:

+DR: <current command value, either 0 or 1>

OK

AT+DR=?, the command will return the strings:

+DR: (0-1)

OK

indicating the valid parameters for this command

If the result code reporting has been turned on, the following strings are returned when the modem establishes a connection:

+DR: NONE data compression is not in use

+DR: V42B Rec. V42bis is in use in both direction

+DR: V42B RD Rec. V42bis is in use in receive direction only

+DR: V42B TD Rec. V42bis is in use in transmit direction only

AT+DS

Description: V.42bis COMPRESSION CONTROL

This command determines if the modem will use V.42bis data compression and what the conditions of its use are after a call has been set up. This command only works for data calls. During GSM connections, data is transmitted transparently. The remote terminal adapter may or may not support this compression. This command must be used in conjunction with AT+CRLP command.

Syntax: **AT+DS[=[<p0>,<n>,<p1>,<p2>]?]] [?]**

Parameters:

<p0> defines the compression direction.

- 0 No compression
- 1 transmit only
- 2 receive only
- 3 both directions, but allow for negotiation. This is the default parameter.

<n> defines the V.42bis negotiation parameters.

- 0 allows negotiation of for compression to take place, if allowed for in p0. This is the default parameter.
- 1 do not allow compression negotiation, even if allowed for in p0. Instead, disconnect if there is a difference.

<p1> defines the size of the dictionary. The valid value range is 512 to 2048. The default value is 512.

<p2> defines the maximum string size. The valid value range is 6 to 255. The default is 20.

? queries the command and returns its current setting or displays the valid values for the commands parameters.

Response: **AT+DS? is typed in, the modem will respond with a list of the commands current settings. For example: +DS: 3,0,512,20 OK.**

AT+DS=? is typed in, the modem will respond with a list of the valid value rages for each of the command parameters. For example: +DS: (0-3),(0-1),(512-1024),(6-64) **OK**.

AT+DS=<p0>,<n>,<p1>,<p2> is typed in, the modem will set each of the parameters to the value defined in each parameter place holder and the command will return the string **OK**.

Example: **AT+DS=1,0,640,50<cr>**

AT+DS=?<cr>

AT+DS?<cr>

AT+FCLASS

Description: FAX CLASS SET OR TEST

Sets a particular mode of operation (data, fax). This causes the TA to process information in a manner suitable for that specific type of device.

Syntax: **AT+FCLASS=<n>**

Parameters:

0 data

1 fax class 1 (TIA-578-A)

Response: **+FCLASS: <n> OK**

Example:	**Input**	**Response**
Test	**AT+FCLASS=?**	**(0,1) OK**
Query:	**AT+FCLASS?**	**(0) OK**

AT+FMI

Description: FAX MANUFACTURER IDENTITY REQUEST

Reports one or more lines of information text permitting the user to identify the manufacturer.

Syntax: **AT+FMI**

Parameters: **None**

Response: **<manufacturer Id> OK**

Example:	Input	Response
Test	**AT+FMI=?**	**OK**
Query	**AT+FMI**	**<manufacturer Id> OK**

AT+FMM

Description: FAX MODEL IDENTITY REQUEST

Reports one or more lines of information text permitting the user to identify the specific model of device.

Syntax: **AT+FMM**

Parameters: **None**

Response: **<model Id> OK**

Example:	Input	Response
Test	**AT+FMM=?**	**OK**
Query	**AT+FMM**	**<model Id> OK**

AT+FMR

Description: FAX VERSION IDENTITY REQUEST

Reports one or more lines of information text which permit the user to identify the version, revision level or data or other information of the device.

Syntax: **AT+FMR**

Parameters: **None**

Response: **<Revision Id> OK**

Example:	Input	Response
Test	**AT+FMR=?**	**OK**
Query	**AT+FMR**	**<Revision**

AT+GCAP

Description: REPORT ADDITIONAL CAPABILITIES

Modem reports a list of additional capabilities.

Syntax: **AT+GCAP: <name>s ,<cr>**

Parameters: **None**

Response: **Not Applicable**

Example: **AT+GCAP<cr>**

AT+GMI

Description: MANUFACTURER IDENTITY

Request for manufacturer identification.

Syntax: **AT+GMI or ATI2**

Parameters: **None**

Response: **<MANUFACTURERS NAME/ID> OK**

AT+GMM

Description: MODEM IDENTITY

Request TA model identification. Unit reports one or more lines of information text which permits the user to identify the specific model of device.

Syntax: **AT+GMM or ATI3**

Parameters: **None**

Response: **<MODEL ID> OK**

Example:	**Input**	**Response**
Test	**AT+GMM=?**	**OK**
Query	**AT+GMM**	**<modem Id> OK**

AT+GMR

Description: REVISION NUMBER / IDENTITY

This command reports the version, revision and date of the software or firmware used in the device. It is also used to identify the software version to facilitate easier tracking and code updates.

Syntax: **AT+GMR or ATI1**

Parameters: **None**

Response: **<REVISION ID> OK**

Example:	**Input**	**Response**
Query	**AT+GMR**	**Software Version OE071-XX OK** **Date: May 17, 2001, Time 10:58:12** **OK**
Test	**AT+GMR=?**	**OK**

AT+GOI

Description: GLOBAL OBJECT IDENTITY

Reports one or more lines of information text which permits the user to identify the device, based on the ISO system for registering unique object identifiers.

Syntax: **AT+GOI**

Parameters: **None**

Response: **NULL ID OK**

<OBJECT ID> OK see X.208, 209 for the format

Example: **AT+GOI=? <OBJECT ID> OK**

AT+GSN

Description: SERIAL NUMBER IDENTITY

Reports the IMEI (international mobile equipment identifier) number in information text which permits the user to identify the individual ME device. The serial number (IMEI) is varied by individual ME device.

Syntax: **AT+GSN**

Parameters: **None**

Response: **<SERIAL NUMBER> OK**

Example:	**Input**	**Response**
Test	**AT+GSN=?**	**OK**
Query	**AT+GSN**	**<serial number> OK**

AT+ICF

Description: INTERFACE CHARACTER FRAMING

This command setting determines the serial interface character framing format and parity received by TA from TE.

Syntax: **AT+ICF=[<format>,[<parity>]]**

Parameters:

<format>	1	8 data 0 parity 2 stop
	2	8 data 1 parity 1 stop
	3	8 data 0 parity 1 stop
	4	7 data 0 parity 2 stop
	5	7 data 1 parity 1 stop
	6	7 data 0 parity 1 stop

<parity>	0	odd
	1	even
	2	mark (1)
	3	space (0)

The parity field is ignored if the format field specifies no parity.

Response: **+ICF: <format>,<parity> OK**

Example:	**Input**	**Response**
Test	**AT+ICF=?**	**+ICF: <format>,<parity> OK**
Query	**AT+ICF?**	**<3,3> OK**

AT+IFC

Description: LOCAL DATA FLOW CONTROL

This setting determines the data flow control on the serial interface for data mode.

Syntax: **AT+IFC=[<dce_by_dte>[,<dte_by_dce>]]**

Parameters:

<dce_by_dte>	specifies the method will be used by TE at receive of data from TA	
	0	None
	1	XON/XOFF, don't pass characters on to data stack
	2	line 133: Ready for Receiving
	3	XON/XOFF, pass characters on to data stack
<dte_by_dce>	specifies the method will be used by TA at receive of data from TE	
	0	None
	1	XON/XOFF
	2	line 106: Clear to send (CTS)

Response: **OK**

Example:	**Input**	**Response**
Test	**AT+IFC=?**	**OK**

AT+ILRR

Description: LOCAL RATE REPORTING

This AT setting determines whether or not an intermediate result code of local rate is reported at connection establishment. The rate is applied after the final result code of the connection is transmitted to TE.

Syntax: **AT+ILRR=<value>**

Parameters:

Value	0	Disables reporting of local port rate
	1	Enables reporting of local port rate

Response: **<value> OK**

Example:	**Input**	**Response**
Test	**AT+ILRR?**	**<value> OK**

AT+IPR

Description: FIXED LOCAL RATE

This parameter setting determines the data rate of the TA on the serial interface. The rate of command takes effect following the issuance of any result code associated with the current command line.

Syntax: **AT+IPR=<rate>**

Parameters:

<rate> port rate setting on call connection in Baud per second

300
1200
2400
4800
9600
19200
28800
38400
57600
115200

Response: **OK**

Example: **AT+IPR=2400<cr>**

Test	**AT+IPR=?**	**<rate list> OK**
Query	**AT+IPR?**	**<rate> OK**

AT+NWOPN

Description: READ OPERATOR NAMES

This command returns the list of operator names, stored in the SIM's ONS field, from the SIM Card.

Syntax: **AT+NWOPN?**

Parameters: **None**

Response: **OK**

Example: **Operator Name: <Operator Name>**

AT+NWRST

Description: RESET MODEM TO POWER-UP STATE

This command resets the modem to its power-up state. The mdoem will be unresponsive for up to 6 seconds during the reset sequence. Any characters sent to the modem during this time will be lost.

AT+NWSIM

Description: CHECK FOR SIM PRESENCE

AT+NWW

Description: WRAPPER STATUS

This command queries the status of the wrapper driver.

Syntax: **AT+NWW<n>**

Parameters:

<status=n>	0	Turns wrapping off
	1	Turns wrapping on
		Wrapper Protocol not supported by this build

Response: **AT+NWW<n> OK**

	Input	**Response**
Query	**AT+NWW?**	**+NWW<n> OK**

AT+VTD

Description: TONE DURATION (VOICE)

This command refers to an integer <n> that defines the length of tones emitted as a result of the AT+VTS command in voice mode. This does not affect the D command.

Syntax: **AT+VTD = <duration>**

Parameters:

<duration>	0	default setting (NO TONE)
	1-255	duration of the tone in 1/10 seconds

Response: **+VTD: <n> OK**

Example:	**Input**	**Response**
Query	**AT+VTD?**	**+VTD: <n> OK**
Test	**AT+VTD=?**	**List of supported <n>s OK**

AT+VTS

Description: DTMF AND TONE GENERATION (VOICE)

This command allows the transmission of DTMF tones and arbitrary tones in voice mode. These tones may be used when announcing the start of a recording period.

Syntax: **AT+VTS=<DTMF-string>**

Parameters:

<dtmf-string> which has a max length of 20 characters, must be entered between double quotes (“ “) and consists of combinations of the following separated by commas:

1. <dtmf> A single ASCII characters in the set 0-9,#,*,A-D. This is interpreted as a sequence of DTMF tones whose duration is set by the +VTD command.
2. {<dtmf>,<duration>} This is interpreted as a DTMF tone whose duration is determined by <duration>.

<duration> duration of the tone in 1/10 seconds range: 1-255

Response: **OK**

Example:	**Input**	**Response**
Test	**AT+VTS=?**	**(List of supported parameters) OK**

CME ERROR Codes for GSM 07.07 Commands

Final result code **+CME ERROR: <err>** indicates an error related to mobile equipment or network, and that the command and any following commands were not executed. As no commands were executed, no result should be expected.

Table 9: CME Error Codes below, lists and defines <err> values used by common messaging commands.

Table 9: CME Error Codes

Code of <err>	Definition
0	phone failure
1	no connection to phone
2	phone-adapter link reserved
3	operation not allowed
4	operation not supported
5	PH-SIM PIN required
6	PH-FSIM PIN required
7	PH-FSIM PUK required
10	SIM not inserted
11	SIM PIN required
12	SIM PUK required
13	SIM failure
14	SIM busy
15	SIM wrong
16	incorrect password
17	SIM PIN2 required
18	SIM PUK2 required
20	memory full
21	invalid index
22	not found
23	memory failure
24	text string too long
25	invalid characters in text string
26	dial string too long
27	invalid characters in dial string
30	no network service

31	network time out
32	network not allowed - emergency calls only
40	network personalization PIN required
41	network personalization PUK required
42	network subset personalization PIN required
43	network subset 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
101...255	Reserved

CMS Error Codes for GSM 07.05 Commands

Final result code **+CMS ERROR: <err>** indicates an error related to mobile equipment or network. The operation is similar to ERROR result code in that none of the commands in the same command line are executed. Neither **ERROR** nor **OK** result code shall be returned.

Table 10: CMS Error Codes below, lists and defines <err> values used by common messaging commands.

Table 10: CMS Error Codes

Code of <err>	Definition
0...127	GSM 04.11 Annex E-2 values, see CME ERROR codes related GSM 07.07
128...255	GSM 03.40 sub clause 9.2.3.22 values
300	ME failure
301	SMS service of ME reserved
302	operation not allowed
303	operation not supported
304	invalid PDU mode parameter
305	invalid text mode parameter
310	SIM not inserted
311	SIM PIN required
312	PH-SIM PIN required
313	SIM failure

314	SIM busy SIM wrong
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 time-out
340	no +CNMA acknowledgment expected
500	unknown error
...511	other values in range 256...511 are reserved
512...	manufacturer specific
513	Unread SM on SIM

Chapter 4: Firmware Setup and Upgrades

Firmware is installed in all modems prior leaving the manufacturing facility. Updates to firmware can be performed by downloading new code into the modem.

Updating Expedite Firmware

To update the Expedite firmware you will require the Expedite Development Kit Interface Board, shown below . The interface board will connect the Expedite module to the host computer.

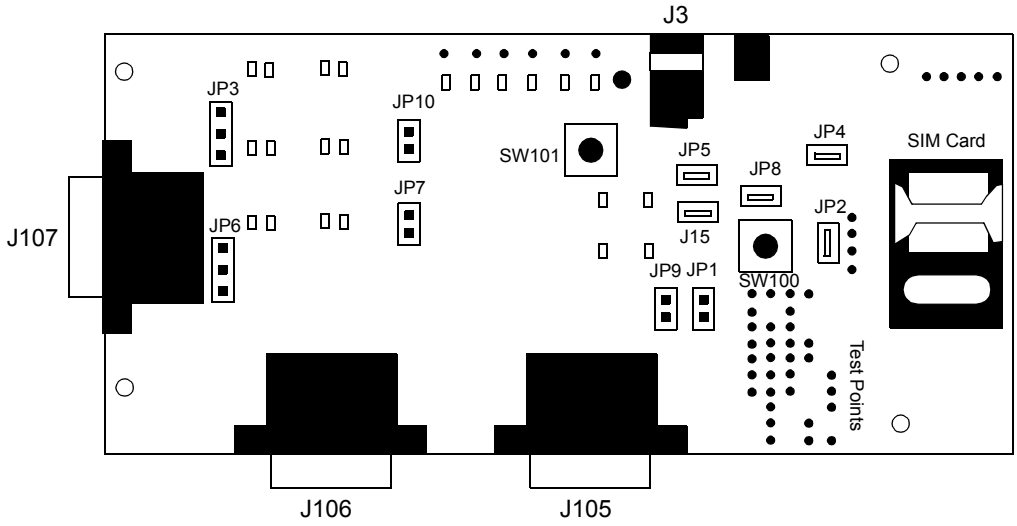


Figure 8: Expedite Development Kit Interface Board

These instructions may change for future product releases.

Topics Included in this Chapter

Updating Expedite Firmware 145
Updating Merlin Firmware 147
Troubleshooting 151

To update Expedite firmware:

1. **Disconnect** the interface board from the power source.
2. **Connect** the serial cable to the Primary Serial Port (J106) on the Expedite interface board.
3. **Connect** the other end of the cable to a port (either 1 or 2, depending on your PC) in your computer.
4. **Start** the Flash.exe program.

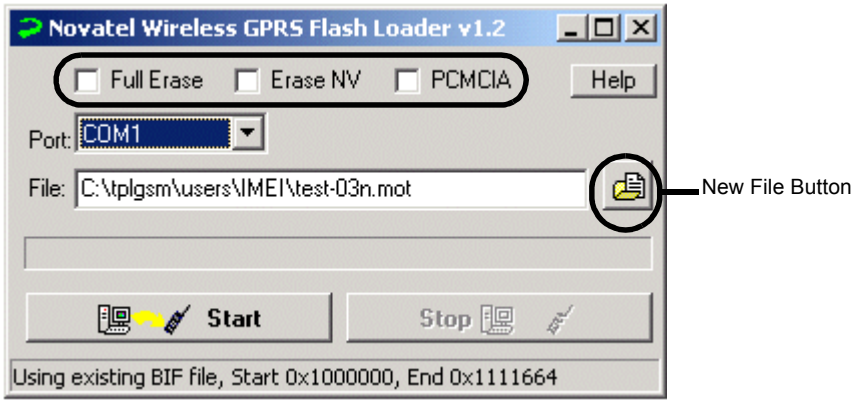


Figure 9: Flash Program

5. **Select** the appropriate Erase option. With no options chosen (recommended), the Flash Loader will do a partial erase.
6. **Navigate** to and **select** the binary Motorola™ (.mot) file to download by pressing the **New File button**.

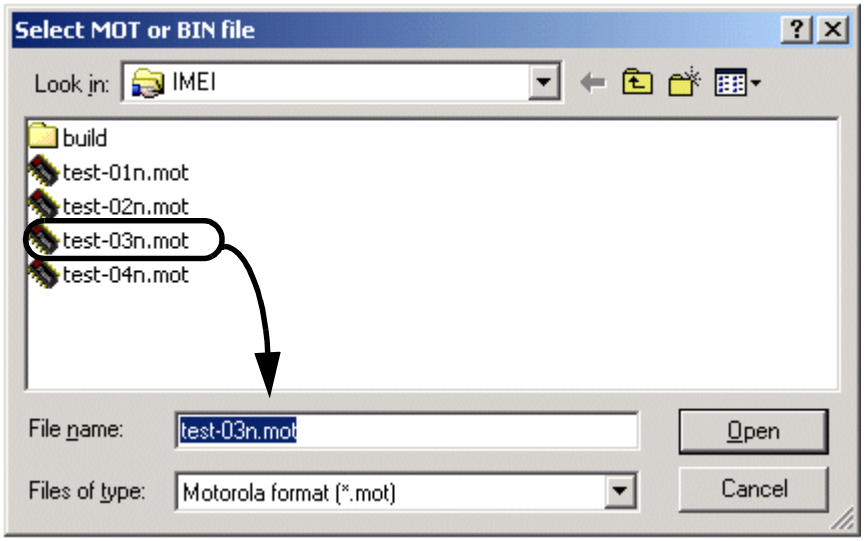


Figure 10: Selecting MOT file

7. The default communications port is COM1; select the correct one if necessary.

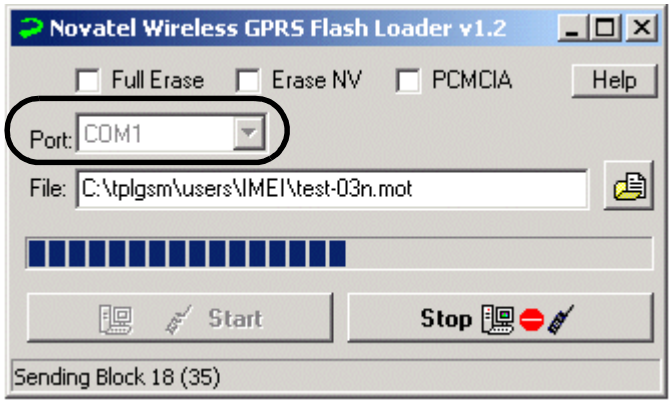


Figure 11: Flash Loader Settings

8. Press **Start**. The message “Power On/Reset Target” will appear in the status bar.

Once you start downloading firmware, you cannot stop the process until the “Download Complete” message is shown on the status bar.

9. **Apply** power to the device. LED’s on interface board will light up.
10. **Disconnect** the power supply when the “Download Complete” message appears in the status bar.
11. **Reconnect** the power again for regular operation.

Updating Merlin Firmware

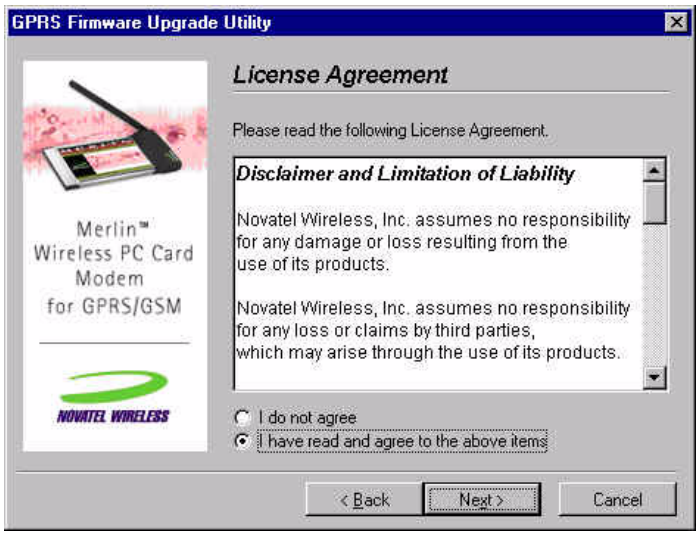
The **GPRS Firmware Upgrade Utility** is used to update Merlin firmware. The utility program and code is delivered as a self-extracting executable file.

To update Merlin firmware:

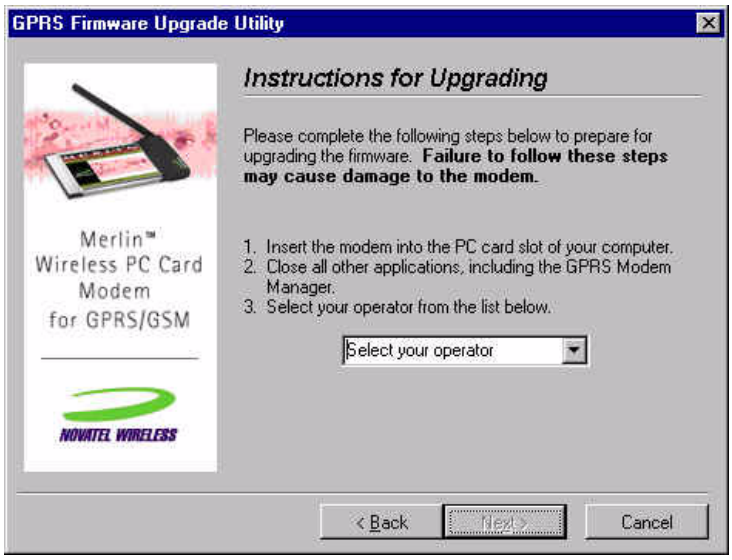
1. Obtain the executable file from your service provider, ensuring that you have the appropriate single band or dual band version. (PN=Single band or North America; PE=Dual band or European.
2. Ensure that you have at least 10 MB of free disk space on your system drive.
3. Close all applications in order to avoid resource conflicts.
4. Run the **Firmware Upgrade Utility** by double-clicking the Desktop icon:

5. After the splash window, the **Welcome** window will be displayed.

6. Read the **Welcome** window and click **Next**.The License agreement will be displayed.



7. Read the **License Agreement**. To continue with the upgrade utility, you must indicate that you have accepted the terms of the agreement by selecting "**I have read and agree to the above items**." Click **Next**. The **Instructions for Upgrading** window will appear.



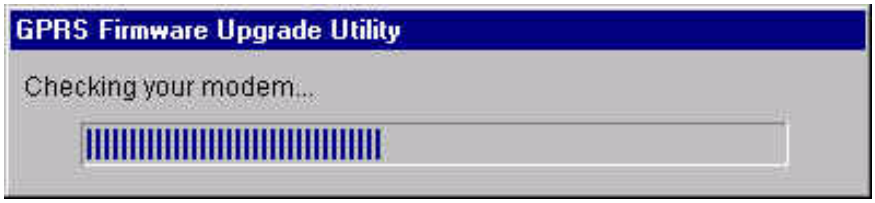
7.1. Insert your modem into the PC Card slot.

7.2. Ensure all other applications are closed.

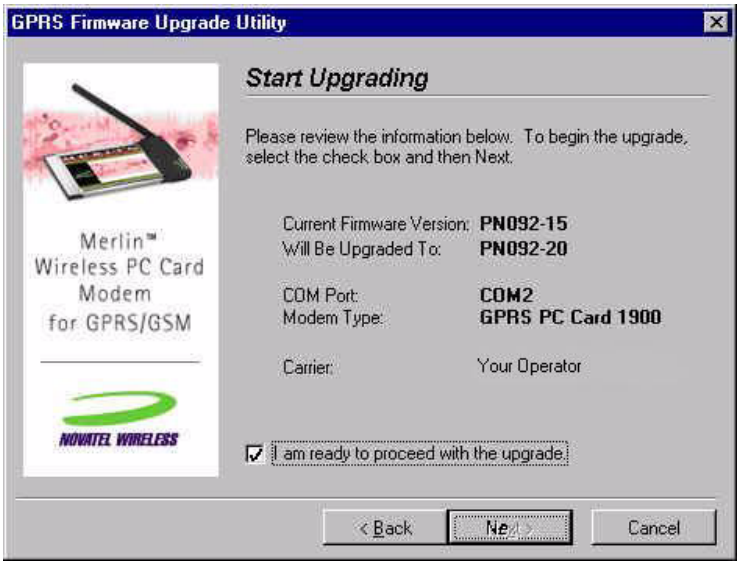
7.3. Select your operator from the drop down menu.

7.4. Click **Next**.

The utility will then locate your modem for the upgrade. The **Checking your modem** window will appear.



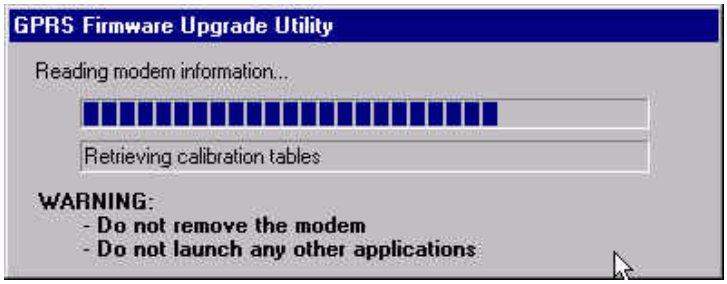
If your modem is located, the **Start Upgrade** window will be displayed.



8. Ensure all information on the window is correct, then select **I am ready to proceed with the upgrade**. and select **Next**.

An **Upgrade Status** window will appear, and the upgrade utility will retrieve your modem information.

NOTE: Do not remove any modem or launch any other applications during the upgrade.

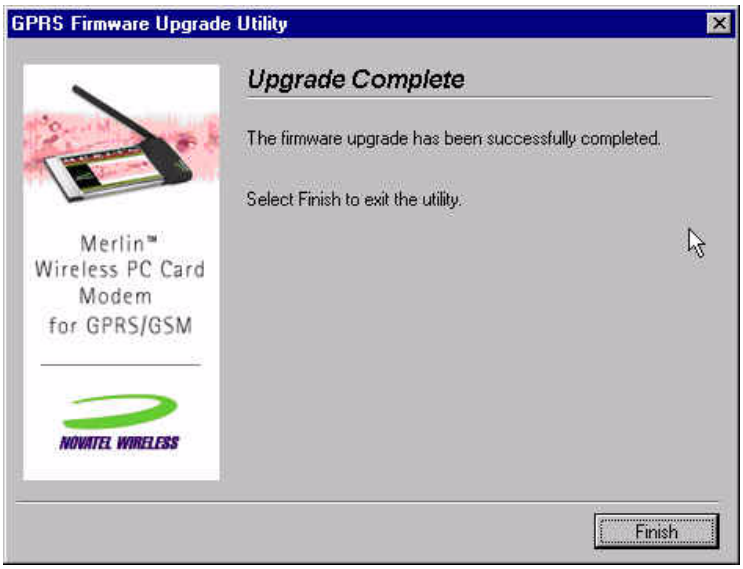


The upgrade consists of 3 phases:

- Phase 1: Reading modem information
- Phase 2: Upgrading firmware
- Phase 3: Writing Modem information

NOTE: The upgrade process may take up to 10 minutes for completion. Please wait for the process to complete even if it appears that the utility has stopped.

Once the upgrade is complete, the **Upgrade Complete** window will appear.



9. Select **Finish** to close the firmware upgrade utility.

NOTE: This utility creates a log file in your Windows temp directory called GPRSFUU.log. Customer support may request this log if there was a problem upgrading your modem's firmware.

Troubleshooting

If there is a problem with the firmware upgrade, a warning window will appear. Follow the steps below to solve the problem indicated by the warning window.

Incorrect Firmware Version

Dual Band Modem with Single Band Firmware

If the warning below appears, the wrong type of modem has been inserted into the PC slot of your computer.

You have inserted a dual band modem that requires a firmware type that starts with "PE." Please locate and install the correct firmware version.

Incorrect Firmware Version

Single Band Modem with Dual Band Firmware

If the warning below appears, the wrong type of modem has been inserted into the PC slot of your computer.

You have inserted a dual band modem that requires a firmware type that starts with “PN.” Please locate and install the correct firmware version.

Firmware Utility Cannot Locate Modem

If the warning below appears, the Firmware Upgrade Utility cannot locate your modem.

Please ensure that the modem is firmly inserted into the PCMCIA slot. If the error message reappears, remove your modem and reinsert it into an adjacent slot.

Older Firmware Version

If the warning below appears, the firmware version that you are about to load is older than the current version of firmware on your modem.

If you have been instructed by your operator to perform the upgrade, click **Yes**. If you have **NOT** been instructed to perform the upgrade, select **No**. This will stop the upgrade process.

Chapter 5: Software Interface

Novatel Wireless™ has designed and developed a protocol which provides facilities to monitor modem status while a data session on the host is active. In a modem environment, modem status is typically accessed through AT commands over the serial port. However, after a data session is activated on the host through the modem, the serial port is deemed “in-use” and direct serial access of AT Commands is not permitted. All data is now encapsulated through the data session protocols.

The following items will be discussed within this chapter:

- wireline modem interface
- wrapper protocol
- pros and cons of the wrapper protocol

Merlin and Expedite

Topics Included in this Chapter

Point-to-Point Protocol Interface 156

Software Architecture 157

Wrapper Protocol Overview 158

Point-to-Point Protocol Interface

A Point-to-Point (PPP) server implementation is supported within the GPRS module. Remote Access Service (RAS) communication over the serial port is supported using the AT commands to enter the PPP session and support PPP negotiation of IP and DNS elements.

PPP negotiation will NOT complete until registration on the network has been completed. In some cases, particularly where dynamic IP addressing is supported by the carrier, this will not occur as it would be impossible to report an IP address until the unit had performed the GPRS “attach request” on the network.

Status Interface

The Expedite and Merlin GPRS modem supports a method to retrieve modem status information using AT commands while the modem is in a data session. This is accomplished by using a unique driver called a Wrapper driver which exposes two serial ports, one for data and the other for status. The Wrapper driver multiplexes or “wraps” the information across the single serial or PCMCIA connection, and the data is then “unwrapped” and routed to the appropriate location in the modem or over the air. This allows status requests to occur in a separate stream to permit either the Novatel Wireless Modem Manager or another user application to communicate with the modem. It is anticipated that this approach will work for the majority of applications.

Software Architecture

Figure 12: Software Architecture below depicts the software interfaces for the Novatel GPRS modem software.

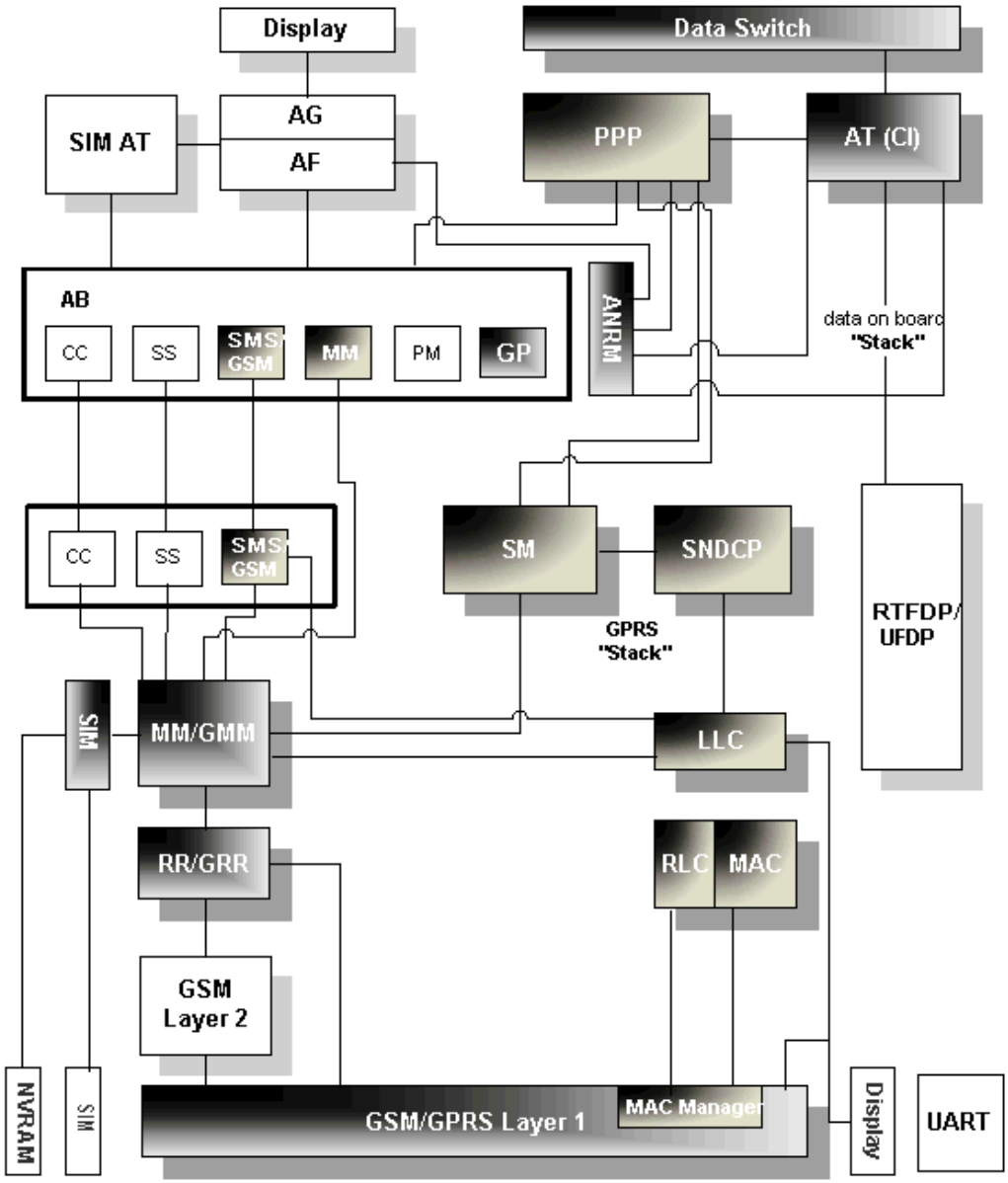


Figure 12: Software Architecture

Wireline Modem Interface

All of the current Merlin based products implement a communication model that emulates a wireline modem interface.

In a traditional modem model, users:

1. select the appropriate modem from the installation list
2. dial a number using that modem to contact their ISP
3. allow the host stack to establish a PPP session with another network entity.

Wrapper Protocol Overview

Novatel Wireless has created a protocol to provide facilities to monitor modem status while a data session on the host is active. In a modem environment, modem status is typically assessed through AT commands over the serial port. However, after a data session is activated on the host through the modem, the serial port is deemed “in-use” and direct serial access of AT commands is not permitted. All data is now encapsulated through the data session protocols. The modem is limited in its processing of the incoming data stream on the serial port to either passing the data along (as in a data session) or processing it internally (as in AT commands).

Appendix A - Expedite Connectors

SMK

Board to Board Connector

PB-5 Series 0.5mm Spacing

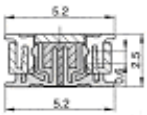
Features

1. A dual-lined board to board connector of a between terminal pitch of 0.5mm.
2. Variety of 7 between PWB dimensions from 2.5mm to 6.0mm available.
3. Use of supporting hardware ensures high degree solder strength.
4. With choices of 20p to 100p,most suitable for high density surface monuting.
5. Compact design yet a sufficient suction area provided.

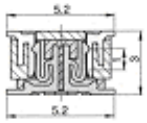
Specifications

1. Rating : 0.5A 50V AC/DC (up to 40Poles)
   0.3A 50V AC/DC (up to 100Poles)
2. Contact Resistance : 30mΩ max.
3. Insulation Resistance : 100MΩ min.at 100V DC
4. Withstanding Voltage : 100V AC for one minute
5. Operating Temperature Range : −25°C to +70°C

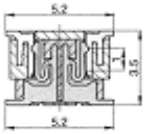
Connection Diagram



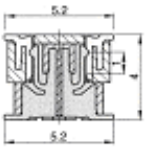
PLUG : CPB72□□-11□□
SOCKET : CPB71□□-01□□



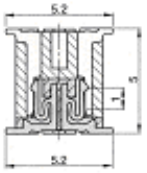
PLUG : CPB72□□-12□□
SOCKET : CPB71□□-02□□



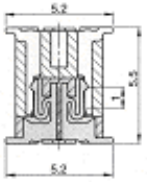
PLUG : CPB72□□-12□□
SOCKET : CPB71□□-04□□



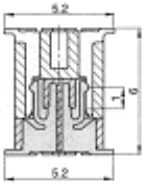
PLUG : CPB72□□-12□□
SOCKET : CPB71□□-03□□



PLUG : CPB72□□-03□□
SOCKET : CPB71□□-02□□



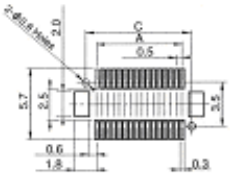
PLUG : CPB72□□-03□□
SOCKET : CPB71□□-04□□



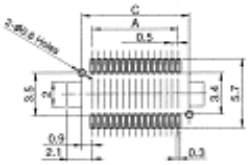
PLUG : CPB72□□-03□□
SOCKET : CPB71□□-03□□

PC Board Diagram

Socket



Plug



SMK

Board to Board Connector PB-5 Series

● Socket CPB 71□□-01⊠⊠ (S Type)
CPB 71□□-02⊠⊠ (M Type)
CPB 71□□-03⊠⊠ (H Type)
CPB 71□□-04⊠⊠ (C Type)

No. of Pins

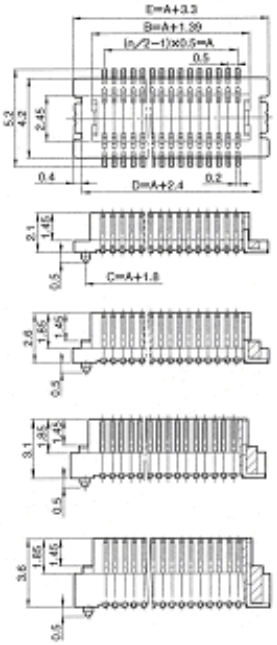
No. of Pins	□□	A	B	C	D	E
20	20	4.5	5.89	6.3	6.9	7.8
30	30	7.0	8.39	8.8	9.4	10.3
40	40	9.5	10.89	11.3	11.9	12.8
50	50	12.0	13.39	13.8	14.4	15.3
60	60	14.5	15.89	16.3	16.9	17.8
70	70	17.0	18.39	18.8	19.4	20.3
80	80	19.5	20.89	21.3	21.9	22.8
100	91	24.5	25.89	26.3	26.9	27.8

Boss Pitch

■ Material and Plating
- Housing : Liquid Crystal Polymer (Natural Color) 94V-0
- Contact : Phosphor Bronze
  Tin-lead Plating (20~60Poles)
  Gold Plating (70~100Poles)
- Frame : Phosphor Bronze Tin-lead Plating

■ Variation

⊠⊠	Reinforce Metal	Boss
00	Without	Without
01	Without	With
10	With	Without
11	With	With



● Plug CPB 72□□-11⊠⊠ (S Type)
CPB 72□□-12⊠⊠ (M Type)
CPB 72□□-03⊠⊠ (H Type)

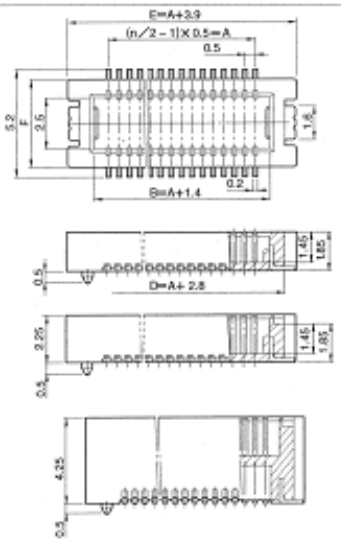
No. of Pins

No. of Pins	□□	A	B	C	D	E
20	20	4.5	5.9	6.3	7.3	8.4
30	30	7.0	8.4	8.8	9.8	10.9
40	40	9.5	10.9	11.3	12.3	13.4
50	50	12.0	13.4	13.8	14.8	15.9
60	60	14.5	15.9	16.3	17.3	18.4
70	70	17.0	18.4	18.8	19.8	20.9
80	80	19.5	20.9	21.3	22.3	23.4
100	91	24.5	25.9	26.3	27.3	28.4

Type	F
S, M	4.8
H	4.2

Boss Pitch

■ Material and Plating
- Housing : Polyamide (Natural Color) 94V-0
- Contact : Phosphor Bronze
  Tin-lead Plating (20~60Poles)
  Gold Plating (70~100Poles)
- Frame : Phosphor Bronze Tin-lead Plating

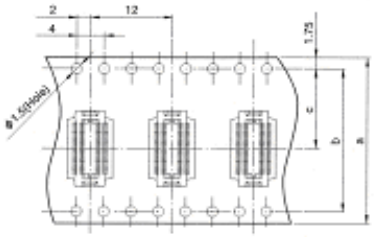


SMK

Board to Board Connector PB-5 Series

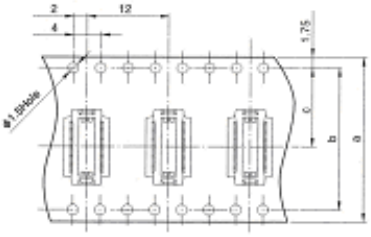
Dimensions of Reels and Tapes (JIS Standard)

● Socket



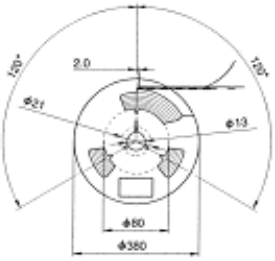
No. of Pins	□□	a	b	c
20	20	16.0		7.5
30	30	24.0		11.5
40	40			
50	50			
60	60	32.0	28.4	14.2
70	70			
80	80	44.0	40.4	20.2
100	91			

● Plug

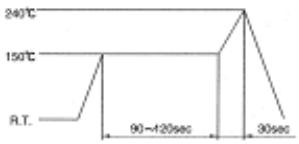


No. of Pins	□□	a	b	c
20	20	16.0		7.5
30	30	24.0		11.5
40	40			
50	50			
60	60	32.0	28.4	14.2
70	70			
80	80	44.0	40.4	20.2
100	91			

■ Reel Dimensions
1000pcs/reel



■ Reflow Soldering Conditions



180℃min. : 45sec max., 200℃ min. : 30sec max.
240℃ : 5sec max.

MMCX - 50 Ohm Connectors

JOHNSON Components®

Specifications

INCHES (MILLIMETERS)
CUSTOMER DRAWINGS AVAILABLE UPON REQUEST

ELECTRICAL RATINGS

Impedance: 50 ohms

Frequency Range: Connectors ..... 0-6 GHz
Dummy loads ..... 0-1 GHz

VSWR: (f = GHz)

	Straight Cabled Connectors	Right Angle Cabled Connectors
.047 dia flexible	1.20	1.14 + .07f
RG 178, RG 316, RG 316DS	1.20	1.25
.086 semi-rigid	1.15	1.15
Uncabled receptacles, dummy loads	N/A	

Working Voltage: Connectors ..... 170 Vrms at sea level†
Dummy loads ..... N/A

Dielectric Withstanding Voltage: Connectors...500 Vrms at sea level†
Dummy loads ..... N/A

Insulation Resistance: 1000 megohms min

Contact Resistance: (milliohms maximum)

	Initial	After Environmental
Center contact (straight cabled connectors and uncabled receptacles)	5.0	8.0
Center contact (right angle cabled connectors)	5.0	15.0
Outer contact (all connectors)	1.0	1.5
Braid to body	1.5	N/A

Corona Level: Connectors ..... 190 volts min at 70,000 feet†
Dummy loads ..... N/A

Insertion Loss: (dB max tested at 1 GHz)
Straight cabled connectors 0.1
Right angle cabled connectors 0.2
Uncabled receptacles, dummy loads ..... N/A

RF Leakage: (dB minimum, tested at 2.5 GHz)
Flexible cable connectors ..... -60 dB
.086 semi-rigid ..... -70 dB
Dummy loads ..... N/A

RF High Potential Withstanding Voltage: (400 Vrms at 4 and 7 MHz)†

Power Rating (Dummy Load): - 0.5 watt @ +25°C, derated to 0.25 watt @ +125° C

MECHANICAL RATINGS

Engagement Design: Series MMCX

Engagement/Disengagement Force: 8 lbs. max engagement
1.4 lbs. min disengagement

Contact Retention: 2.0 lbs. minimum axial force

Cable Retention:

	Axial Force* (pounds)	Torque (in-oz)
Connectors for .047 flexible	3.5	N/A
Connectors for RG 178	7.0	N/A
Connectors for RG 316	20.0	N/A
Connectors for RG 316DS	25.0	N/A
Connectors for .086 semi-rigid	30.0	16

*Or cable breaking strength whichever is less.

Durability: ..... 500 cycles minimum

ENVIRONMENTAL RATINGS (Meets or exceed the applicable paragraph of MIL-C-39012)

Operating Temperature: Connectors ..... - 65°C to + 165°C
Dummy loads ..... - 65°C to + 125°C

Thermal Shock: Connectors: MIL-STD-202, Method 107, Condition C, except -55°C to + 155°C (N/A dummy loads)

Corrosion: MIL-STD-202, Method 101, Condition B (N/A dummy loads)

Shock: MIL-STD-202, Method 213, Condition B (N/A dummy loads)

Vibration: MIL-STD-202, Method 204, Condition D (N/A dummy loads)

Moisture Resistance: MIL-STD-202, Method 106 (N/A dummy loads)

MATERIAL SPECIFICATIONS

Bodies: Brass per QQ-B-626, gold plated* per MIL-G-45204 .00001" min.

Contacts: Beryllium copper per QQ-C-530, gold plated* per MIL-G-45204 .00003" min.

Interface Spring: Beryllium copper per QQ-C-530, gold plated* per MIL-G-45204 .00003" min.

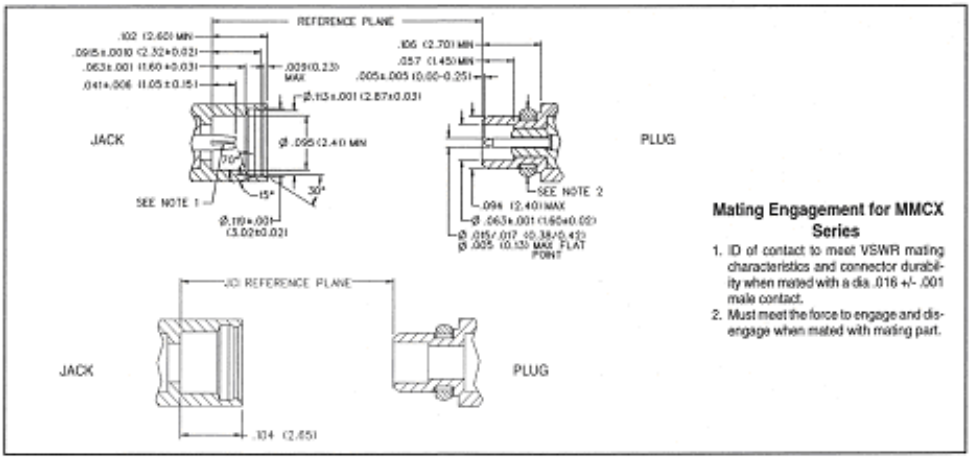
Insulators: PTFE fluorocarbon per ASTM D 1710 and ASTM D 1457

Crimp Sleeves: Copper per WW-T-799 or brass per QQ-B-626, gold plated per MIL-G-45204 .00001" min.

Mounting Hardware: Brass per QQ-B-626 or QQ-B-613, gold plated per MIL-G-45204 .00001" min.

†Avoid user injury due to misapplication. See safety advisory definitions on page 2.

*All gold plated parts include a .00005" min nickel barrier layer.



Mating Engagement for MMCX Series

1. ID of contact to meet VSWR mating characteristics and connector durability when mated with a dia .016 +/- .001 male contact.
2. Must meet the force to engage and disengage when mated with mating part.

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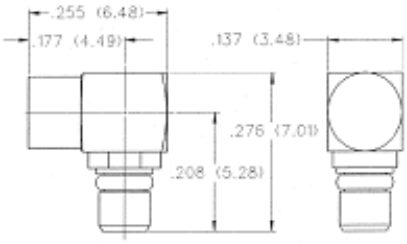
INCHES (MILLIMETERS)
CUSTOMER DRAWINGS AVAILABLE UPON REQUEST

MMCX - 50 Ohm Connectors

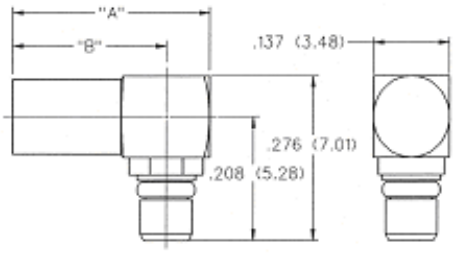
For Semi-Rigid and Flexible Cable

Right Angle Solder Type Plug - Captivated Contact



CABLE TYPE	PART NUMBER
.086 Semi-rigid	135-3693-101

Right Angle Crimp Type Plug - Captivated Contact



CABLE TYPE	PART NUMBER	"A"	"B"	TERMINATION
.047" Diameter Flexible Huber K01152-07 Axon P512479A Astrolab 3201B DS	135-3436-101	.354 (8.99)	.276 (6.98)	Crimp Insert
RG 178/U, 196	135-3402-101	.354 (8.99)	.276 (6.98)	Crimp Insert
RG 316/U, 188, 187 179, 161, 174	135-3403-101	.412 (10.46)	.334(8.48)	Crimp Sleeve
RG 316 DS, RG 188DS	135-3404-101	.412 (10.46)	.334 8.48)	Crimp Sleeve

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MMCX - 50 Ohm Connectors

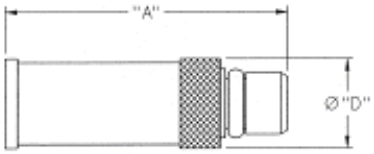
For Flexible Cable

JOHNSON Components®

INCHES (MILLIMETERS)
CUSTOMER DRAWINGS AVAILABLE UPON REQUEST

Straight Crimp Type Plug

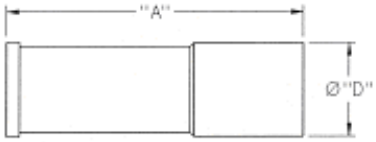
Solder or Crimp Captivated Contact



CABLE TYPE	PART NUMBER	"A"	"D"	TERMINATION
.047" Diameter Flexible Huber K01152-07 Axon P512479A Astrolab 32018 DS	135-3436-001	.462 (11.73)	.137 (3.48)	Crimp Insert
RG 178/U, 196	135-3402-001	.462 (11.73)	.137 (3.48)	Crimp Insert
RG 316/U, 188, 161, 174	135-3403-001	.509 (12.93)	.173 (4.39)	Crimp Sleeve
RG 316 DS, 188 DS, 187 DS	135-3404-001	.509 (12.93)	.173 (4.39)	Crimp Sleeve
RG 179/U, 187	135-3433-001	.509 (12.93)	.173 (4.39)	Crimp Sleeve

Straight Crimp Type Jack

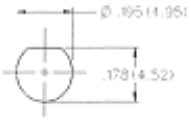
Solder or Crimp Captivated Contact

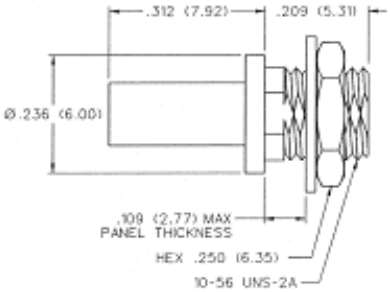


CABLE TYPE	PART NUMBER	"A"	"D"	TERMINATION
.047" Diameter Flexible Huber K01152-07 Axon P512479A Astrolab 32018 DS	135-3336-001	.462 (11.73)	.137 (3.48)	Crimp Insert
RG 178/U, 196	135-3302-001	.462 (11.73)	.137 (3.48)	Crimp Insert
RG 316/U, 188,161, 174	135-3303-001	.545 (13.84)	.173 (4.39)	Crimp Sleeve
RG 316 DS, 188 DS, 187 DS	135-3304-001	.545 (13.84)	.173 (4.39)	Crimp Sleeve
RG 179/U, 187	135-3333-001	.545 (13.84)	.173 (4.39)	Crimp Sleeve

Straight Crimp Type Bulkhead Jack

Solder or Crimp Captivated Contact





CABLE TYPE	PART NUMBER	TERMINATION
.047" Diameter Flexible Huber K01152-07 Axon P512479A Astrolab 32018 DS	135-3336-401	Crimp Insert
RG 178/U, 196	135-3302-401	Crimp Insert

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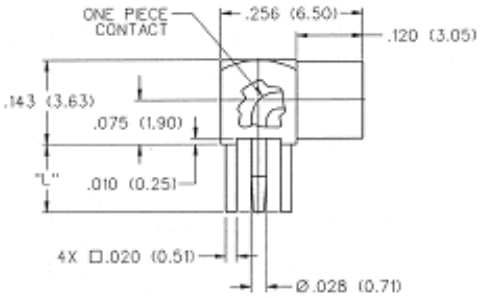
MMCX - 50 Ohm Connectors

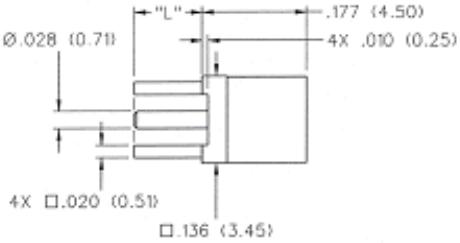
PC Mount

Right Angle Jack Receptacle



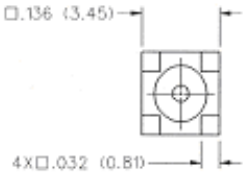
"L"	PART NUMBER
.115 (2.92)	135-3701-301
.068 (1.73)	135-3701-311

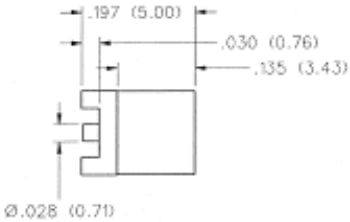
Straight Mount Jack Receptacle

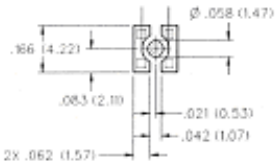


"L"	PART NUMBER
.115 (2.92)	135-3701-201
.068 (1.73)	135-3701-211

Straight Jack Receptacle - Surface Mount







PART NUMBER	PACKAGING
135-3711-201	Stock
135-3711-202	Tape and Reel 1500 pcs/reel

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MMCX - 50 Ohm Connectors

PC Mount and Termination

JOHNSON Components®

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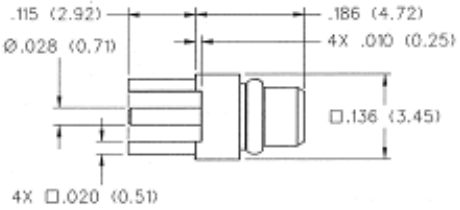
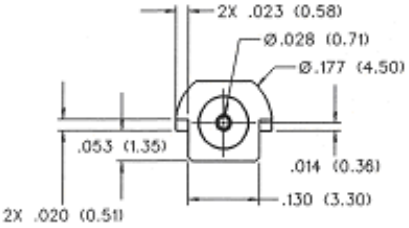
CUSTOMER DRAWINGS AVAILABLE UPON REQUEST

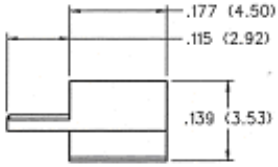
Straight Plug Receptacle

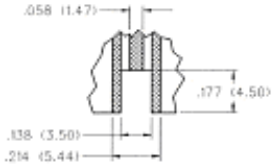


PART NUMBER
135-3801-201

End Launch Jack Receptacle - Surface Mount





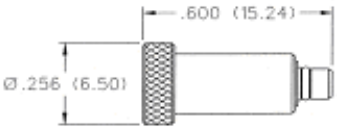


PART NUMBER	PACKAGING
135-3711-801	Stock
135-3711-802	Tape and Reel 1000pcs/reel

Recommended Land Pattern and Board Notch figure 14 page 175.

Plug Dummy Load

NEW



FREQ. RANGE	PART NUMBER	PLATING	RESISTANCE
0-1 GHZ	135-3801-811	Gold	50 Ohms

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Appendix B - Merlin Connectors

Merlin G100 Connectors

Figure 13: G100 68 Pin Connector

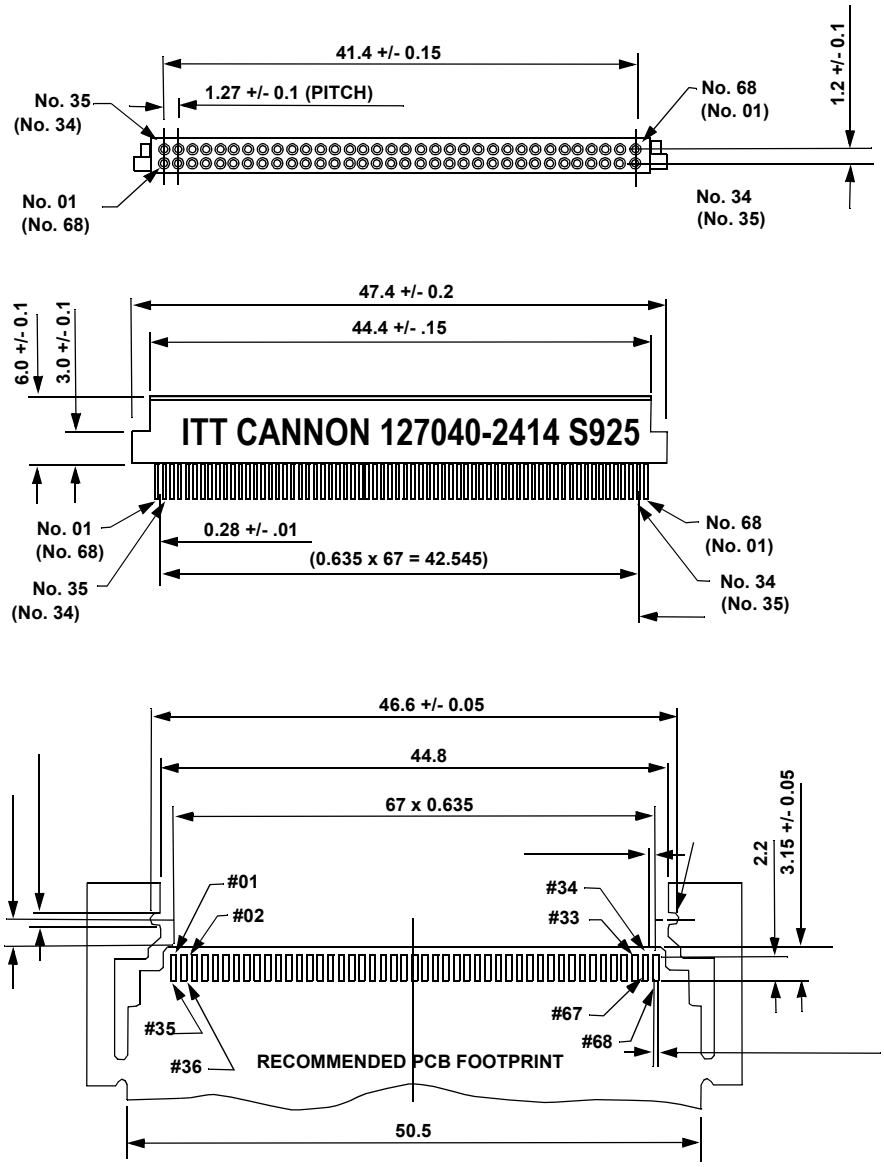


Figure 14: G100 Radiall RF Connector

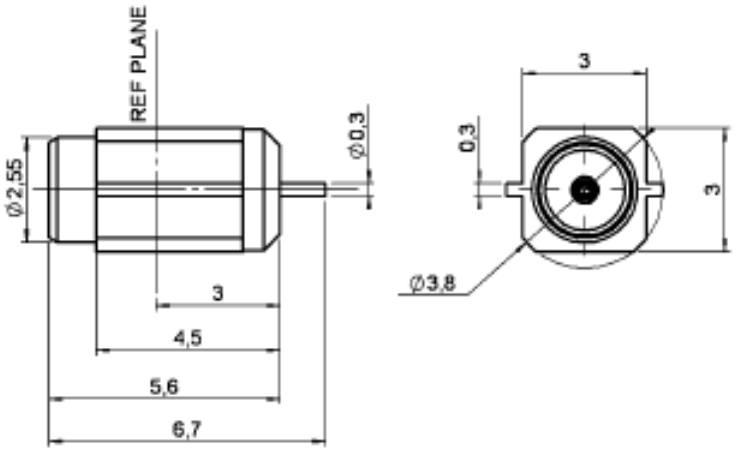
TECHNICAL DATA SHEET 1 / 6

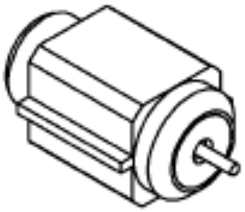
EDGE-CARD RECEPTACLES REEL OF 1800

-

R199.005.801

Series : **MC-CARD**





Scale 1/1

All dimensions are in mm.

COMPONENTS	MATERIALS	PLATINGS (µm)
BODY	BRASS	GOLD 0.2 OVER NICKEL 2
CENTER CONTACT	BERYLLIUM COPPER	GOLD 0.8 OVER NICKEL 2
OUTER CONTACT	-	-
INSULATOR	PTFE	
GASKET	-	
OTHERS PARTS	-	-
-	-	-
-	-	-

Issue : 0147 E

In the effort to improve our products, we reserve the right to make changes judged to be necessary.

RADIALL

TECHNICAL DATA SHEET 2 / 6

EDGE-CARD RECEPTACLES REEL OF 1800

-

R199.005.801

Series : **MC-CARD**

PACKAGING

Standard	Unit	Other
1800	**'W' option**	**Contact us**

ELECTRICAL CHARACTERISTICS

Impedance		**50**	Ω
Frequency		**0-8**	GHz
VSWR	**1.15** +	**0.015**	x F(GHz) Maxi
Insertion loss		**.07**	√(F(GHz) dB Maxi
RF leakage	- (	-	- F(GHz)) dB Maxi
Voltage rating		**170**	Veff Maxi
Dielectric withstanding voltage		**500**	Veff mini
Insulation resistance		**5000**	MΩ mini

MECHANICAL CHARACTERISTICS

Center contact retention		
Axial force – Mating end	**10**	N mini
Axial force – Opposite end	**10**	N mini
Torque	**NA**	N.cm mini
Recommended torque		
Mating	**NA**	N.cm
Panel nut	**NA**	N.cm
Mating life	**5000**	Cycles mini
Weight	**0.270**	g

SPECIFICATION

ENVIRONMENTAL

Operating temperature	**-65/+165**	° C
Hermetic seal	**NA**	Atm.cm3/s
Panel leakage	**NA**	

OTHERS CHARACTERISTICS

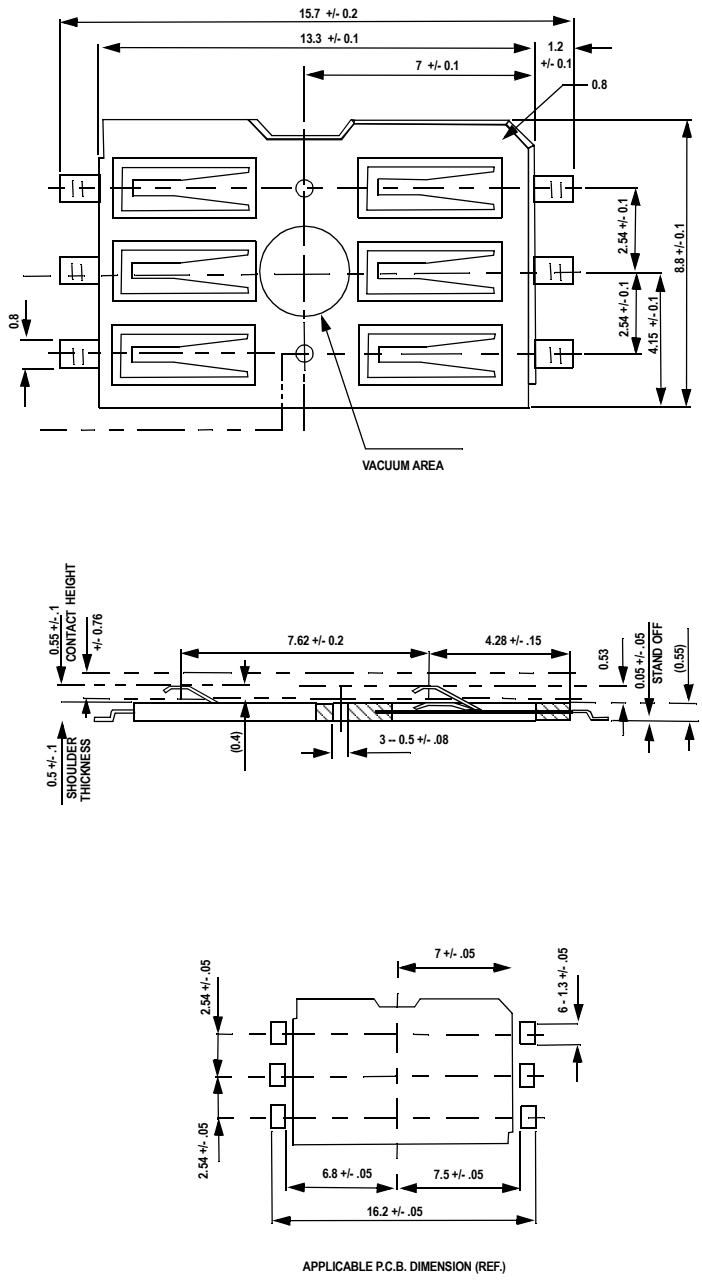
Assembly instruction

Others :
-

Issue : 0147 E
In the effort to improve our products, we reserve the right to make changes judged to be necessary.

RADIALL

Figure 15: G100 SIM Connector



Merlin G200 Connectors

Figure 16: G200 68 Pin Connector

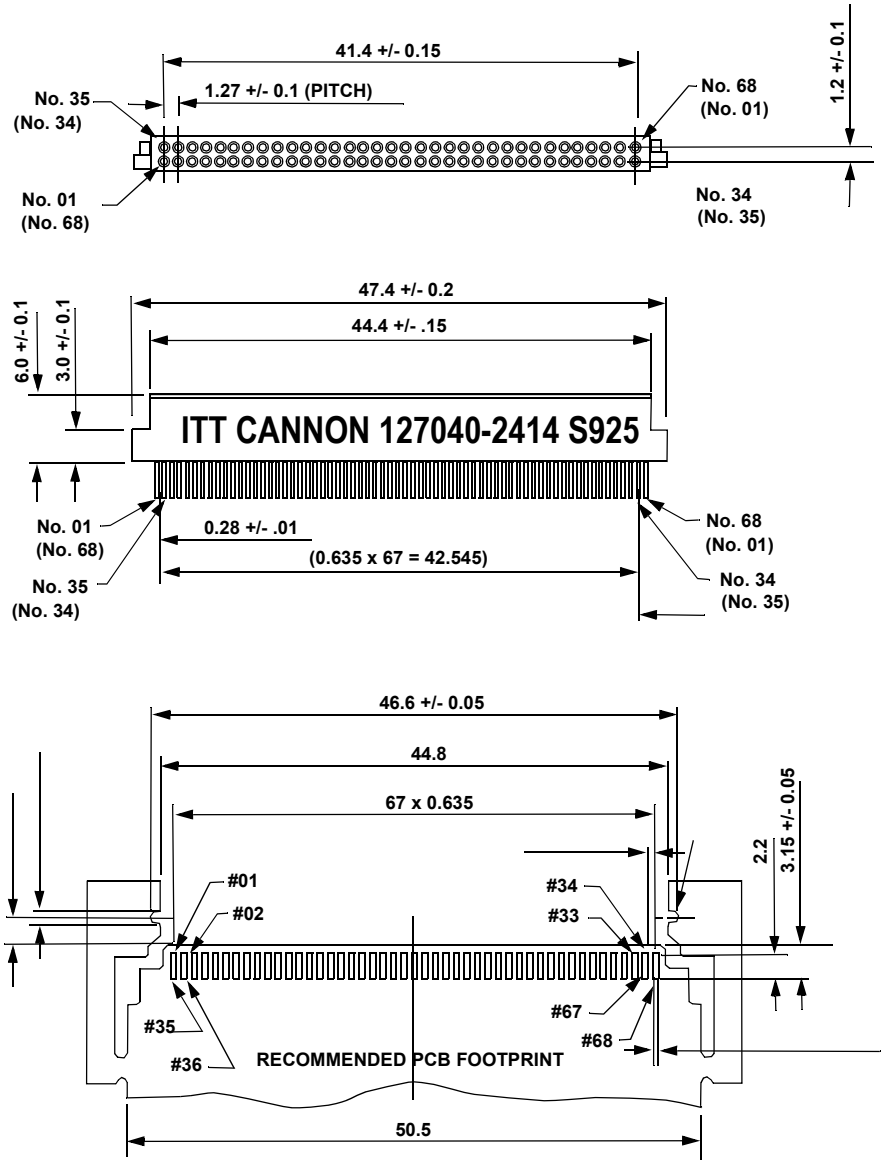


Figure 17: G200 Audio Jack

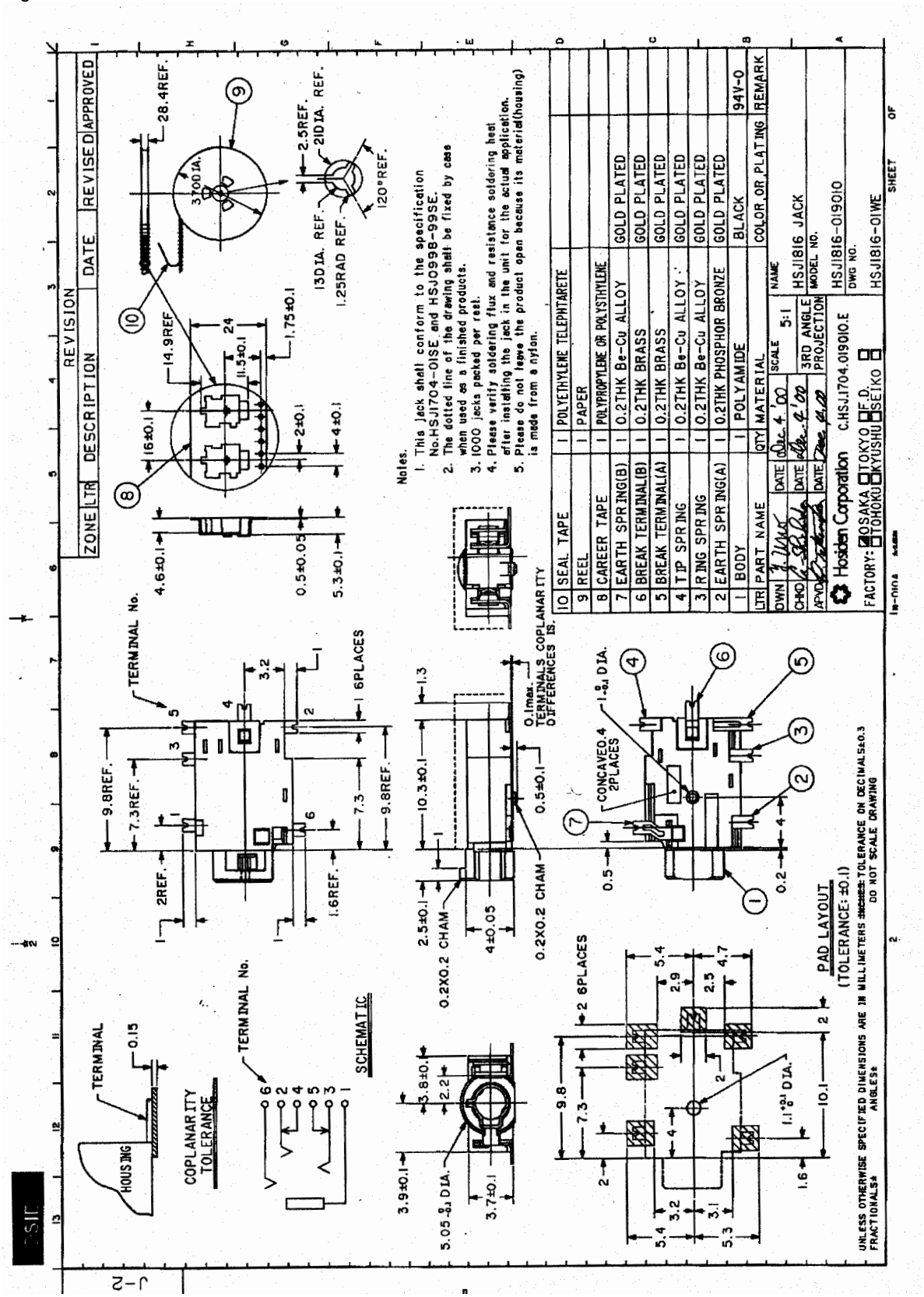


Figure 18: G200 RF Connector

SUHNER® COAXIAL CONNECTOR DATA SHEET

TYPE 82 MMCX-S50-0-2

Description
Straight PCB jack

General Information

Interface according to:	SUHNER® MMCX
Weight:	0.7 g / *0.02 oz*

Electrical Data

Impedance:	50 Ω
Frequency range for connector interface:	DC ... 6.0 GHz

Material Data	Material	Surface Plating
Centre contact:	Copper-Beryllium	Gold / nickel underplated
Outer contact:	Brass	Gold / nickel underplated
Body:	Brass	Gold / nickel underplated
Insulator:	PTFE / PFA	
Coupling nut:	-	
Fastening nut:	-	
Gasket:	-	
Washer:	-	

Packaging Tape and Reel

Attachments

Outline drawing No.:	21471
Assembly instruction:	

Notes
-
Order as82 MMCX-S50-0-2/111 KG under Article No22649679

WAIVER!
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Uncontrolled copy page 1 of 1

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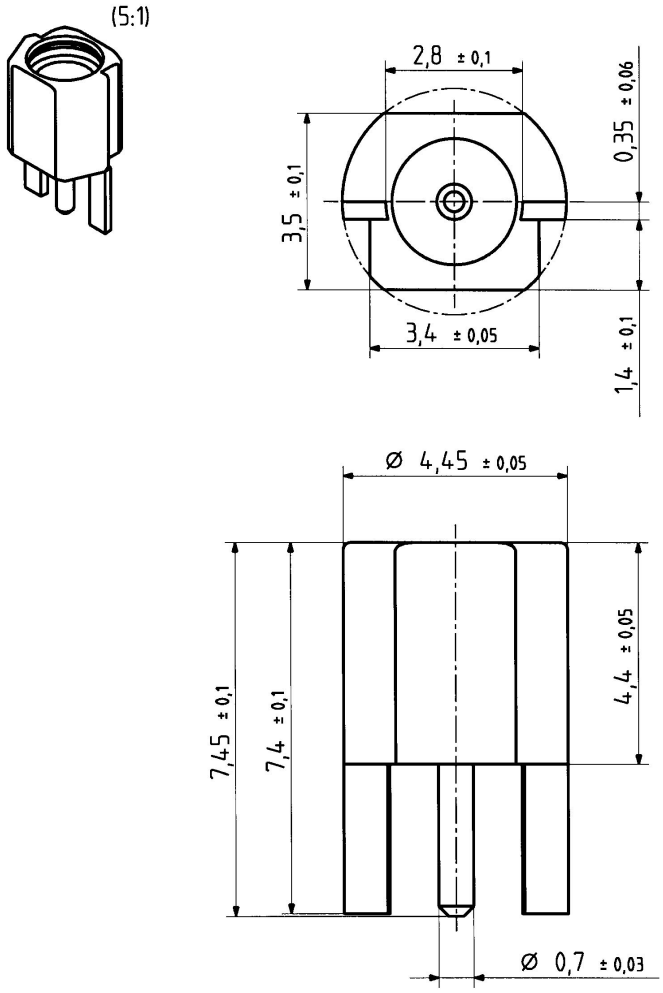
82 MMCX S50 - 0 - 2

	Datum	Kurzz./Visum
Erstellt	05.11.96	726/SMA
Geprueft	5.11.96	726 / Bam
Freigabe	5.11.96	726 / Bam



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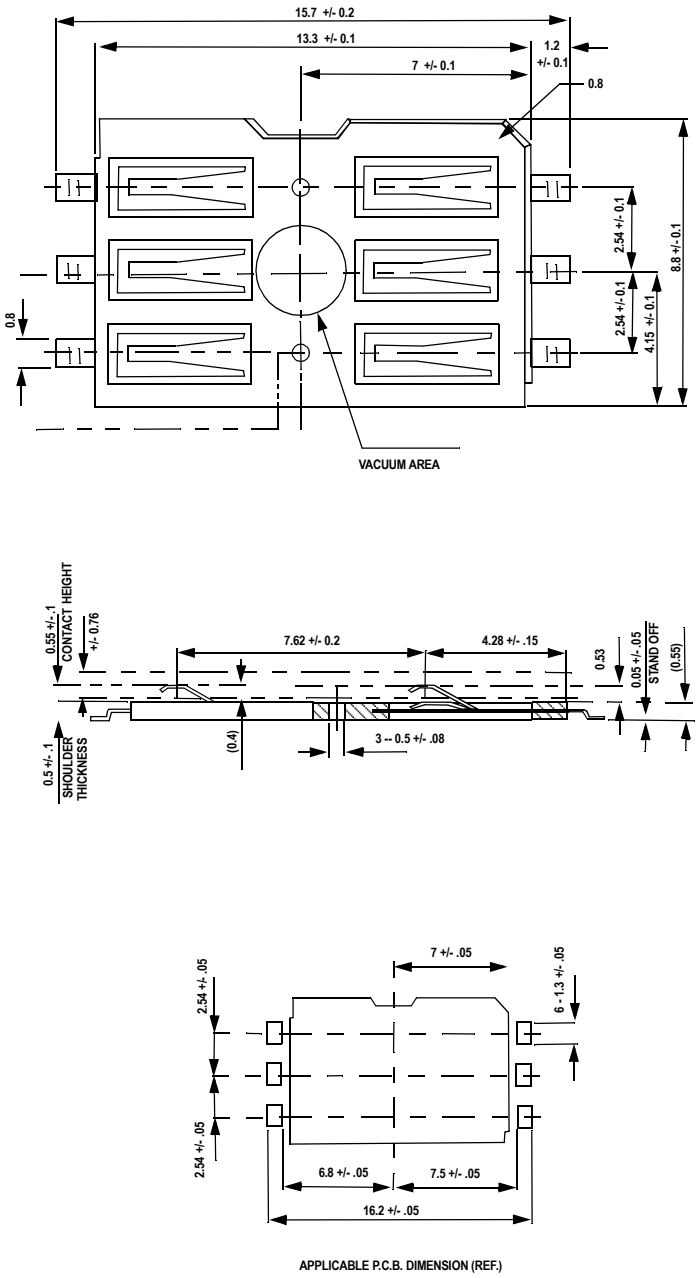
M. 10 : 1 | HUBER + SUHNER AG 9100 Herisau | 4.13.21471 | d

H+S 701 448.05

Figure 19: G200 SIM Connector



Appendix C – Expedite Development Kit Interface Board

The Expedite Development Kit is used to develop applications for embedding GPRS capability into OEM products and for upgrading firmware.

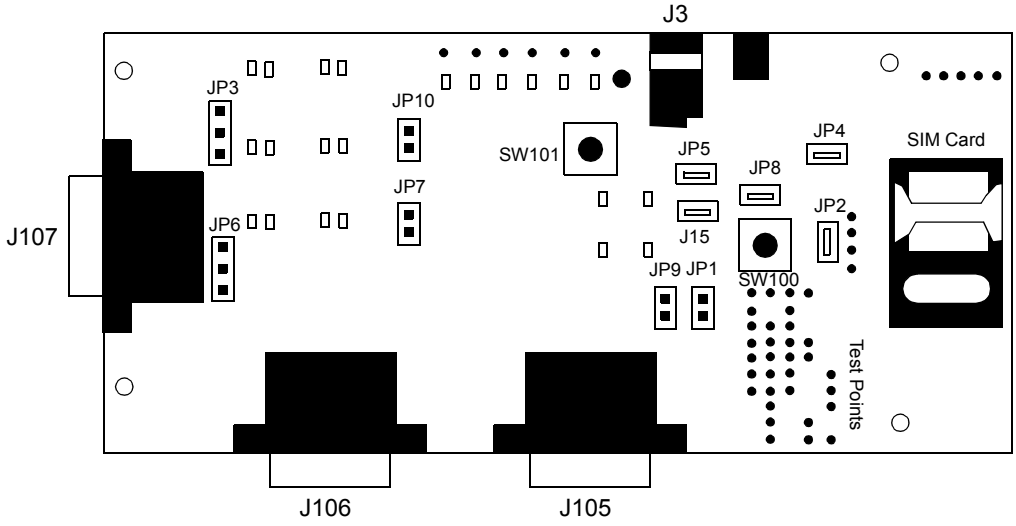


Figure 1: Expedite Development Kit Interface Board

Table 1: Interface Board Connector Assignment

Point Name	Function
JP1 & JP9	ADC Input pin – monitors ADC Battery Voltage
JP2 or SIM_IN	Activates switch on PC card
JP6	Allows debugging to either J107 (jumper on pins 2 and 3) or not (jumper on pins 1 and 2). GPIO6 LED turns on during transmission regardless.
JP5 & JP15	Always enable jumpers; used for current measurements.
JP7 & JP10	Jumper must be placed on either JP10 (primary serial port) or JP7 (USC) to disable serial port (i.e.: jumper on JP7 disables USC). NOTE: printing error on interface card – should read DIS_PRM for JP10 and DIS_USC for JP7.
JP8	Wake up hardware button
JP3	Allows debugging to either J107 (jumper on pins 2 and 3) or to GPIO4 LED (jumper on pins 1 and 2)
JP108	Voltage bench box supply
JP4	Ground
J3	5 V power supply.

J104	Place SIM card here
SW100	Wakeup button (press for 750 ms to wake up device). Jumper on pins above SW100 enable software download without having to manually press button.
SW101	Testing purposes.

Power supply should vary between 3.8 – 4.5 Volts. DO NOT EXCEED 4.5 V.

Glossary

Access Point Name (APN)

The IP domain name (e.i. Novatel Wireless.com) of the network device that acts as a gateway by connecting a GPRS wireless radio network to a wired local or wide area network.

Active Network Session

An active network session allows you to send and receive data across the Internet using point-to-point protocol through your network connection.

Anonymous Access (AA)

Network does not know the real identity of the mobile. Opposite to non-anonymous.

AP Access Point

An entry point to an external network.

AT Commands

AT commands are a language type that enables PC communications software to give the modem directions. The term **AT** comes from the command terminology which always begins with **attention**, or AT.

Baud Rate

The actual bit rate, excluding compression and other Tx enhancements, on a communication line.

Border Gateway (BG)

Logical box that connects two (or more) operators together via an Inter-PLMN backbone. BG protects operator's intra-PLMN network against intruders.

Carrier

See **Service Provider** on page 183.

Circuit Switched Data

A wireless network connection established, using a single circuit that extends from you, directly through the network to your call's destination. Opposite to packet switched.

This connection type is also referred to as **GSM-Data.**

CLI

Command Line Interface.

CLIR

Call Line Identification Restriction.

Connection Oriented Network Service (CONS)

Same as X.25 protocol for packet network transmission and switching.

CSD

See "Circuit Switched Data" on page 179.

Connection Profile

See **Network Connection Profiles** on page 182.

dBm

dBm stands for decibels below 1 milliwatt. It is essentially a device's signal output power compared against a standard input signal strength of 1 (one) milliwatt. This number represents a ratio and is expressed as a negative number (e.i. -60dBm)

Default Network Connection Profile

The default network connection profile is the connection profile, chosen by the user, that the Modem Manager will use to connect to the network. The default network connection profile can be thought of as the **active** network connection profile.

Direct Memory Access (DMA)

A fast method of moving data from a storage device or LAN device interface card directly to RAM which speeds up processing. DMA by passes the CPU.

Domain Name

The name assigned to a computer or group of computers that constitute an IP network domain. In general, a domain name is comprised of its local host name and its top-level domain. The top-level domain can be made up of several names, each separated by a period (.).

An example of a domain name is **novatelwireless.com**.

Domain Name System (DNS)

This is a network server used on IP networks, such as the Internet, for translating network host names and Universal Resource Locators (URL's) into IP addresses.

Domain Name System (DNS) Address

The IP (internet protocol) address of the Domain Name System (DNS).

Firmware

Firmware is a program or set of programs that have been set permanently into a computer chip. The programs themselves usually are low-level programs that directly manipulate or interact with the hardware. An example of firmware is your desktop computer's BIOS.

Gateway GPRS Support Node (GGSN)

The SGSN communicates with what is called the Gateway GPRS Support Node (GGSN), a system that maintains connections with other networks such as the Internet, X.25 networks or private networks.

GPRS

GPRS stands for General Packet Radio Service. GPRS is a high-speed data transfer technique, used on GSM networks. It does not require that a continuous data stream be opened between the data source and destination. Instead, it uses packet to move data back and forth, making efficient use of the available radio spectrum.

GPRS Mobility Management and Session Management (GMM/SM)

Protocol stack between MS and SGSN that handles GPRS attach/detach and PDP context activation/deactivation.

GPRS Tunnelling Protocol (GTP)

Protocol between SGSN and GGSN to encapsulate user data and to carry GPRS signaling.

GSM

GSM stands for Global System for Mobiles. It is an open, non-proprietary system with international roaming capability providing seamless and same standardized same number contact ability in more than 170 countries. GSM satellite roaming has extended service access to areas where terrestrial coverage is not available.

GSM uses digital technology and time division multiple access transmission methods. Voice is digitally encoded via a unique encoder, which emulates the characteristics of human speech. This method of transmission permits a very efficient data rate/ information content ratio.

GSM-Data

See “Circuit Switched Data” on page 179.

Home Public Land Mobile Network (HPLMN)

The home network.

IMEI

IMEI stands for International Mobile Station Equipment Identity.

Internet Protocol (IP)

Internet Protocol works in conjunction with Transmission Control Protocol (TCP). TCP/ IP are part of a group of protocols that provide communication across interconnected networks. TCP/IP is the protocol used on the Internet. The TCP protocol first establishes a connection between the two systems in order to send and receive data, and then breaks and sequentially marks the message into small packets. The IP protocol routes and sends the packets based on the IP address.

Internet Control Message Protocol (ICMP)

IP network control protocol.

IP Addresses

As with personal computers that access the Internet, modems using GPRS technology also have a dedicated Internet Protocol (IP) address, which is used to identify the node or access point for the modem on the Internet. The service provider assigns this IP address.

The 32-bit host address is usually represented in dotted decimal notation, e.g. 128.121.4.5. The address can be split into a network number (or network address) and a host number unique to each host on the network and sometimes also a subnet address.

IP Network

A network of computer networks that employ Internet Protocol allowing a user to access the Internet, provided that the user has a modem; telephone line, cable line, or wireless data network (e.g. CDPD); and a service provider.

Local Area Network (LAN)

A computer network that spans a relatively small area (typically up to a 1 km radius), although most LANS are confined to a single building or group of buildings. This type of networking allows for easy interconnection of terminals, printers, and computers within a building or buildings.

Logical Link Control (LLC)

Protocol layer between MS and SGSN.

Medium Access Control (MAC)

Protocol in the radio level that is used to allocate the radio channel.

Megahertz (MHz)

One million hertz. Hertz is another word for cycles in a radio frequency.

Network Connection Profiles

A network connection profile is a group of connection settings that define a specific network connection to the Modem Manager. This includes such settings as network ID, network password, APN, DNS addresses and so on.

Mobile Station (MS)

The device being used to receive/transmit data and/or voice.

Original Equipment Manufacturer (OEM)

The original manufacturer of a pieces of equipment, typically complete boards, duplexers or enclosures etc.

Packet

A short block of data transmitted across a network.

Packet Control Unit (PCU)

Functional element in BSS that handles upper level GPRS control in the radio.

Packet Data Network (PDN)

Network that carries user data in packets. e.i Internet and X.25

Packet Size

The size of a packet expressed in bytes.

PC Card

A PC Card, similar in size to a credit card, is used for adding devices on to portable computing devices such as laptop, handheld, and palmtop computers. Some examples of these devices are modems, network cards, disk drive adapters, and extra memory. PC cards are often called PCMCIA cards.

PCMCIA Card Slots

The PCMCIA card slots are the sockets in the computing device, in which the PCMCIA card is inserted. It is the hardware interface between the computing device and the PCMCIA card.

Point to Multipoint (PTM)

Widely used protocol under IP to connect. i.e PC and ISP via modems.

Point to Point (PTP)

One sender on receiver.

Point-to-Point Protocol (PPP)

PPP is an interconnection protocol which allows a device, such as a wireless IP modem, to connect to a network or the Internet.

Primary Domain Name System

In order to get the translated IP addresses, the modem will try to connect to the server with the primary DNS address. If the modem cannot connect to this address, it will try to connect using the secondary DNS address.

Protocol Data Unit (PDU)

One data packet.

Quality of Service (QoS)

Definition of the service class of the connection between MS and the network.

Routing Area (RA)

A set of cells that belongs to one group. RA is always a subset of an LA (Location Area).

Registration

In order to send and receive data across a given network, a GPRS modem must first register to GSM/GPRS network. This involves the selection of an available channel and interaction with various systems on the GPRS network to set up a communication path.

Remote Access Service (RAS)

Software that enables distant PCs and workstations to get into a Remote Access Server to retrieve software and/or data on a corporate LAN. This service is provided through modems, analog telephone lines or digital ISDN lines.

Request to Send (RTS)

A control signal that has a dedicated wire in the RS-232 protocol. When the far device places a logic “one” or 5-V voltage on this wire, it enables the near modem to initiate a transmission.

Secondary Domain Name System

If the modem cannot connect to the DNS using the primary address, it will try to connect using the secondary DNS address.

Segment

Each IP network address consists of four numeric segments, which are divided by a period (."). For example, 204.119.63.40.

Service Provider

A company that provides network connections to the Internet.

Short Message Service (SMS)

Short messages either in binary (160 characters) or text messages (140 bytes) format.

SIM

The term SIM stands for Subscriber Identity Module.

SIM Card

A SIM card is a type of *smart card* that contains all of your account information for your GSM and GPRS account. It also used to encrypt the data and voice that is sent across the network during a session.

SIM Card Contact Points

These are the small gold- or aluminum-colored.

Serving GPRS Support Node (SGSN)

The SGSN is the node within the GSM infrastructure that sends and receives data to and from the mobile stations. It also keeps track of the mobiles within its service area.

Transmission Control Protocol (TCP)

Protocol layer on top of conventional IP protocol.

Type II PCMCIA Card

A Type II PCMCIA card is identical to the Type I PCMCIA card in all ways except that it is thicker than the Type I card. The Type II PCMCIA card is in general use now.

User Datagram Protocol (UDP)

Another protocol on top of IP.

Wireless IP Network

A wireless network (e.g. GPRS) that uses Internet Protocol (IP).

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