



# Technical Manual

with Specifications

Merlin and Expedite GPRS Products  
P/N 90023363 Rev. 1.8



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Printed and produced in Canada.

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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.

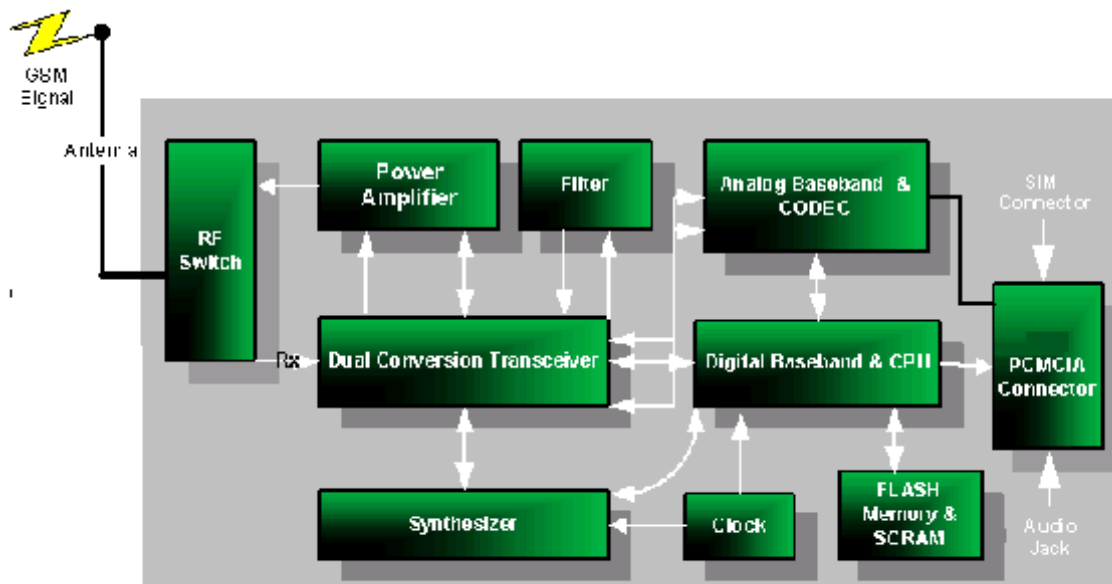


Figure 1 GSM-Merlin Interface

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.

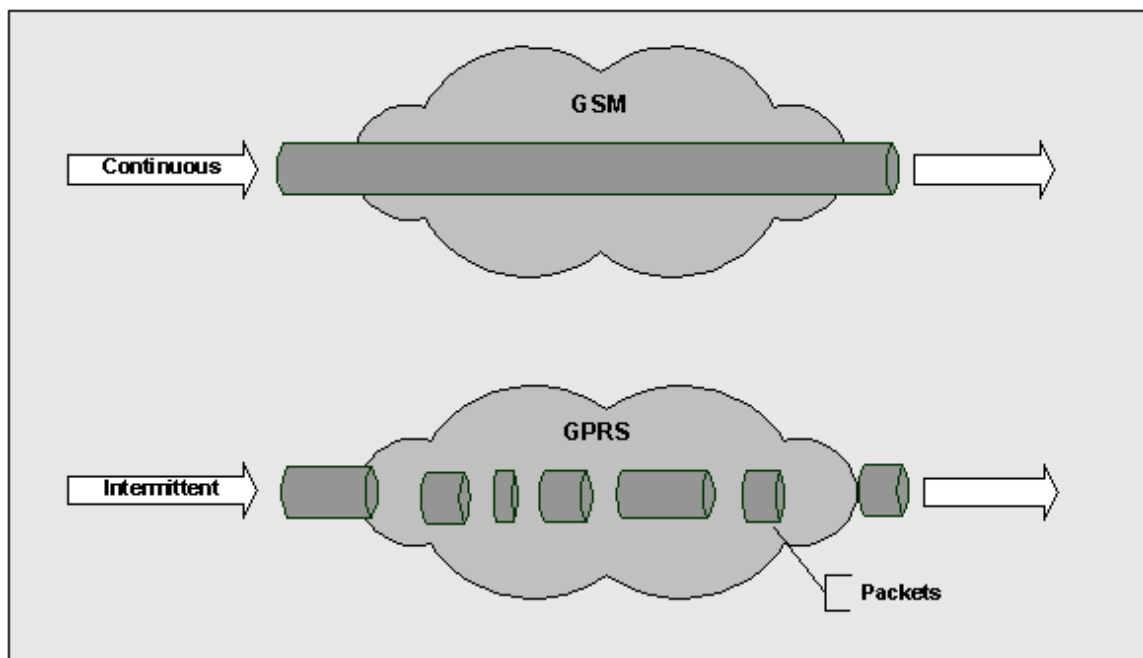


Figure 2 GSM Vs. GPRS Data Transfer

## 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.

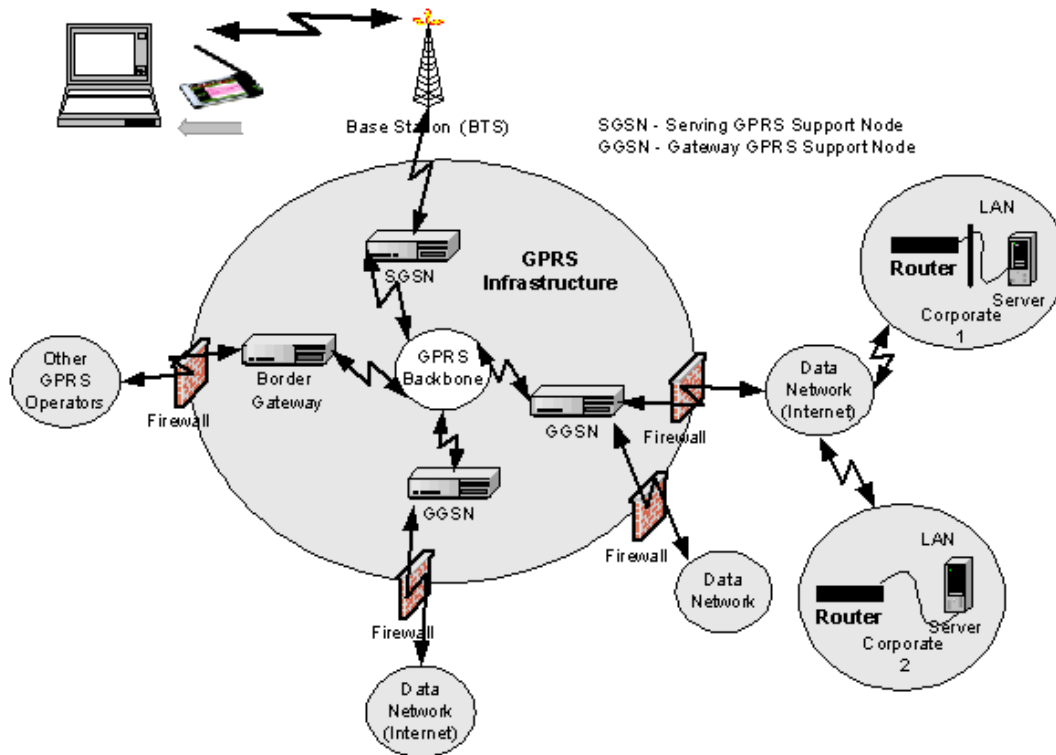


Figure 3 GPRS Network Architecture

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:

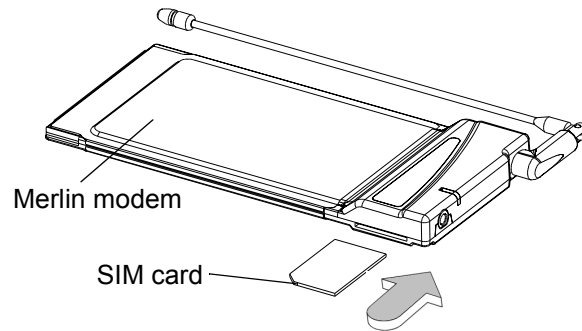
- **Multi-slot Class**  
Each timeslot can handle a given amount of data, established through negotiation between the device and the network.
- **Channel Coding Scheme**  
Four CS schemes are defined, each with a different level of error correction (basically “overhead”, similar to CDPD, which takes 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)	<ul style="list-style-type: none"> <li>MS-10 operation</li> <li>Type 1 device (Simplex RF operation)</li> <li>up to 4 receive slots, up to 2 transmit slots, for a combined maximum of 5 slots</li> <li>4/1, 3/1,3/2,2/2, 2/1 combination provides theoretical rates of up to 56 kbps receive and 28 kbps transmit</li> <li>automatically maintains GPRS virtual circuit when CSD or Voice traffic is present</li> </ul>
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	<ul style="list-style-type: none"> <li>standard GSM AT Command set with enhancements</li> <li>supports PPP protocols for external hosting</li> <li>supports channel coding schemes CS-1 and CS-2</li> </ul>
Software included	<ul style="list-style-type: none"> <li>Compatible with Windows 98SE/ME/2000/XP, Windows NT 4.0 SP4, Pocket PC 3.0 and Pocket PC 2002</li> </ul>
Approvals	<ul style="list-style-type: none"> <li>Full Type Approval, compliant to GSM Phase 2+ standard (all)</li> <li>FCC Part 15 and Part 24 (PCS1900) (Merlin G100, G301, Expedite G301)</li> <li>Essential requirements of the Radio and Telecommunications Terminal Equipment (R&amp;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)</li> </ul>
Frequency Band	<ul style="list-style-type: none"> <li>PCS 1900 North American GSM (Merlin G100) or</li> <li>GSM 900 / DCS 1800 (Merlin G200 series) or</li> <li>GSM 900 / PCS 1900 / DCS 1800 (Merlin G301 and Expedite G301)</li> </ul>
Data Power Connector	<ul style="list-style-type: none"> <li>standard 16 bit PCMCIA PC Card Interface</li> <li>70 pin electrical interface for Expedite</li> </ul>
SIM Card	<ul style="list-style-type: none"> <li>SIM card supplied by the carrier as a separate item. Expedite provides connection signals for an external SIM Module</li> </ul>
Antenna Interface	<ul style="list-style-type: none"> <li>standard 50-ohm MMCX antenna termination (Expedite G301, Merlin G201)</li> <li>standard 50-ohm Radial MC card type antenna connector (Merlin G100)</li> </ul>
Output Power Level	<ul style="list-style-type: none"> <li>GSM Power Class 1 (1 watt/30 dBm, max Tx power) at DCS 1800 and PCS 1900 frequency bands.</li> <li>GSM Power Class 4 (2 watt/33dBm, max Tx power) at GSM 900 frequency bands</li> </ul>
Temperature	<ul style="list-style-type: none"> <li>Operating -10°C to +55 °C</li> <li>Storage -30°C to +75 °C</li> </ul>
Power Supply	<ul style="list-style-type: none"> <li>nominal 3.6 volt DC supply for Expedite module</li> </ul>

## 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.





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## 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

In general, for 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. In some cases the module use may fit the definition of “portable devices” as per FCC CFR47 paragraph 2.1093.



*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](http://www.nvtl.com/support/index.htm)

**Email:** [gprs\\_support@nvtl.com](mailto: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.

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## 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 than 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**

<b>Physical Dimensions and Weight</b>		<b>Merlin G100</b>	<b>Merlin G200</b>
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
<b>Temperature</b>			
Temperature Range		Operating -10°C to 55 °C Storage -30°C to 75°C	
<b>Relative Humidity</b>			
Maximum operating humidity at 50°C (non-condensing)		up to 95% Non-condensing	
<b>Recommended Operating Conditions</b>			
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	
<b>Moisture and Dust Resistance</b>			
Do not immerse or expose to excessive moisture. The case is not to be considered dustproof.			
<b>Thermal Shock</b>		<b>Merlin G100</b>	<b>Merlin G200</b>
Non-Operating		-50 °C to +20 °C, +70 °C to +20 °C; less than 5 min	-20 <sup>0</sup> C to 55 <sup>0</sup> C





<b>Vibration</b>		
Sinusoidal	3.0 mm displacement, 2 to 9 Hz; 1 m/s <sup>2</sup> , 9 to 350 Hz	147 m/s <sup>2</sup> , 15g peak amplitude, 10Hz-2000 Hz
Random	0.1 m <sup>2</sup> /s <sup>3</sup> , 2 to 200 Hz	0.96 m <sup>2</sup> /s <sup>3</sup> , 5 Hz-20Hz, -3db/Oct, 20 Hz-500Hz
Transport	Packaged ASTM D999	N/A
Mechanical Shock	N/A	semi sine 50 g 11ms
<b>Emissions</b>		
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
<b>Transmit Power</b>		
GSM Power Class 1 (DCS 1800 / PCS1900) GSM Power Class 4 (GSM 900)	<ul style="list-style-type: none"> <li>• 1 Watt maximum Tx power</li> <li>• 2 Watt maximum Tx power</li> </ul>	
<b>Connectors</b>		
Antenna	RADIALL SMT microminature 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.

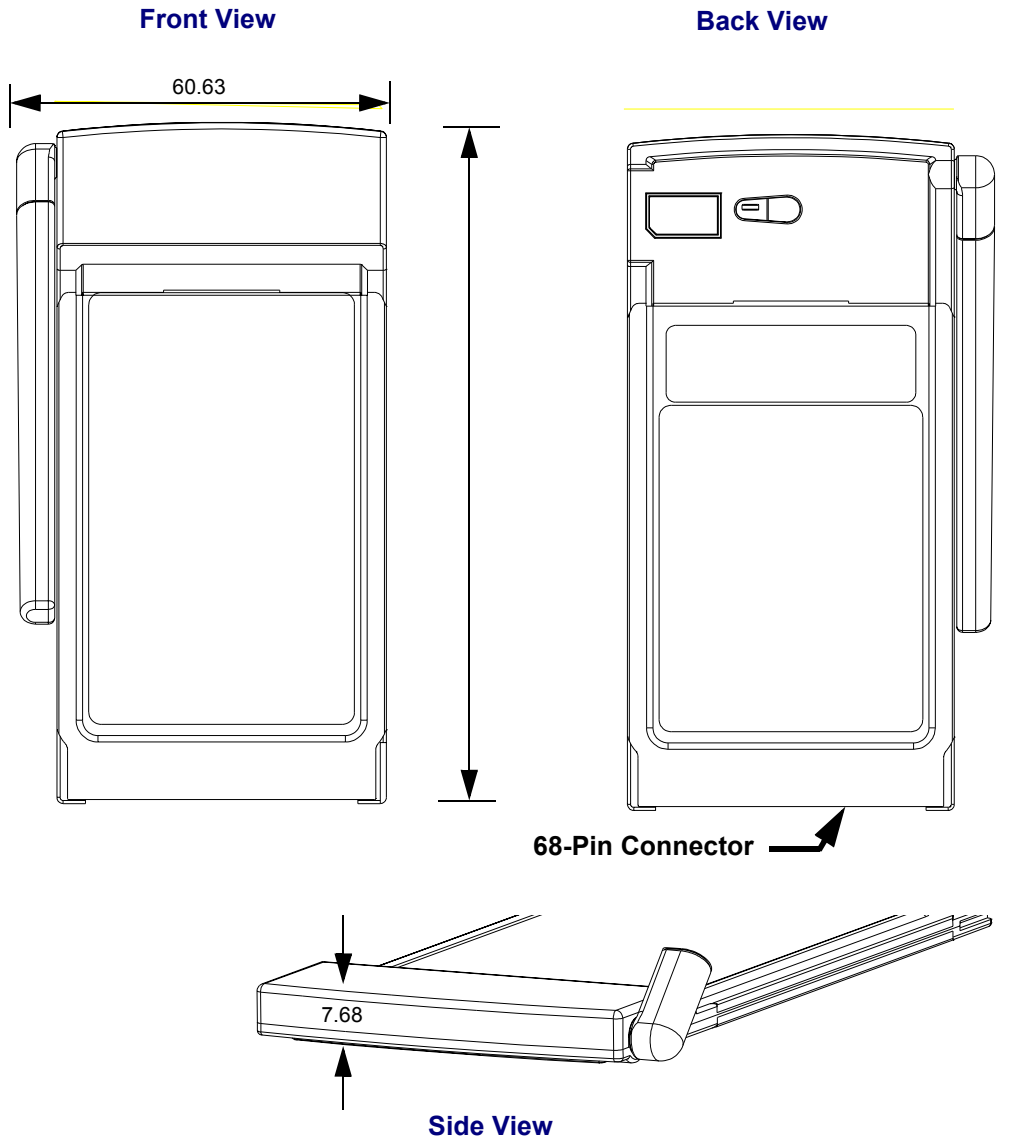


Figure 1: Mechanical View of MerlinG100

### Merlin G200

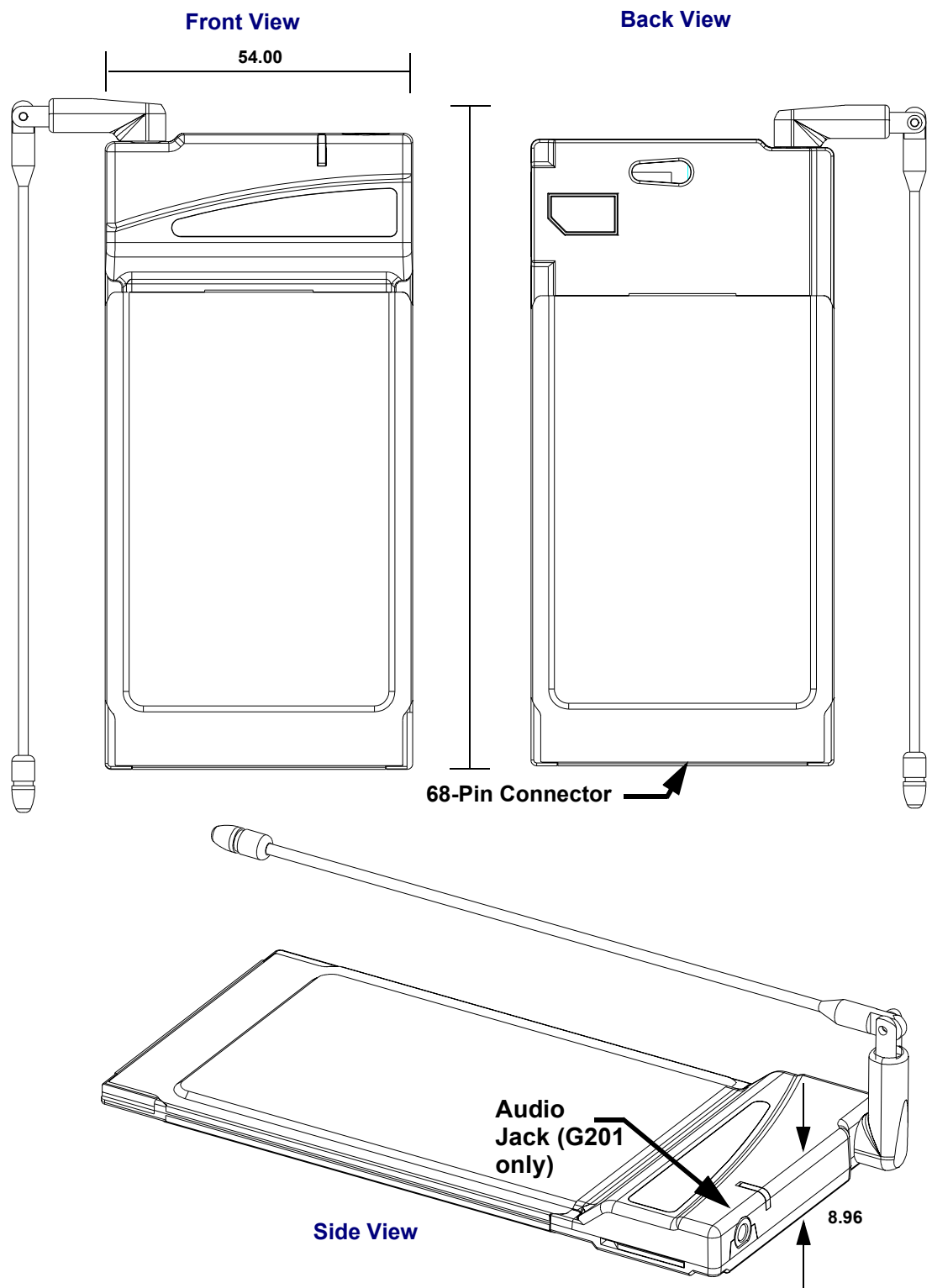


Figure 2: Mechanical View of Merlin G200 Series

## 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 LVTTTL 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	$1 \leq n \leq 124$	$\text{Freq}(n)=890+0.2*n$	$\text{Freq}(n)=935+0.2*n$
E-GSM 900	$0 \leq n \leq 124$ $975 \leq n \leq 1023$	$\text{Freq}(n)=890+0.2*n$ $\text{Freq}(n)=890+0.2*(n-1024)$	$\text{Freq}(n)=935+0.2*n$ $\text{Freq}(n)=935+0.2*(n-1024)$
DCS 1800	$512 \leq n \leq 885$	$\text{Freq}(n)=1710.2+0.2*(n-512)$	$\text{Freq}(n)=1805.2+0.2*(n-512)$
PCS 1900	$512 \leq n \leq 810$	$\text{Freq}(n)=1850.2+0.2*(n-512)$	$\text{Freq}(n)=1930.2+0.2*(n-512)$



Table 7: Radio Power Index

Radio Power Index		
Bands	Index	Power
GSM 900	5-19	33 - 5 dBm
PCS 1900/DCS 1800	0-15	30 - 0 dBm

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 <sup>0</sup> C to +60 <sup>0</sup> C Storage -30 <sup>0</sup> C to 75 <sup>0</sup> C
Relative Humidity	
Maximum operating humidity at 50 <sup>0</sup> 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 <sup>2</sup> , 9 to 350 Hz
Random	0.1 m <sup>2</sup> /s <sup>3</sup> , 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
<b>Data Rates</b>	
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
<b>Transmit Power</b>	
GSM Power Class 1 (DCS 1800 / PCS1900) GSM Power Class 4 (GSM 900)	<ul style="list-style-type: none"> <li>• 1 Watt maximum Tx power</li> <li>• 2 Watt maximum Tx power</li> </ul>

## Expedite Physical Appearance

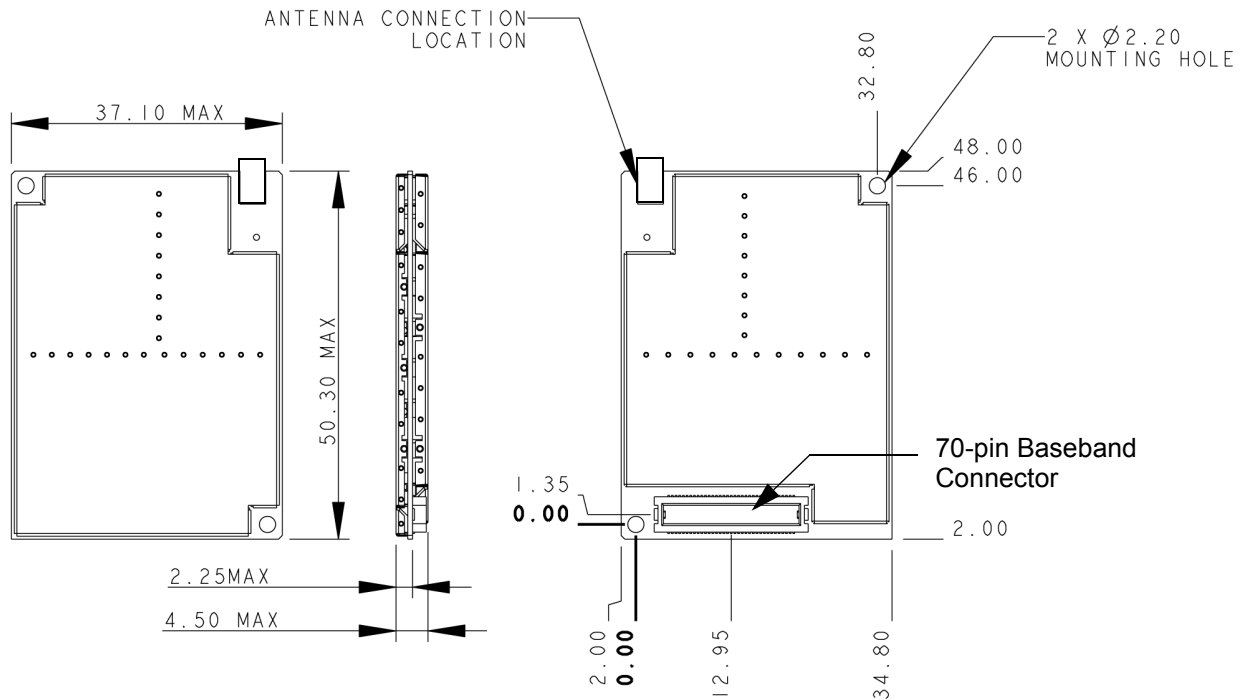


Figure 3 Expedite G301 Mechanical Dimensions

## 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 its 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 its 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 4.7k $\Omega$  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		TOTAL
		MIN	MAX	MIN	MAX	
Power Supply Requirement		3.4V	4.5V	3.4V <sup>1</sup>	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		TOTAL
		MIN	MAX	MIN	MAX	
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		TOTAL
		MIN	MAX	MIN	MAX	
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
<b>Primary Serial Port</b>				
	V <sub>OH</sub>	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
	I <sub>drive</sub>			4mA
	Input Impedance	TBD		
	Input Capacitance			9pF

**SIM**

	As per ETSI 11.12			
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**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				
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	Max Output Swing			0.789 Vpp
	Output Bias Voltage		1.15V	
	Minimum Load Resistance	1 kOhm		
	Maximum Load Capacitance			150pF

MANUAL RESET INPUT				
--------------------	--	--	--	--

	V <sub>IH</sub>	2.3V		
	V <sub>IL</sub>			0.8V
	Pulse Width	1uS		
	Glitch Rejection		100nS	
	Pull up value on Modem	32kOhm	63kOhm	100kOhm

POWER UP AND WAKEUP			
PUL_PWREN			
	$V_{IH}$	$0.7 * V_{CC}$	
	$V_{IL}$		$0.3 * V_{CC}$
PWR_ON			
	$V_{IH}$	$0.7 * V_{CC}$	
	$V_{IL}$		$0.3 * V_{CC}$
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

$T_{\text{RESET}}$	Reset Pulse timing	TBD			mS
--------------------	--------------------	-----	--	--	----

Will be reduced to <200ms.

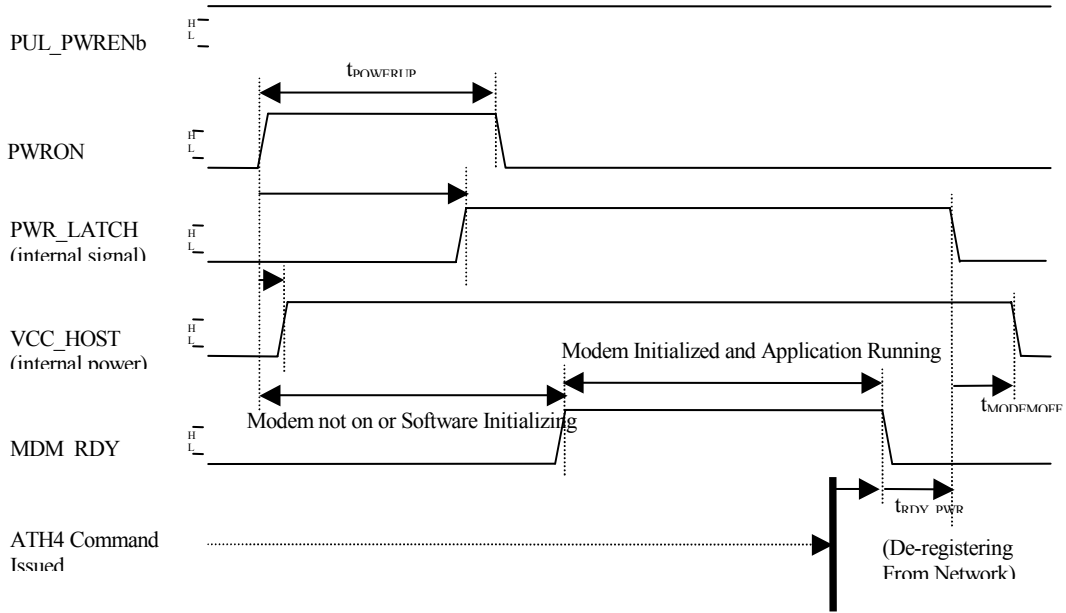
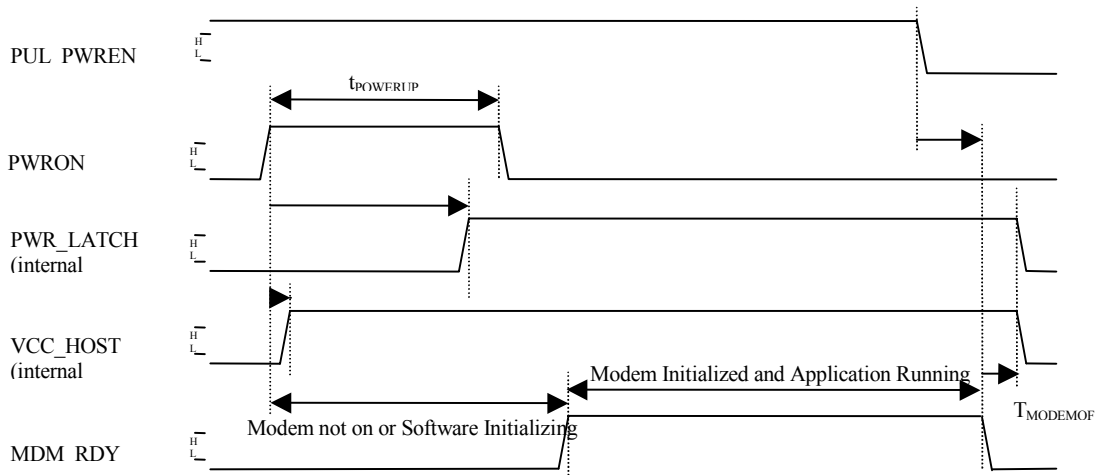


Figure 4 Pulsed Power-on, ATH4 Command Shutdown



\* ATH4 Command Not Issued (Method Not Preferred)

Figure 5 ATH4 Command Not Issued (Method not Preferred)

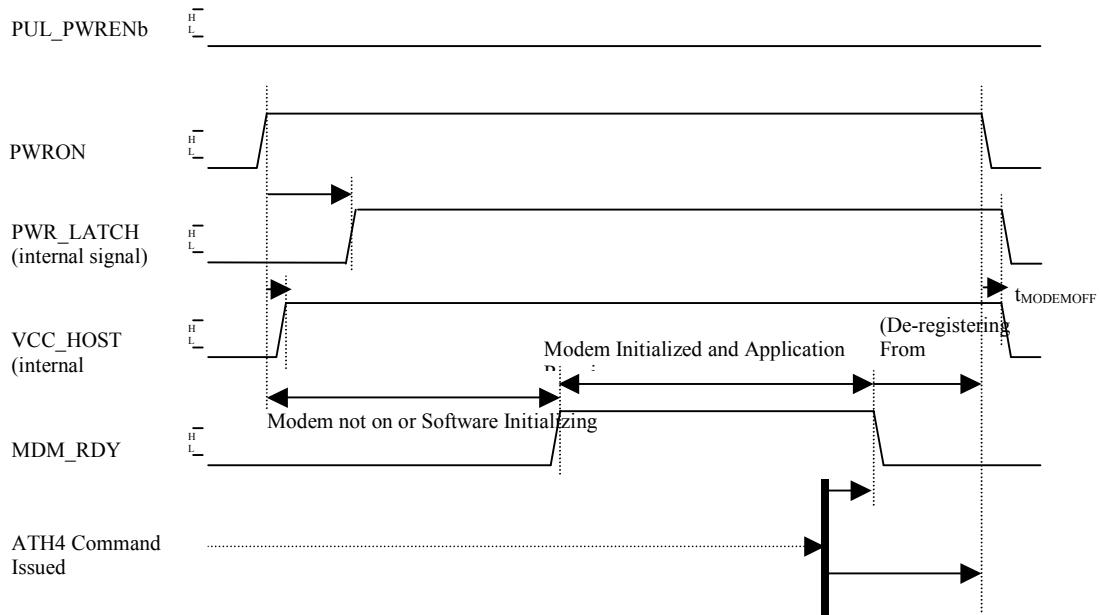
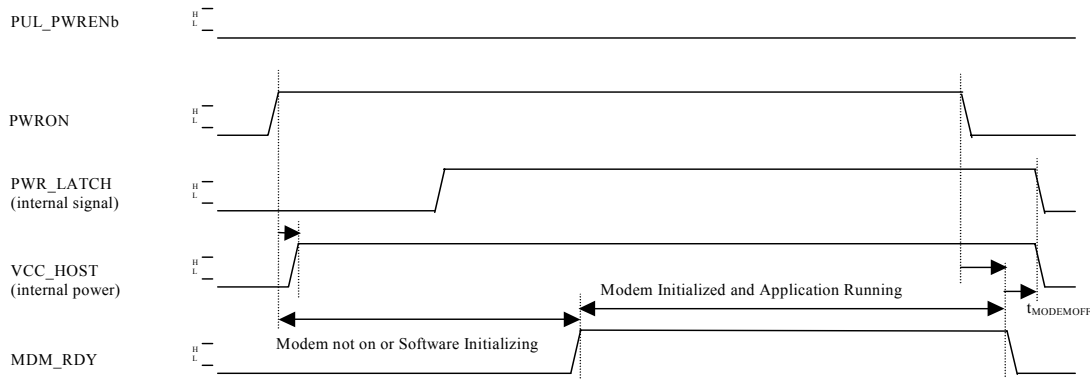


Figure 6 Power Enable-On, ATH4 Command Shutdown



\* ATH4 Command Not Issued (Method Not Preferred)

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.

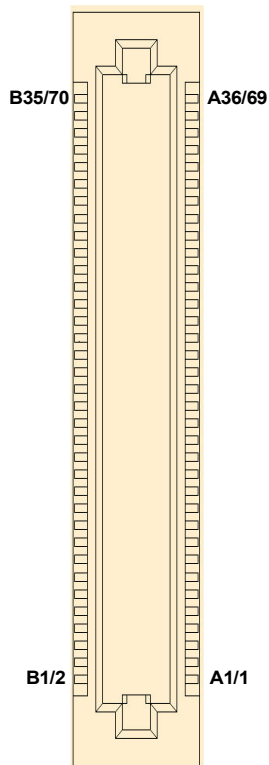
## Baseband Mating Connector on the Host

The recommended mating connector is:

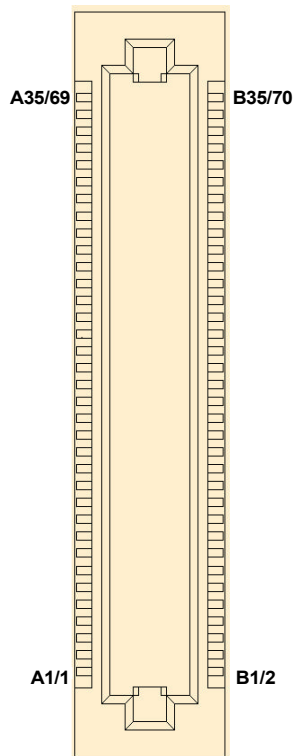
Novatel Part Number	21823061
CSC Part Number	CSC70S01RB-TR
SMK Part Number	CPB7170-0111

## 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	$1 \leq n \leq 124$	$\text{Freq}(n)=890+0.2*n$	$\text{Freq}(n)=935+0.2*n$
E-GSM 900	$0 \leq n \leq 124$ $975 \leq n \leq 1023$	$\text{Freq}(n)=890+0.2*n$ $\text{Freq}(n)=890+0.2*(n-1024)$	$\text{Freq}(n)=935+0.2*n$ $\text{Freq}(n)=935+0.2*(n-1024)$

DCS 1800	$512 \leq n \leq 885$	$\text{Freq}(n)=1710.2+0.2*(n-512)$	$\text{Freq}(n)=1805.2+0.2*(n-512)$
PCS 1900	$512 \leq n \leq 810$	$\text{Freq}(n)=1850.2+0.2*(n-512)$	$\text{Freq}(n)=1930.2+0.2*(n-512)$

**Table 19: Radio Power Index**


Radio Power Index		
Bands	Index	Power
GSM 900	5-19	33 - 5 dBm
PCS 1900/DCS 1800	0-15	30 - 0 dBm

**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  <i>May exceed occasional peaks of up to 85°C.</i>

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



<b>ATP</b>	Select pulse dialing	SELECT PULSE MODE
<b>ATQ</b>	Set Result code presentation mode	SET RESULT FORMAT
<b>ATS0</b>	Set number of rings before automatically answering the call	AUTO-ANSWER THRESHOLD
<b>ATS2</b>	Modem goes from off-line to on-line data state.	ESCAPRE CHARACTER SELECTION
<b>ATS3</b>	Set command line termination character	COMMAND LINE TERMINATOR
<b>ATS4</b>	Set response formatting character	RESPONSE FORMATTING CHARACTER
<b>ATS5</b>	Set command line editing character	COMMAND LINE EDITING CHARACTER
<b>ATS6</b>	Set pause before blind dialing	PAUSE BEFORE DIALING
<b>ATS7</b>	Set number of seconds to wait for connection completion	CONNECTION TIMEOUT
<b>ATS8</b>	Set number of seconds to wait when comma dial modifier used	COMMA CONNECTION TIMEOUT
<b>ATS10</b>	Set disconnect delay after indicating the absence of data carrier	DATA IDLE TIMEOUT
<b>ATS12</b>	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
<b>ATT</b>	Select tone dialing	SET TONE DIALING
<b>ATV</b>	Set result code format mode	SET RESULT CODE FORMAT MODE
<b>ATX</b>	Set connect result code format and call monitoring	SET CONNECT CODE AND CALL MONITORING
<b>ATZ</b>	Set all current parameters to user defined profile	SET CONFIGURATION TO USER DEFINED PROFILE
<b>AT&amp;C</b>	Set DCD function mode	SET DCD MODE
<b>AT&amp;D</b>	Set DTR function mode	SET DTR MODE
<b>AT&amp;F</b>	Set all current parameters to manufacturer defaults	RESTORE FACTORY DEFAULTS
<b>AT&amp;V</b>	Display current configuration	DISPLAY CONFIGURATION
<b>AT&amp;W</b>	Store current parameter to user defined profile	SAVE CONFIGURATION
<b>AT+DR</b>	V.42bis data compression reporting control	DATA COMPRESSION REPORTING CONTROL
<b>AT+DS</b>	V.42bis data compression control	DATA COMPRESSION CONTROL
<b>AT+GCAP</b>	Request complete TA capabilities list	CAPABILITES LIST

<b>AT+GMI</b>	Request manufacturer identification	MANUFACTURER IDENTIFICATION
<b>AT+GMM</b>	Request TA model identification	MODEL IDENTIFICATION
<b>AT+GMR</b>	Request TA revision identification	REVISION IDENTIFICATION
<b>AT+GOI</b>	Request global object identification	GLOBAL IDENTIFICATION
<b>AT+GSN</b>	Request TA serial number identification (IMEI)	SERIAL NUMBER IDENTIFICATION
<b>AT+ICF</b>	Set TE-TA control character framing	CONTROL CHARACTER FRAMING
<b>AT+IFC</b>	Set TE-TA local data flow control	LOCAL DATA FLOW CONTROL
<b>AT+IPR</b>	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
<b>AT+CACM</b>	Accumulated call meter (ACM) reset of query	ACCUMULATED CALL METER
<b>AT+CAMM</b>	Accumulated call meter maximum (acm-max) set or query	ACCUMULATED CALL METER MAXIMUM
<b>AT+CAOC</b>	Advice of charge	ADVICE OF CHARGE
<b>AT+CBST</b>	Select bearer service type	BEARER SERVICE TYPE
<b>AT+CCFC</b>	Call forwarding number and conditions control	CALL FORWARDING
<b>AT+CCUG</b>	Closed user group control	CLOSED USER GROUP
<b>AT+CCWA</b>	Call waiting control	CALL WAITING
<b>AT+CEER</b>	Extended error report	EXTENDED ERROR REPORT
<b>AT+CGMI</b>	Request manufacturer identification	MANUFACTURER IDENTIFICATION
<b>AT+CGMM</b>	Request model identification	MODEL IDENTIFICATION
<b>AT+CGMR</b>	Request revision identification	REVISION IDENTIFICATION
<b>AT+CGSN</b>	Request product serial number identification (identical with +gsn)	SERIAL NUMBER IDENTIFICATION
<b>AT+CGOI</b>	Global Identity Request	Identifier of device type.
<b>AT+CSCS</b>	Select TE character set	TE CHARACTER SET
<b>AT+CSSN</b>	Enables presentation of supplementary service notification result codes	SUPPLEMENTARY SERVICE NOTIFICATION
<b>AT+CSTA</b>	Select type of address	SELECT TYPE OF ADDRESS
<b>AT+CHLD</b>	Call hold and multiparty	CALL HOLD AND MULTIPARTY
<b>AT+CIMI</b>	Request international mobile subscriber identity	INTERNATIONAL MOBILE SUBSCRIBER IDENTITY

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





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

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

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

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



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## 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:**

<b>ATD9,555-1212&lt;cr&gt;</b>	<b>DIAL 9, PAUSE, DIAL 5551212</b>
<b>ATD555-1234;&lt;cr&gt;</b>	<b>DIAL 5551234</b>
<b>ATD555-09871G&lt;cr&gt;</b>	<b>DIAL 5550987, OVERRIDE CLIR, DISPLAY CUG</b>

## 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
ATDDC2!;<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:**

<code>ploc</code>	is an integer referring to a mobile equipment phone number stored at the specified location in the modem's internal memory.
<code>mgsm</code>	is a string of GSM modifiers, where: <ul style="list-style-type: none"> <li><code>I</code> overrides the current Calling Line Identification Restriction (CLIR) setting for the call</li> <li><code>G,g</code> displays the Closed User Group (CUG) information, set with the command <code>+CCUG</code></li> <li><code>;</code> signifies the call is a voice call and instructs the modem to return to the command mode.</li> </ul>

**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 echoed  
OK  
ATE0<cr> All further data entered is echoed  
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 send result codes to the terminating equipment. Text sent from the modem to the terminating equipment using the AT+I 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 no response 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, 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  $1/10^{\text{th}}$  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  $1/10^{\text{th}}$  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 AT0 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 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

<b>Example:</b>	<b>Input</b>	<b>Response</b>
Query	<b>AT+CAMM?</b>	<b>00037F</b>
Set	<b>AT+CAMM=000400</b>	<b>OK</b>
Test	<b>AT+CAMM=?</b>	<b>OK</b>

## 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

<b>Example:</b>	<b>Input</b>	<b>Response</b>
Query	<b>AT+CAOC?</b>	<b>Current mode OK</b>
Set	<b>AT+CAOC=1</b>	<b>OK</b>
Test	<b>AT+CAOC=?</b>	<b>List of possible selections</b>

---

## 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
2		PAD access (asynchronous)
<ce>	0	transparent
	1	non-transparent

<b>Example:</b>	<b>Query</b>	<b>Response</b>
Query	<b>AT+CBST?</b>	<b>Current mode OK</b>
Set	<b>AT+CBST=7,2,0</b>	<b>OK</b>
Test	<b>AT+CBST=?</b>	<b>List of possible selection</b>

## 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)
<mode>	5	all conditional call forwarding (1-3)
	0	disable
	1	enable
	2	query status
	3	registration
<number>	4	erasure
	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>**

<b>Example:</b>	<b>Input</b>	<b>Output</b>
Query	<b>AT+CCFC?</b>	<b>Current mode OK</b>
Set	<b>AT+CCFC=0,1,,,,,,</b>	<b>OK</b>
Test	<b>AT+CCFC=?</b>	<b>List of possible selection</b>

## 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
<index>	71	9600 bps (V.110 or X.31 flag stuffing)
	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:**

	<b>Input</b>	<b>Output</b>
Query	<b>AT+CCUG?</b>	<b>Current mode OK</b>
Set	<b>AT+CCUG=0,1,,,,,</b>	<b>OK</b>
Test	<b>AT+CCUG=?</b>	<b>List of possible selections</b>

## 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

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

**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 <ul style="list-style-type: none"> <li>0 – deactivated</li> <li>1 – activated</li> </ul> <p>Other values are reserved and will result in an ERROR response to the execution command.</p>

**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) OSPFH 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 SMDCP. 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:HOSS 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\_co  
                   mp>,<head\_comp>[,<pd1>[,...[,pdN]]]  
                   [<cr><LF>+CGDCONT:  
                   <cid>,<PDP\_type>,<APN>,<PDP\_addr>,<data\_co  
                   mp>,<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	1.0.0.0 OK
Test	AT+CGMR=?	OK