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GSP-1620 Satellite Data Modem.
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QUALCOMM Globalstar GSP-1620 Satellite Data Modem Integrator's Reference Manual

80-99208-1, Rev. D

April 17, 2001

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REVISION HISTORY

Version	Release Date	Notes
Rev. A	August 23, 2000	First Production Release
Rev. B	October 13, 2000	Revised hardware specifications
Rev. C	January 25, 2001	Release to accompany GSP-1620 modem software version 5.2: ■ Changed modem name and manual title (removed “packet”) ■ Added information about asynchronous data, especially in Chapters 5 and 6 ■ Revised Diagnostic cable graphic and procedures in Chapter 2 ■ Revised Customer Service information in Appendix D ■ Added antenna specifications to Appendix E
Rev. D	April 17, 2001	Updates and corrections: ■ Revised some AT command descriptions or parameter values in Chapter 6 ■ Added pinout information for Diagnostic port in Chapter 7 ■ Added references to the Modem Operation Monitor in Chapters 2 and 6 ■ Applied new document layout design

ABOUT THIS MANUAL

This *QUALCOMM Globalstar GSP-1620 Satellite Data Modem Integrator's Reference Manual,* also referred to as the *Integrator's Reference Manual*, provides the information needed to install and use the QUALCOMM Globalstar GSP-1620 Satellite Data Modem, also referred to as the GSP-1620 modem in this document.

Who Should Use This Manual

This manual is intended for the following users:

- People who set up the modem from the Modem Integrator's Kit on a bench for development and testing
- Application developers who create software applications that work with the GSP-1620 modem
- Developers and OEMs who service-program modems to make them work with Globalstar Service Providers
- OEMs or system integrators who incorporate GSP-1620 modem hardware into commercial products (for example, oil pipeline monitors)
- OEM field technicians who install those products on site

Getting Started on page 1-1 includes a roadmap pointing different users to relevant sections in this manual.

How This Manual Is Organized

This following table summarizes how information is organized in this manual.

Chapter	Description
Chapter 1. Getting Started	Introduction to the GSP-1620 modem and the Modem Integrator's Kit.
Chapter 2. Quick Bench Set-Up	Quick instructions for connecting and powering up the modem and sending commands via HyperTerminal.
Chapter 3. Service-Programming Modems	Coordinating with Service Providers and re-programming default modem parameters.
Chapter 4. Making Simple Data Calls	Quick tutorial on setting up a PC for packet data, making mobile-originated packet data calls, and using modem ports.
Chapter 5. Developing Modem Applications	Developing software applications that work with modem features.
Chapter 6. AT Command Reference	Developer's reference for AT commands, syntax, and values.
Chapter 7. Integrating GSP-1620 Modems into OEM Products	Hardware descriptions of the modem and antenna, mounting guidelines, and environmental specifications.
Chapter 8. Troubleshooting	Suggested solutions for modem problems.
Appendix A. Globalstar Background	Globalstar space and ground segments, coverage and carriers.
Appendix B. RF Certification/ Restrictions	Certification compliance and RF restrictions for the modem and antenna.
Appendix C. Warranty	QUALCOMM warranty information for the GSP-1620 modem.
Appendix D. Product Support	How to contact QUALCOMM Globalstar Customer Service.
Appendix E. Specification Summary	Quick reference list of hardware specifications for the GSP-1620 modem and antenna.

Notational Conventions

The following table shows the notational conventions that convey specific types of information in this manual.

Convention	Description
`Commands, parameters, values, filenames, directory locations`	Items shown in `courier` typeface indicate commands, parameters, filenames, and directory locations.
`<Non-literal elements>`	Items shown within angle brackets and `<courier>` indicate non-literal elements for which you type a substitute.
Menu items and buttons	Menu items, commands, and buttons appear in **bold sans serif**.
Dialog box and window titles	Dialog box and window titles appear in **bold sans serif**.
Book titles and section references	Book titles and section references appear in *italics*.
Steps	This symbol identifies "how-to" procedure. Follow these steps to accomplish a specific task.
Note	This symbol identifies related information that deserves emphasis.
Tip	This symbol identifies a shortcut or information that you might find handy.
Caution	This symbol identifies a potentially hazardous situation which, if not avoided, could damage equipment or property.
Warning	This symbol and **bold text** identify potential danger, which, if not avoided, could cause serious injury or death.

Abbreviations and Acronyms

AC	Alternating Current
API	Application Programming Interface
AT	Attention
CCA	Circuit Card Assemblies
CDMA	Code Division Multiple Access
CDR	Call Detail Record
CD-ROM	Compact Disc Read-Only Memory
CE	Community European
CFR	Code of Federal Rules
CP	Control Port
CTS	Clear To Send
DC	Direct Current
DCD	Data Carrier Detect
DCE	Data Communications Equipment
DM	Diagnostic Monitor
DN	Directory Number
DNI	Do Not Install
DNS	Domain Name Server
DP	Data Port
DRA	Dielectric Resonator Antenna (see ODU)
DSR	Data Set Ready
DTE	Data Terminating Equipment
DTR	Data Terminal Ready
EIRP	Equivalent Isotropic Radiated Power
ESD	Electrostatic Discharge
ESN	Electronic Serial Number
FAX	Facsimile
FCC	Federal Communications Commission

FDX	Full-Duplex
GAI	Globalstar Air Interface
GEO	geostationary-Earth-orbit
GLP	Globalstar Limited Partnership
GMT	Greenwich Mean Time
GND	Ground or Signal Common
GPS	Global Positioning System
GW	Gateway
IMSI	International Mobile Subscriber Identity
IP	Internet Protocol
ISP	Internet Service Provider
IWF	Interworking Function (Gateway)
LCD	Liquid Crystal Display
LEO	low-Earth-orbit
LNA	Low Noise Amplifier
MCC	Mobile Country Code
MCX	Miniature Coaxial Connector
MEO	medium-Earth-orbit
MIK	Modem Integrator's Kit
MNC	Mobile Network Code
MPE	Maximum Permissible Exposure
MSIN	Mobile Station Identification Number
MSS	Mobile Satellite System
NAM	Number Assignment Module
ODU	Outdoor Unit (see DRA)
OEM	Original Equipment Manufacturer
OSPL	Overall Sound Pressure Level
PC	Personal Computer
PDF	Portable Document File
PDT	Pacific Daylight Time

PLS	Position Location Service
POS	Point of Sale; or Position
PPP	Point-to-Point Protocol
PST	Pacific Standard Time
PSTN	Public Switched Telephone Network
PT	Pacific Time
QA	Quality Assurance
RF	Radio Frequency
RFR	Ready For Receive
RI	Ring Indicator
RLSD	Received Line Signal Detector
RMA	Return Material Authorization
RSSI	Received Signal Strength Indicator
RTS	Ready To Send
RTU	Remote Termination Unit
Rx	Receive
RxD	Receive Data
SCADA	Supervisory Control and Data Acquisition
SLIP	Serial Line Internet Protocol
SMA	Subminiature type "A" Connector
SMS	Short Messaging Service
SMT	Surface Mount Technology
SP	Service Provider
SPC	Service Programming Code
TCP	Transmission Control Protocol
TCXO	Temperature Compensated Crystal Oscillator
TSS	Technical Support Specialist
TTL	Transistor Transistor Logic
Tx	Transmit

TxD	Transmit Data
UCT	Universal Coordinated Time
URL	Uniform Resource Locator
UT	User Terminal
UTC	Universal Time Coordinated
UTPST	User Terminal Program Support Tool
VPN	Virtual Private Network
VSWR	Voltage Standing Wave Ratio

Related Documentation

Globalstar UT Program Support Tool User's Guide, 80-98225-1.

Globalstar User Terminal Service Programming Guide, 80-98482-1.

Globalstar UTPST Script API Reference Manual, 80-99114-1.

QUALCOMM Globalstar Data User Guide, 80-99126-1.

QUALCOMM Globalstar Modem Operation Monitor User's Guide, 80-99399-1.

Cautions and Warnings

Warning **Before working with the modem hardware or power connections, remove rings, watches, and other metallic objects that could cause electrical shock or burns.**

Caution Use proper electrostatic discharge (ESD) equipment and procedures to avoid damage to the modem.

Caution Any changes or modifications to this equipment not expressly approved in this document could void your warranty and your authority to operate this equipment.

1 GETTING STARTED

Welcome to the *Integrator's Reference Manual* for the QUALCOMM Globalstar GSP-1620 Satellite Data Modem.

The GSP-1620 modem offers data communication solutions, particularly for Remote Monitoring and Supervisory Control and Data Acquisition (SCADA) applications in locations such as power substations, telecommunication concentration nodes, oil and gas wells, pipes, and offshore facilities.

Whether you are an application developer, system integrator, or Original Equipment Manufacturer (OEM), this *Integrator's Reference Manual* contains information you need.

If you want to:	Go to:
■ Bench-set up, connect, and power-up the GSP-1620 modem in the Modem Integrator's Kit, and get HyperTerminal to talk to the modem	Chapter 2
■ Service-program modems to work with your Service Provider (SP) and within the Globalstar system	Chapter 3
■ Set up your computer for packet data and make a simple packet data call	Chapter 4
■ Develop market-specific application software to work with the GSP-1620 modem (using packet data or asynchronous data)	Chapter 5
■ Understand modem AT commands	Chapter 6
■ Mount GSP-1620 modems and antennas for market-specific OEM products (including all hardware and environmental specifications)	Chapter 7
■ Troubleshoot modem problems	Chapter 8

GSP-1620 Modem Overview

The QUALCOMM Globalstar GSP-1620 Satellite Data Modem delivers reliable digital data communications wherever Globalstar data service is available, using QUALCOMM's patented CDMA technology and the Globalstar Communications System's constellation of 48 low-Earth-orbit (LEO) satellites.

The GSP-1620 modem handles two kinds of data connections:

- *Packet* — over the Internet or other TCP/IP packet-switched network
- *Asynchronous* — routed through the Public Switched Telephone Network (PSTN) to a destination modem

Tip

QUALCOMM Globalstar packet data service has a lower overhead and faster connection time than asynchronous data does. If a SCADA application does not specifically need asynchronous data, it should use packet data instead.

As an OEM, you directly integrate the GSP-1620 modem into a market-specific product, to resell to a business/industrial customer.

Note

For additional information about the Globalstar system, see *Globalstar Background*, page A-1. For information about buying bulk modems from QUALCOMM, contact QUALCOMM Globalstar Customer Service as described in Appendix D.

Typical Modem SCADA Applications

In remote settings or difficult-to-access sites, acquiring and responding to process control and alarm data can be challenging and costly. For both system integrators and OEMs, the QUALCOMM Globalstar GSP-1620 Satellite Data Modem provides real-time, low cost, bi-directional data communication solution applications in remote locations for fixed or mobile use.

The GSP-1620 modem lets you retrieve data automatically from remote sites. Unmanned sensors connected to the GSP-1620 modem can monitor remote operations and initiate alert notifications.

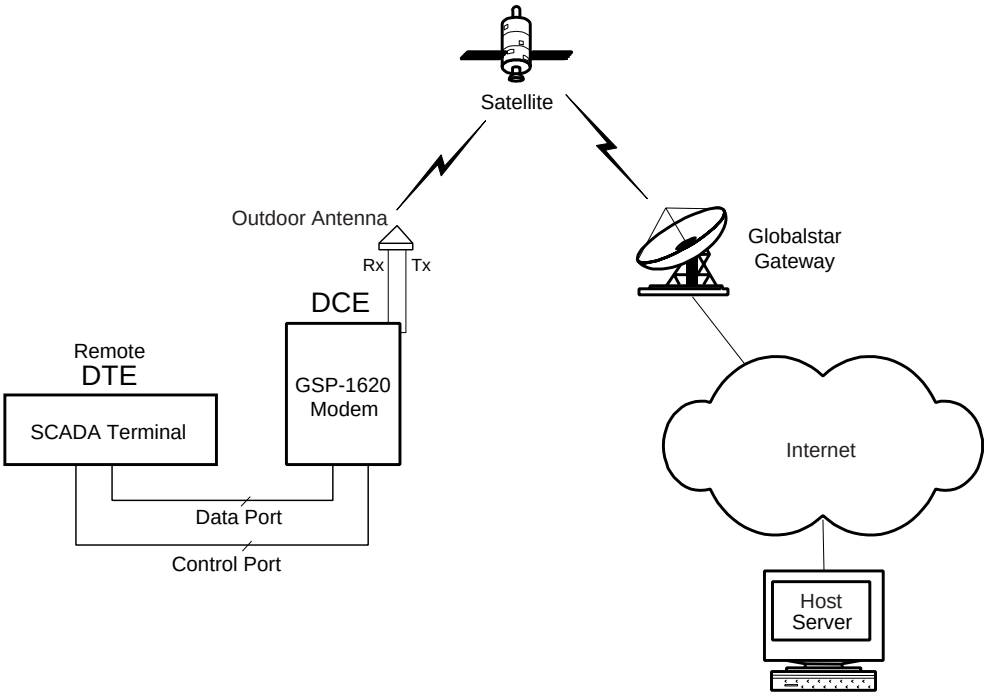
Table 1-1 lists some typical Remote Monitoring and Supervisory Control and Data Acquisition (SCADA) applications.

Table 1-1. Typical GSP-1620 Modem Applications

Electric Utility Industry	Remote Security Systems Monitoring
Oil and Gas Wells, Tanks, Pipelines, Offshore Platforms	Energy Management
Water Treatment Plants	Retail Point of Sale (POS) Transactions
Remote Inventory Management	Remote Banking
Electronic Billboards	Agriculture
Highway Traffic Monitoring	Aircraft Weather/Messaging for Commercial and General Aviation

Figure 1-1 depicts a typical use of the GSP-1620 modem for a SCADA application using packet data.

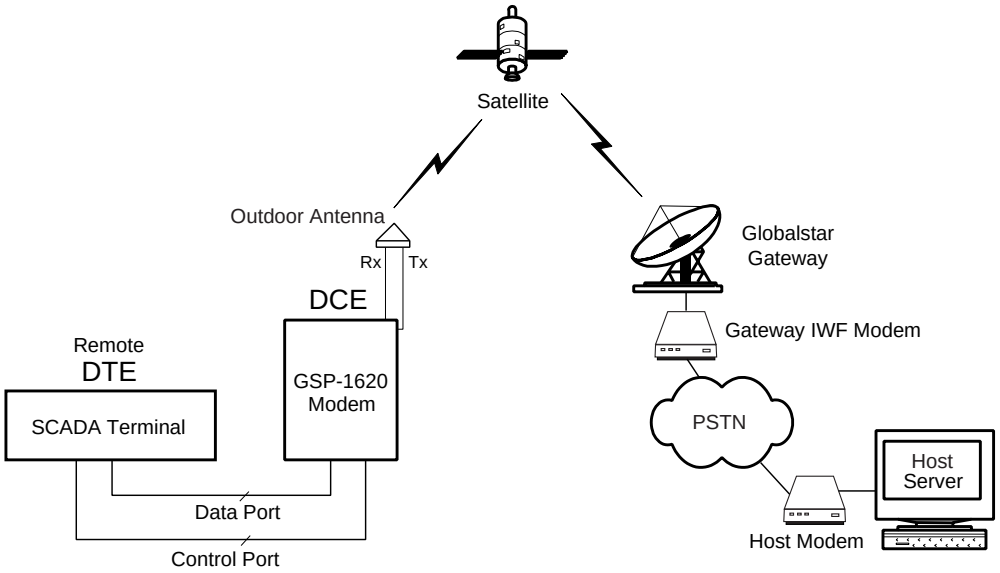
Figure 1-1. Typical Modem SCADA Application Using Packet Data



For packet data connections, the GSP-1620 modem essentially functions as a "node" on the Internet and, with its fixed or dynamically assigned IP address, can be addressed in real time as often as necessary to maintain application control over the remote devices.

Figure 1-2 depicts a typical use of the GSP-1620 modem for a SCADA application using asynchronous data.

Figure 1-2. Typical Modem SCADA Application Using Asynchronous Data



For asynchronous data connections, the GSP-1620 modem can dial or be dialed by a host modem, connecting through the Globalstar Satellite Communications System and the PSTN.

You can think of the GSP-1620 modem in Figure 1-1 and Figure 1-2 as a 9600 bps full duplex satellite modem. The modem uses typical Hayes AT commands (see Chapter 6, *AT Command Reference*). Standard RS-232 interfaces facilitate ease of use and OEM application integration.

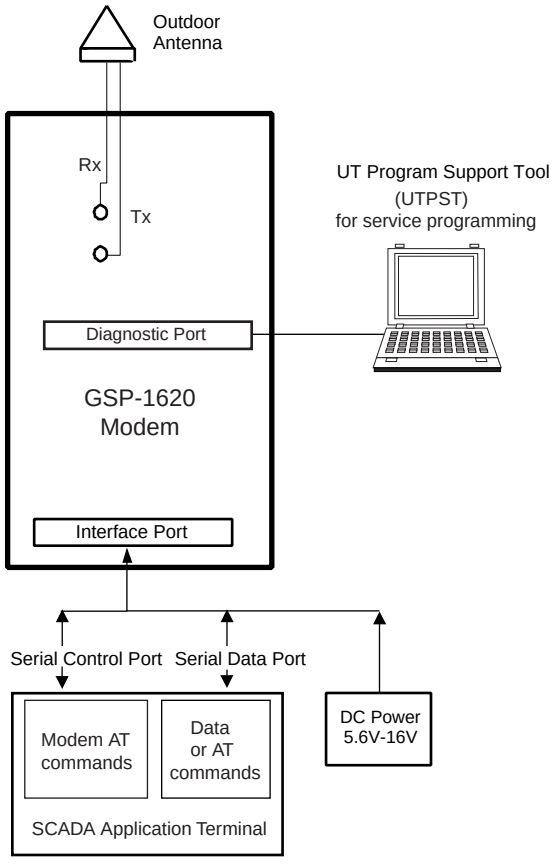
For either packet or asynchronous connections, OEMs provide the host application (server), which uses the GSP-1620 modem to communicate with a custom SCADA application on data terminating equipment (DTE) at a remote site. The host application manages the field processing of data and reports process exceptions, performance reports, alarm conditions—in short, any data needed from the remote site.

For example, in the electric utility industry, a SCADA application using the GSP-1620 modem could remotely turn on a pump, close a switch, open a gate, request a new meter reading, monitor line voltage, or report on power outages.

Conceptual Overview

Figure 1-3 depicts a conceptual overview of the QUALCOMM Globalstar GSP-1620 Satellite Data Modem, including its ports and antenna.

Figure 1-3. Conceptual Diagram of GSP-1620 Modem



The GSP-1620 modem is a bare board "sandwich" stack of Circuit Card Assemblies (CCA) containing two boards:

- Globalstar RF board — includes the LNA, RF power amp, upconverters and downconverters, TCXO, synthesizers, and the remaining power electronics.
- Globalstar Digital board — includes the processor, the modem, and some of the power management electronics.

QUALCOMM offers the GSP-1620 modem without a mechanical enclosure, anticipating that OEMs will integrate and package the modem with the end-user's application.

The GSP-1620 modem operates in the "Globalstar (or satellite) data mode only," as opposed to the GSP-1600 Tri-Mode Phone, which has additional terrestrial cellular (analog and digital) and voice capabilities. The GSP-1620 modem is powered by an external power source provided by the user.

A weatherproof Dielectric Resonator Antenna (DRA), sometimes referred to as an Outdoor Unit (ODU), comes with each modem. OEMs provide antenna cables (SMA to MCX connectors), to meet customer antenna-cable length needs.

A single DB-25 (male) connector is used for the user interface port. The DB-25 carries DC power, as well as the Data and Control RS-232 signals, between the SCADA application (DTE) and the modem (DCE).

A Diagnostic port on the modem allows network provisioning (service programming) and software upgrades.

What's in the Modem Integrator's Kit?

Your GSP-1620 Modem Integrator's Kit (MIK) is designed to help you rapidly develop user applications for GSP-1620 modems.

Table 1-2 shows the items contained in your GSP-1620 Modem Integrator's Kit (QUALCOMM part number: MCN 65-82317-1).

Table 1-2. Checklist of Modem Integrator's Kit Components

✓	Kit Component
	QUALCOMM Globalstar GSP-1620 Satellite Data Modem
	Dielectric Resonating Antenna (DRA)
	Pair of antenna cables with connectors (for quick bench setup of the kit modem)
	Custom DB-25 cable bridle, which splits out the DE-9 Data Port connector, the DE-9 Control Port connector, and the DC power leads (positive, negative, and reset)
	Diagnostic port cable, for service-programming the modem or to use as alternate power source via its AC adapter
	GSP-1620 modem CD-ROM containing the following: ■ Software code samples for modem applications ■ A "soft copy" (PDF file) of this *Integrator's Reference Manual* ■ "CDMA by QUALCOMM" logo in an Encapsulated PostScript (EPS) file ■ A "soft copy" (PDF file) of the *QUALCOMM Globalstar Data User Guide*, 80-99126-1EN, as a guide for the setup of a Windows modem driver and Windows Dial-Up Networking.
	Globalstar UT Program Support Tool (UTPST), including: ■ CD-ROM containing the UTPST software and a "soft copy" (PDF file) of the *Globalstar UTPST Script API Reference Manual*, 80-99114-1 ■ *Globalstar UT Program Support Tool User's Guide,* 80-98225-1 ■ *Globalstar User Terminal Service Programming Guide*, 80-98482-1

What You May Need in Addition to the Kit

The Modem Integrator's Kit should be sufficient for setting up one modem on a bench for development and testing.

For GSP-1620 modem development purposes (bench setup and developing modem applications), it is recommended that you have a Windows PC, because the Modem Integrator's Kit CD-ROM contains some Windows code samples.

If necessary, you can power the modem via the AC adapter on the Diagnostic cable, but you may prefer to use your own DC power supply. Mounting a bench modem and antenna is optional, but would require M3 and M4 screws, respectively, and a screwdriver.

OEMs who are packaging modems into end-user products will need to supply mounting enclosures and customized cables. For details, see *Integrating GSP-1620 Modems into OEM Products* on page 7-1.

Configuration and setup of computer systems to use the GSP-1620 modem with Point-to-Point Protocol (PPP) is beyond the scope of this document. However, the configuration procedures for the QUALCOMM Globalstar GSP-1600 Tri-Mode Phone are included as a reference in the *QUALCOMM Globalstar Data User Guide*, 80-99126-1 (located on the kit's CD-ROM). For example, using the procedures in that document, you can set up a Windows modem driver and Windows Dial-Up Networking. With the proper DNS addresses from your Service Provider (SP) or Internet Service Provider (ISP), you can access the Internet using your GSP-1620 modem via the Globalstar satellite system.

2 QUICK BENCH SET-UP

Your GSP-1620 Modem Integrator's Kit contains a QUALCOMM Globalstar GSP-1620 Satellite Data Modem. This chapter tells how to quickly set up the GSP-1620 modem on a test bench so that you can interact with it, including the following topics:

- Connecting hardware components as appropriate for a bench setup
- Providing power to the modem
- Setting up HyperTerminal to talk to the modem and query its status, using modem AT commands

Keep in mind that the quick bench setup shown in this chapter differs from the setup you might use for developing applications, integrating modems permanently into OEM products, or for field installation.

For example, in the quick bench setup, you communicate with the modem by typing AT commands into HyperTerminal, whereas a SCADA application will communicate with the modem using AT commands embedded within its code.

Also, in the quick bench setup, you can use the cables provided in the kit to connect to the modem ports and antenna, whereas for a SCADA field installation, OEMs will make custom cables.

Note Examples in this chapter assume you are connecting a Windows PC to the modem.

Caution For your safety and to avoid potential damage to the equipment, observe the *Cautions and Warnings* on page xxiv.

Connecting Hardware Components

The setup process for the GSP-1620 modem includes:

- A quick tour of the modem
- Connecting the modem cables
  - Connecting the Interface cable (Data port, Control port, power) to the modem and to your PC
  - Connecting the antenna cables (Tx, Rx) to the modem
  - Connecting the Diagnostic cable (if you want to power the modem from its AC adapter, service-program the modem, or monitor some modem functions)
- Connecting and mounting the antenna
- Mounting the modem (optional)
- Grounding the system
- Providing power to the modem
- Setting up HyperTerminal to talk to the modem and testing your connection

Tip A Windows PC is recommended for modem bench setup and application development. Modems must be service programmed using the Globalstar UT Program Support Tool, which is a Windows software application.

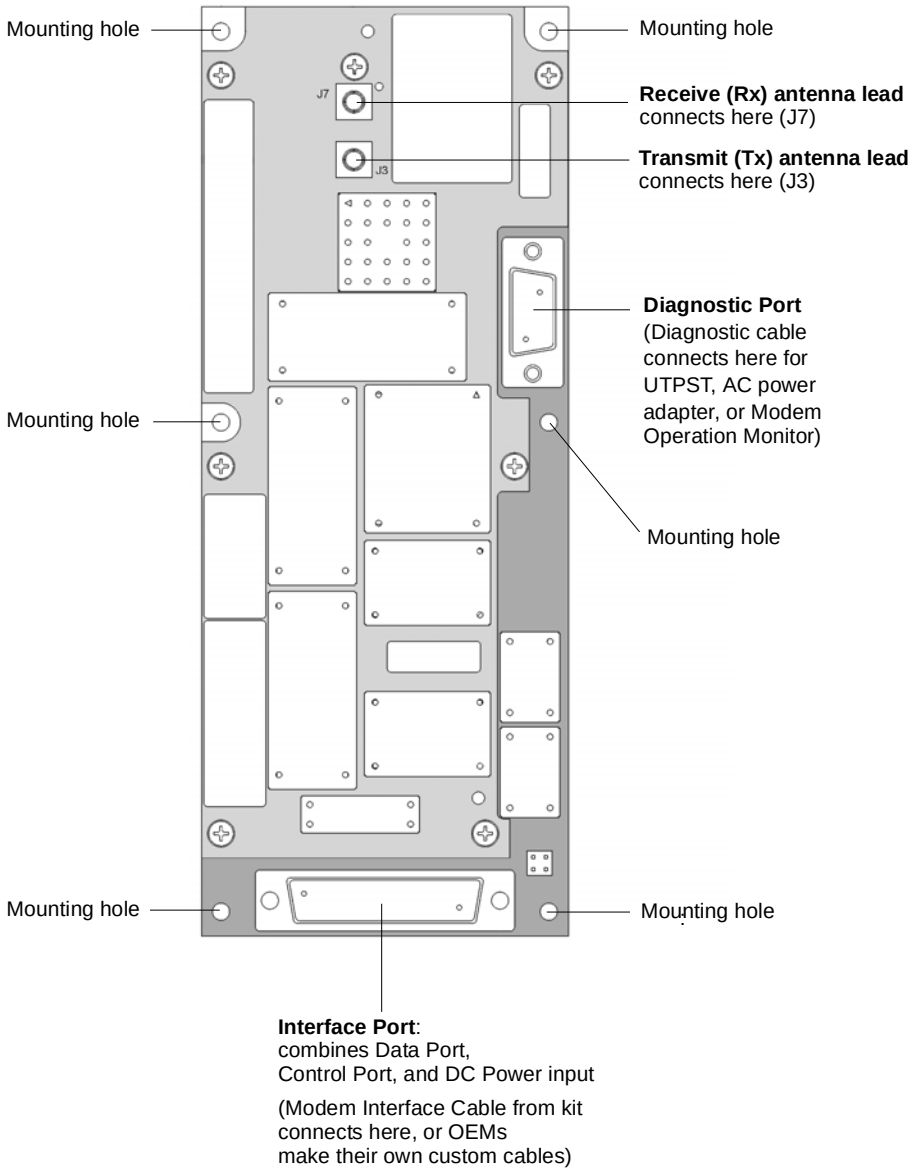
A Quick Tour of the Modem

For quick bench set-up, first remove the GSP-1620 modem from the GSP-1620 Modem Integrator's Kit.

Caution When handling the modem, observe precautions necessary to avoid damage by electrostatic discharge (ESD).

Compare the GSP-1620 modem to Figure 2-1. This illustration shows the connectors and components you will use in the following sections.

Figure 2-1. Simplified Top View of GSP-1620 Modem



Connecting the Modem Cables

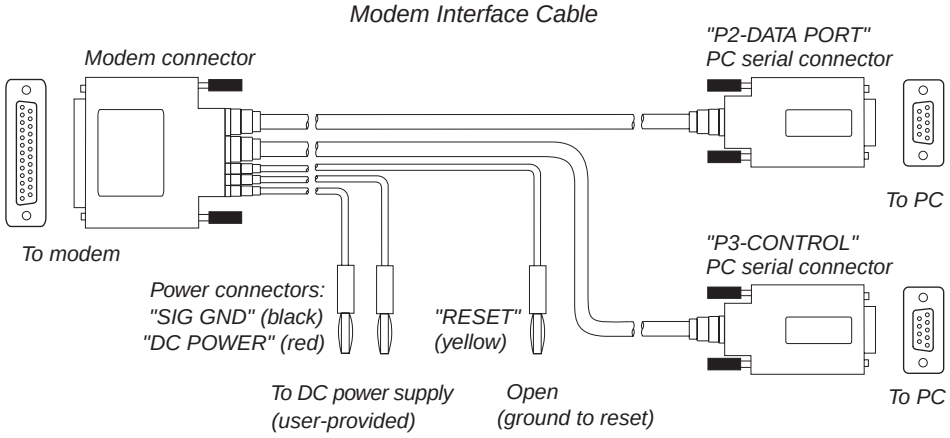
For the GSP-1620 modem to work, you must connect several cables:

- Modem interface cable — connects the Data port to a PC, connects the Control port to a PC (optional), and connects power leads to a DC power supply.
- Antenna cables — connect the transmit (Tx, J3) and receive (Rx, J7) leads to the Tx and Rx connectors on the Dielectric Resonator Antenna.
- Diagnostic cable — connects the Diagnostic port to a PC running the Globalstar UT Program Support Tool (UTPST) for modem service programming, or the QUALCOMM Globalstar Modem Operation Monitor; can also be used as an optional, alternate power supply via its AC adapter.

Connecting the Modem Interface Cable

Your Modem Integrator's Kit includes a custom DB-25 modem interface cable bridle, which connects to the Interface port on the modem. The cable bridle splits out the DE-9 Data Port and DE-9 Control Port, and the DC power connectors (DC POWER, SIG GND, and RESET), as shown in Figure 2-2.

Figure 2-2. Modem Interface Cable Bridle



Steps

TO CONNECT THE INTERFACE CABLE TO THE MODEM

- Connect the DB-25 modem connector on the interface cable (Figure 2-2*)* to the interface port on the modem (Figure 2-1).

  Do not connect power yet.

Steps

TO CONNECT THE INTERFACE CABLES TO YOUR PC

1. On the interface cable (Figure 2-2), connect the Data port connector (labeled “P2-DATA PORT”) to COM 1 or another available serial COM port on your PC.

   The Data port transmits packet (PPP) or asynchronous data. You can also use it to send AT commands to the modem. You will see an example of how this works in Chapter 4.

2. On the interface cable (Figure 2-2), connect the Control port connector (labeled “P3-CONTROL”) to COM 2 or another available serial COM port on your PC (or a different PC, if desired).

   You can use the Control port to send AT commands to the modem, without interrupting data flow on the Data port. You will see an example of how this works in Chapter 4. The Control port can also receive SMS messages; for information, see *Short Messaging Service (SMS)* on page 5-17.

Note

If you need to extend the interface cables to reach your PC(s), you can use straight RS-232 9-pin serial cables (with no crossovers). For maximum RS-232 extension cable lengths, see the TIA/EIA-232-E specification.

Connecting Antenna Cables

The Modem Integrator's Kit contains two antenna cables (3 feet long) with snap-in connectors, for connecting the modem to the Dielectric Resonator Antenna (DRA). The antenna must be located outdoors.

Due to loss constraints on antenna length (see *Calculating Antenna Cable Length* on page 7-27), if you need to extend the kit cables to reach your antenna, it is more practical to locate the modem closer to the antenna and extend the modem's serial cables instead. For a tip on how to do this, see *Connecting and Mounting the Antenna* on page 2-9.

OEMs must supply custom antenna cables for their modem applications.

Caution

Either antenna cable in the developer's kit can be used for transmit or receive; however, you must make sure not to cross them. In other words, be careful to connect the Tx connector on the antenna to the Tx connector (J3) on the modem, and the Rx connector on the antenna to the Rx connector (J7) on the modem. Crossing the Tx and Rx cables can damage the modem.

Steps

TO CONNECT THE ANTENNA CABLES TO THE MODEM

1. Select one antenna cable to be the transmit cable (it does not matter which one).
2. Label both ends of that cable with "Tx." For example, you could write "Tx" on a piece of tape wrapped around each end of the cable.
3. Plug either end of the cable marked "Tx" into the transmit (Tx) connector (**J3**) on the modem, as shown in Figure 2-1.
4. Plug either end of the unmarked cable into the receive (Rx) connector (**J7**) on the modem, as shown in Figure 2-1.

Connecting the Diagnostic Cable

The Diagnostic cable lets you:

- Service-program GSP-1620 modems, using the Globalstar User Terminal Program Support Tool (UTPST). For more information about the UTPST, see *UTPST Overview* on page 3-2.
- Monitor or verify some modem functions, using the QUALCOMM Globalstar Modem Operation Monitor. For more information, see the *QUALCOMM Globalstar Modem Operation Monitor User's Guide*, 80-99399-1.

The cable includes an optional AC adapter. If a DC power supply is not available on your bench, you can power the modem with the AC adapter on the Diagnostic cable.

The Diagnostic cable also includes a switch box that controls whether the cable's DTR (Data Terminal Ready) signal is asserted ("POS 1 DTR to GND") or de-asserted ("POS 2 DTR Open" or "POS 3 Not Used"). When DTR is asserted, the modem powers up immediately if power is provided. Before powering down the modem with this cable attached, you must set this switch to "POS 2" or "POS 3."

Note

On the switch box, "POS 2 DTR Open" and "POS 3 Not Used" are functionally equivalent. Some cables are equipped with a two-position switch box and do not have "POS 3." The switch positions for these cables are "POS 1 DTR to GND" (DTR asserted) and "POS 2 DTR Open" (DTR de-asserted).

Tip

When the Diagnostic cable is connected but you are *not* using the UTPST to service-program the modem, *leave the Diagnostic cable switch in the "POS 2 DTR Open" (de-asserted) position*.

Figure 2-3. Modem Diagnostic Cable

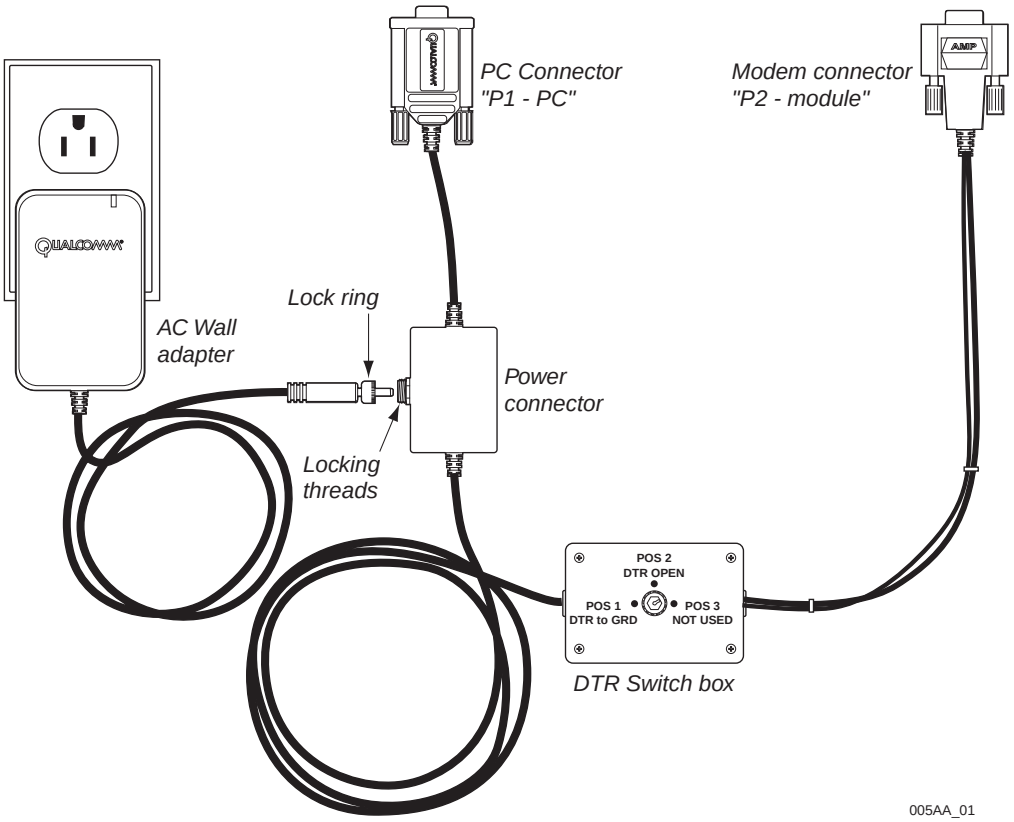


Table 2-1. DTR Switch Positions

Position	Switch Label	Effect
POS 1	DTR to GND	DTR is asserted.
POS 2	DTR Open	DTR is de-asserted.
POS 3	Not Used	DTR is de-asserted (equivalent to POS 2). **Note:** Some cables are equipped with a two-position switch box and do not have "POS 3." The switch positions for these cables are "POS 1 DTR to GND" (DTR asserted) and "POS 2 DTR Open" (DTR de-asserted).

Steps

TO CONNECT THE DIAGNOSTIC PORT CABLE

1. Connect the DE-9 modem connector (“P2-Module”) on the Diagnostic cable (Figure 2-3) to the 9-pin Diagnostic port on the modem (Figure 2-1).
2. Connect the DE-9 PC connector (“P1-PC”) on the Diagnostic cable to a COM port on your computer.
3. Locate the switch on the cable, and set it to “POS 1 DTR to GND.”

   Do not plug in the AC wall adapter yet. For information about powering the modem, see *Providing Power to the Modem* on page 2-12.

Connecting and Mounting the Antenna

The GSP-1620 modem uses a Dielectric Resonator Antenna (DRA) with a passive transmit and an active receive section. The transmit (Tx) and receive (Rx) connectors are labeled on the base of the antenna.

Since the antenna communicates with Globalstar satellites, it must be positioned outdoors where it has a clear view of the sky, unimpeded by tall obstacles such as buildings and trees.

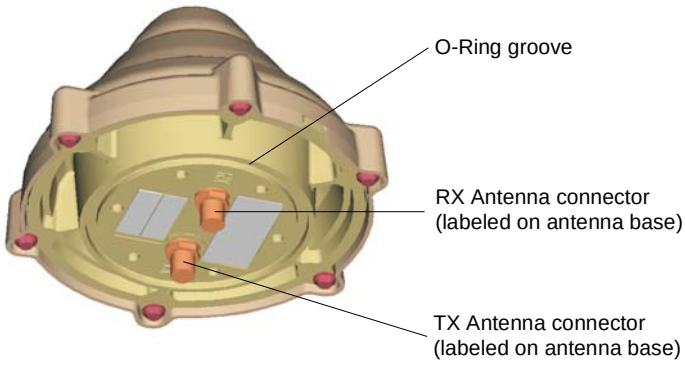
Caution

Antenna cable length is limited, due to insertion loss and potential emission problems. For details, see *Antenna Cable Specifications* on page 7-25 and *Calculating Antenna Cable Length* on page 7-27.

Tip

For a quick setup, you may want to mount the antenna on top of a water-tight box on your roof. Mount the modem inside the box, then run extension cables (straight RS-232 9-pin serial cables with no crossovers) for the power and serial connectors to your indoor bench. (For maximum RS-232 extension cable lengths, see the TIA/EIA-232-E specification.) A box setup lets you use the antenna cables from the kit, without worrying about antenna cable length.

Figure 2-4. Antenna Base Showing Connectors



Steps

TO MOUNT THE ANTENNA

1. Locate the antenna outdoors where it has a clear view of the sky. Make sure the antenna is close enough to the modem that you can use the antenna cables provided in the Modem Integrator's Kit.

   The antenna must have a clear view of the sky to get a strong signal.

2. Plug the antenna cable that you labeled "Tx" into the transmit connector (also labeled Tx) on the antenna (Figure 2-4). Make sure the other end of the cable is connected to the J3 connector on the modem.

Caution

You must be careful to connect the Tx connector on the antenna to the Tx connector on the modem, and the Rx connector on the antenna to the Rx connector on the modem. Crossing the Tx and Rx cables can damage the modem.

3. Plug the other antenna cable into the receive (Rx) connector on the antenna.
4. Secure the antenna to a flat surface using six M4 screws through the six mounting holes. To prevent moisture and dirt from getting underneath the antenna and onto the connectors, you can use an O-ring (2.050 inches in diameter by 0.103 inch wide, silicone or ethylene-propylene) if the mounting surface is smooth, or adhesive caulking if the surface is rough.

Note For complete details about sealing the antenna to a flat mounting surface, or for information about mounting antennas on poles, see *Mounting Antennas at the Field Site* on page 7-27.

Mounting the Modem

For quick bench set-up, you probably do not need to mount the modem to a surface or in an enclosure, as it would be mounted in an OEM product for use in the field.

If you do wish to fasten the modem to a rigid structure, you will need six M3 screws (see mounting holes in Figure 2-1).

For details, see *Modem Mounting Guidelines* on page 7-19. For details on acceptable environmental conditions for the modem, see *Environmental Specifications* on page 7-30.

For a tip on how to mount the modem and antenna using a box, see *Connecting and Mounting the Antenna* on page 2-9.

Grounding the System

You have several options for grounding the modem; see *Grounding* on page 7-18.

Caution The RF connector ground is the same as the signal and power ground. Incorrectly wiring these grounds could cause ground loops in the final installation.

Providing Power to the Modem

The GSP-1620 modem requires input DC power of 5.6 V to 16 V, 1 Amp (maximum), with a maximum of 50 mV peak-peak ripple and noise.

Using the contents of the Modem Integrator's Kit, you can power your bench modem in two ways:

- Use the AC adapter on the Diagnostic cable
- Use an optional DC power supply connected to the Interface cable bridle — this allows you to monitor exact power levels

The use of a fuse is strongly recommended in the DC power supply. A fuse with a minimum melting I^2t rating of 0.02 A^2 seconds will be sufficient. For complete details about DC power requirements and power supply impedances, see *DC Power* on page 7-15.

Tip For a quick bench setup or service programming, consider just using the provided AC adapter to power the modem.

Caution You CANNOT have both a DC power supply and the AC adapter connected to the modem at the same time. This may cause the modem to fail to power up and may damage the modem.

Note The following power-on procedure is suitable for a bench setup. However, if you are developing modem applications, follow the power-on process explained in *Power-On* on page 7-17.

Steps

TO POWER THE MODEM USING THE KIT'S AC ADAPTER

1. On the Modem Interface cable bridle (shown in Figure 2-2), locate the DC POWER (red) and SIG GND (black) connectors. Then electrically isolate each connector by capping or taping it.

   Since you will be using the AC adapter instead of a DC power supply, it is important to isolate the DC power connectors to prevent shock.

2. On the Modem Interface cable bridle (shown in Figure 2-2), locate the RESET lead (yellow). Electrically isolate the RESET lead by capping or taping it.

   The RESET lead is designed to reset the GSP-1620 modem whenever it is grounded for five seconds. Electrically isolating the lead prevents it from grounding and inadvertently resetting the modem.

3. Locate the power connector in the middle of the Diagnostic cable (as shown in Figure 2-3), then plug the the AC wall adapter cable into the power connector.

4. Tighten the lock ring on the adapter cable onto the locking threads of the power connector, so the adapter plug remains firmly seated in the power connector.

   The lock ring prevents the adapter cable and Diagnostic cable from inadvertently disconnecting and interrupting power to the modem.

5. Make sure the switch on the Diagnostic cable is set to "POS 1 DTR to GND."

   When this switch is set to "POS 1 DTR to GND," DTR is asserted on the Diagnostic cable and the modem will power up immediately when power is applied.

6. Plug the AC wall adapter (as shown in Figure 2-3) into an AC power wall outlet.

   You are now ready to use the modem.

Caution

To power off the GSP-1620 modem, set the DTR switch to "POS 2 DTR Open," wait at least 10 seconds, and then disconnect power. Setting the DTR switch to "POS 2" allows the modem to gracefully shut down. If the modem is powered off without allowing it to go through its shutdown sequence, some service programming values may be lost.

Steps

TO POWER THE MODEM USING AN OPTIONAL DC POWER SUPPLY

1. Obtain an optional DC power supply, making sure that it meets the specifications described at the beginning of this section.
2. On the Modem Interface cable bridle (shown in Figure 2-2), locate the RESET lead (yellow). Electrically isolate the RESET lead by capping or taping it.

   The RESET lead is designed to reset the GSP-1620 modem whenever it is grounded for five seconds. Electrically isolating the lead prevents it from grounding and inadvertently resetting the modem.
3. Plug the DC POWER (red) and SIG GND (black) leads from the Modem Interface cable bridle into your DC power source.
4. Turn on the power supply.

   You are now ready to use the modem.

Setting Up HyperTerminal to Talk to the Modem

To talk to the modem you will need HyperTerminal or a similar program on your computer. If you are using an operating system other than Windows, you can use any application that can talk to a serial port.

Note

For bench setup, you probably want to run HyperTerminal on the computer connected to the Control port of the modem. For testing purposes, you can run two different HyperTerminal sessions, one connected to the Control port and one connected to the Data port.

Steps

TO SET UP HYPERTERMINAL AND CONNECT TO THE MODEM

1. Set up HyperTerminal with the correct port and speed information for the appropriate port (or both ports, if you have two HyperTerminal sessions).

   The following are the recommended HyperTerminal settings for the Control and Data ports:

Name	Control port: GSP1620_Control Data port: GSP1620_Data
Connect using	Computer COM port connected to modem Control port or Data port
Bits per second	Control port: 9600 (fixed) Data port: 38400 (default, but can vary from 300 to 115200)
Data bits	8
Parity	None
Stop bits	1
Flow control	Control port: None Data port: Hardware (default and recommended, but can vary from None to Software)

2. In HyperTerminal, click **OK** to accept the settings.

   HyperTerminal automatically attempts to connect to the modem, and the modem powers on when HyperTerminal asserts the RS-232 DTR signal. Once it has connected you should see the following within a few seconds:

   ```
   SELF TEST RESULT: OK
   ```

   Note: The `SELF TEST RESULT` message appears only during modem power-up. If the Diagnostic cable has been connected and its switch is set to "POS 1 DTR to GND," then the modem has already powered up. In that case, proceed to step 3 without waiting for the message.

3. Type `AT` and press **Enter**.

   If the HyperTerminal port connection is correctly configured, the modem should respond with:

   ```
   OK
   ```

Tip You can connect to the modem at any time by clicking HyperTerminal's **Connect** button.

Testing the Modem Setup

To ensure that the modem was set up correctly and that the ports are working, you can check the following:

- Control port baud rate
- Data port baud rate

Steps

TO CHECK THE BAUD RATE ON THE CONTROL PORT

1. Look at the Status bar at the bottom of the HyperTerminal window.

   It should read “9600 8-N-1.” The Control port has a fixed baud rate of 9600. Be sure HyperTerminal is configured accordingly.

2. To confirm that HyperTerminal can communicate with the modem, type `AT` and press **Enter**.

   The modem should respond with:

   `OK`

- Your DTE application decides to answer the call by asserting DP_DTR.

Different operating systems handle the DTR-DCD handshake differently. To configure it appropriately, you can use the AT&D and AT&C commands.

For more information, see *DTE Data Terminal Ready Behavior (&D)* on page 6-16 and *DCE Received Line Signal Detector Behavior (&C)* on page 6-16.

Answering Calls Using the Data and Control Ports

If your DTE application is using both the Data and Control ports, how the call is answered depends on whether DTR is high (asserted) or low (de-asserted) on the two ports:

- DP_DTR asserted — the modem will auto-answer.
- DP_DTR de-asserted but CP_DTR asserted — the modem will not auto-answer, but your DTE application can decide whether to monitor RI and answer calls by raising DP_DTR. On an incoming call, the modem asserts RI on the Data port and displays RING to the Control port.

In this scenario, keeping DTR high on the Control port powers the modem, while allowing you to leave DP_DTR low to prevent auto-answering.

Roaming and Packet Data Service

The GSP-1620 modem is capable of both “fixed” operation in one location (for example, a building, tank, pipeline, or well) or “mobile” operation for applications on trucks, rail cars, aircraft, or shipping containers.

For packet data service, roaming operation has the following characteristics:

- Roaming within a Gateway service area can keep the PPP session up the entire time, using dormant mode.
- Roaming between Gateway service areas is supported. However, there is no hard hand-off capability between

separate Gateways. The PPP session will be dropped and will have to be reestablished by the modem.

- Once on a new Gateway, automatic re-registration will be performed and a new dynamic IP address will be assigned to the modem.
- Roaming support for "fixed" IP addressing outside the "home" Gateway service area is not currently supported. Future design work to allow a DNS server to map IP addresses to IMSIs is envisioned, which would permit worldwide fixed IP address roaming.

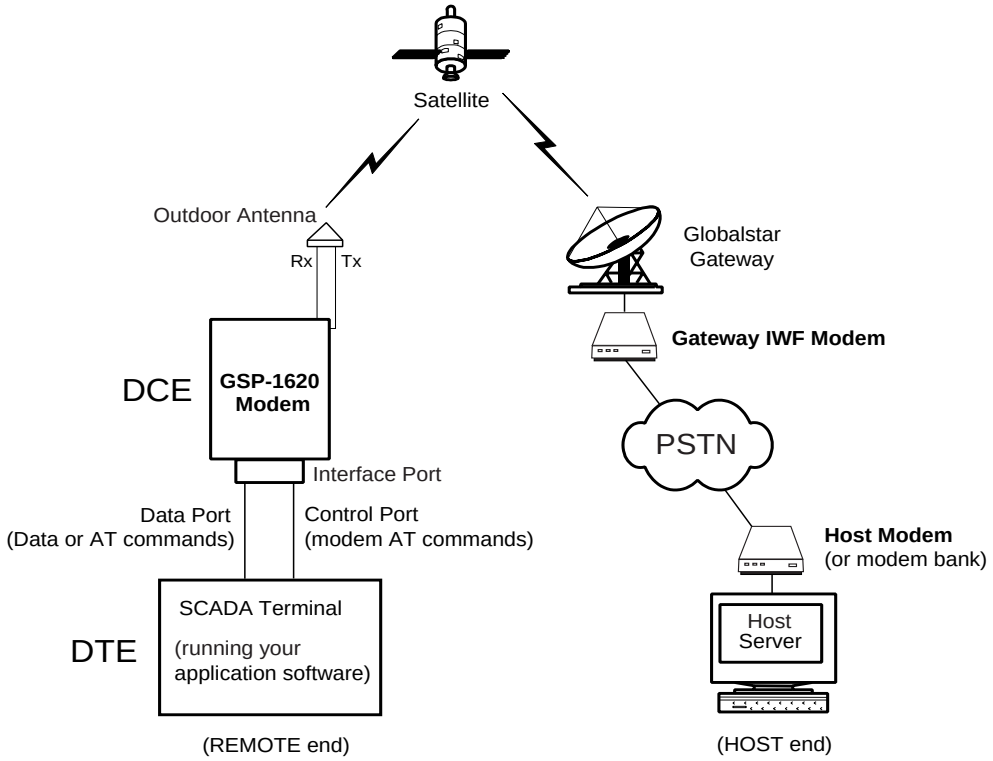
If service alerts are enabled, a service alert is sent out the Data/Control port whenever the Service Provider or Gateway changes. This includes the modem changing from roaming to home service area and vice versa.

Using Asynchronous Data

The GSP-1620 modem lets the application device (DTE) connected to the modem originate or receive an asynchronous data call. It can dial or be dialed by a modem at the host server, connecting through the Globalstar Satellite Communications System and the PSTN.

Figure 5-3 shows the various modems (the GSP-1620 DCE modem, the Gateway IWF modem, and the host modem) and other components involved in an asynchronous data call.

Figure 5-3. Asynchronous Data Call Components



Like most modems, the GSP-1620 modem allows you to customize asynchronous data connections, data compression, and so on. For details, see Chapter 6, *AT Command Reference*.

Note

For a comparison of asynchronous and packet data, see Table 5-1 on page 5-4. For information about packet data service, see *Using Packet Data* on page 5-21.

Data Rate and Throughput

For asynchronous data, the GSP-1620 modem offers full duplex transmit and receive at a Data port rate of somewhat less than packet data's 9600 bps, due to additional overhead for asynchronous data. Similarly, the measured effective "user" throughput (that is, customer data) is somewhat less than the 7400 bps (average) for packet data. Asynchronous connections take longer because of PSTN modem training time.

Tip

QUALCOMM Globalstar packet data service has a lower overhead and faster connection time than asynchronous data does. If your SCADA application does not specifically need asynchronous data, use packet data instead.

Mobile-Originated Asynchronous Data Calls

The GSP-1620 modem lets the application device (DTE) connected to it originate an asynchronous data call.

Steps

TO MAKE A MOBILE-ORIGINATED ASYNCHRONOUS DATA CALL

- Use the `ATD<dial string>` command.

  The modem returns `CONNECT` if the call has been established (for other result codes, see *Dial (D)* on page 6-20).

Steps

TO HANG UP AN ASYNCHRONOUS DATA CALL

1. Enter Online-Command mode by using the in-band control data escape sequence, "`+++`" surrounded by guard time (for details, see *Change from Online to Online-Command Mode (+++)* on page 6-40).
2. Use the `ATH` command.

Note

The `ATH777` command, which hangs up a packet data call and leaves dormant mode active, will also hang up an asynchronous data call.

Note You can also hang up an asynchronous data call by de-asserting DTR. However, if DTR is high on only one port and you then de-assert it, the modem will begin its shutdown sequence.

Mobile-Terminated Asynchronous Data Calls

The GSP-1620 modem lets the application device (DTE) connected to it receive an asynchronous data call. It is the responsibility of the DTE application to keep the modem powered up if it is to receive incoming asynchronous data calls.

Here is what happens during a mobile-terminated asynchronous call:

- The host server directs a host modem to call the GSP-1620 modem (DCE), using the Dial Number (DN) assigned to the GSP-1620 modem by the Service Provider.
- The incoming call toggles RI and displays RING to the appropriate port.
- The `ATA` command tells the GSP-1620 modem (DCE) to answer an incoming call (for details, see *Answer Incoming Call (A)* on page 6-18; also see *Automatic Answer (S0)* on page 6-25).
- How the modem answers the call depends on how the ports are configured. Port behavior for incoming asynchronous calls is the same as for packet calls. For details, see *Answering Calls Using the Data Port Only* on page 5-28 and *Answering Calls Using the Data and Control Ports* on page 5-29.

Accessing Packet Data Over an Asynchronous Connection

Once an asynchronous connection has been established for the GSP-1620 modem, it could be used to access packet data (using protocols such as PPP or SLIP).

If PPP is used on top of asynchronous data service, the DTE would be assigned an IP address. PPP would be required for Internet access using asynchronous data.

Protocols such as Z-modem or Y-modem or other proprietary protocols could be used to transfer data between the GSP-1620 modem and the host modem, without negotiating PPP.

If your SCADA application requires packet data over an asynchronous connection, here are some implementation suggestions:

- For PPP data, contact your Service Provider to obtain necessary account information (whatever you would normally need for an Internet connection, such as an IP address, DNS information, and so on).
- Set up the asynchronous connections for the GSP-1620 modem as described in *Using Asynchronous Data* on page 5-30.
- Use the `AT$QCPKND` command with a value of `2`, to allow mixing packet data calls and asynchronous data calls (for details, see *Packet No Dial ($QCPKND)* on page 6-50).

Roaming and Asynchronous Data Service

The GSP-1620 modem is capable of both “fixed” operation in one location (for example, a building, tank, pipeline, or well) or “mobile” operation for applications on trucks, rail cars, aircraft, or shipping containers.

For asynchronous or “dialed” data service, roaming operation has the following characteristics:

- A host server can call the asynchronous Dial Number and reach the modem, regardless of which Gateway service area it is currently located in (just as voice GSP-1600 Tri-Mode Phones can roam and be reached in any Gateway service area).
- Roaming within a Gateway service area is supported for both mobile-originated and mobile-terminated asynchronous data calls.
- Roaming between Gateway service areas is supported; however, if the modem is in a call when it reaches the edge of a service area, the call will be dropped and must be re-established on the new Gateway.
- Once on a new Gateway, automatic re-registration will be performed and a new data call can be established.
- Fixed (or dynamic) IP addresses are not required for asynchronous data service as they are for packet data service.

If service alerts are enabled, a service alert is sent out the Data/Control port whenever the Service Provider or Gateway changes. This includes the modem changing from roaming to home service area and vice versa.

Typical Modem Initialization Strings

Table 5-5 summarizes some typical GSP-1620 modem initialization strings discussed in this chapter and Chapter 4.

For complete details about these and other initialization strings, see Chapter 6, *AT Command Reference*.

Table 5-5. Sample Typical Modem Initialization Strings

To do this...	Send these commands or strings	Where to find more information
Default all modem settings	`ATZ`	*Reset to Default Configuration (Z)* on page 6-15
Make a packet data call	`ATD#777`	*Dial (D)* on page 6-20
Make an asynchronous data call	`ATD<phone number>`	*Dial (D)* on page 6-20
Make a Markov test call	`ATD#627568`	*Dial (D)* on page 6-20
Make a Loopback test call	`ATD#56672225`	*Dial (D)* on page 6-20
Hang up a packet data call and end dormant mode; or hang up an asynchronous data call	`ATH`	*Hook Control (H)* on page 6-22
Hang up a packet data call but leave dormant mode active; or hang up an asynchronous data call	`ATH777`	*Hook Control (H)* on page 6-22
Check modem status (Globalstar service, signal strength, registration, current call state and so on)	`AT$QCSTATUS`	*Service Status ($QCSTATUS)* on page 6-62
Set up dormant mode (with a 20-second timeout value)	`AT&C0` `AT+CTA=20`	*DCE Received Line Signal Detector Behavior (&C)* on page 6-16; *Set Dormant Mode Timeout Value (+CTA)* on page 6-49
Enable SMS Alerting	`AT$QCSMSA`	*SMS Alert ($QCSMSA)* on page 6-57
Read SMS messages	`AT$QCSMSP`	*SMS Print ($QCSMSP)* on page 6-52

Table 5-5. Sample Typical Modem Initialization Strings (continued)

To do this...	Send these commands or strings	Where to find more information
Enter Online-Command Mode while a data call is progress on the Data port, then re-enter Online mode	+++ (surrounded by guard time) ATO	*Change from Online to Online-Command Mode (+++)* on page 6-40; *Return to Online Data Mode (O)* on page 6-23
Enable Globalstar service alerts	AT$QCSA	*Service Alert ($QCSA)* on page 6-61
Get current position of the modem	AT$QCPLS	*Position Location Service ($QCPLS)* on page 6-66
Allow the modem to mix packet and asynchronous data calls, by handling packets based on the previous dialed data call type	AT$QCPKND=2	*Packet No Dial ($QCPKND)* on page 6-50

6 AT COMMAND REFERENCE

This chapter provides complete details about the AT command set for the QUALCOMM Globalstar GSP-1620 Satellite Data Modem. The AT command set is the control interface between the Data Terminal Equipment (DTE) and Data Communications Equipment (DCE).

For a handy quick reference to all AT commands, see the tables at the beginning of this chapter:

- Table 6-1, “Operational AT Commands” — lists the AT Commands recognized by the modem software.
- Table 6-2, “Non-Operational AT Commands” — lists commands that are recognized, but not supported, by the modem. For example, because the modem has no speaker, the command to set speaker volume will neither set the volume nor return an ERROR. The command is accepted, but performs no action.

Reference sections in this chapter contain complete details for each AT command, organized into the following groups:

- Basic AT Commands (page 6-8)
- Basic Action Commands (page 6-18)
- Basic S-Registers (page 6-24)
- Globalstar-Specific S-Register Extensions (page 6-31)
- Extended Configuration AT Commands (page 6-32)
- Online-Command Mode Commands (page 6-40)
- Dormant Mode Commands (page 6-48)
- SMS Commands (page 6-51)
- Error Log Services Commands (page 6-59)
- Service Status Commands (page 6-61)

- Special Calls and Services Commands (page 6-64)
- Protocol Stack Modification Commands (page 6-70)

Note For details about AT commands supported by the GSP-1600 Tri-Mode Phone, see the *QUALCOMM Globalstar Data User Guide* (80-99126-1).

AT Command Quick Reference Tables

For many commands listed in Table 6-1 and Table 6-2, the entries for "Value Range," "No Value Definition," or "Power-On/Reset Default" have no valid value. These entries have different symbols in place of values:

- A dash "-" character means that, for this command, the value is either not present or not allowed.
- A caret "^" character means that no current value state (or Power-On state) is kept internally.
- An asterisk "*" character means you should consult a footnote for this entry.

Table 6-1. Operational AT Commands

AT Command	Brief Description (reference page)	Value Range	No Value Definition	Power-On/ Reset Default
E	Echo OFF | ON (p. 6-9)	[0-1]	0	1
I	Request Identification Information (p. 6-9)	[0-2]	0	^
Q	Result Code Suppression (p. 6-12)	[0-1]	0	0
V	DCE Response Format (p. 6-13)	[0-1]	0	1
X	Result Code Selection Command (p. 6-14)	[0-4]	0	4
Z	Reset Default Configuration (p. 6-15)	0	0	^
&C	DCE RLSD (DCD) Behavior (p. 6-16)	[0-2]	0	1

Table 6-1. Operational AT Commands (continued)

AT Command	Brief Description (reference page)	Value Range	No Value Definition	Power-On/ Reset Default
&D	DTE DTR Behavior (p. 6-16)	[0-2]	0	2
&F	Set to QUALCOMM-Defined Default Configuration (p. 6-17)	0	0	^
A	Answer Command (p. 6-18)	-	-	-
A/[1]	Repeat Last Command (p. 6-19)	-	-	^
D	Dial (p. 6-20)	*[2]	*[2]	*[2]
H	Hook Control (p. 6-22)	(0, 777)	0	^
O	Return to Online State (p. 6-23)	0	0	^
S0	Auto Answer Ring Count (0 disables) (p. 6-25)	[0-255]	-	0
S3	Command Line Termination Character (p. 6-25)	[0-127]	-	13
S4	Response Format Character (p. 6-26)	[0-127]	-	10
S5	Command Edit Character (p. 6-27)	[0-127]	-	8
S6	Pause Before Blind Dialing Time (p. 6-27)	[2-10]	-	2
S7	Connection Completion Timeout (p. 6-28)	[1-255]	-	50
S8	Comma Dial Modifier Time (p. 6-29)	[0-255]	-	2
S9	Carrier Detect Threshold Timeout (p. 6-29)	[0-255]	-	6
S10	Carrier Loss to Disconnect Timeout (p. 6-30)	[1-255]	-	14
S11	DTMF Tone Duration and Spacing (p. 6-31)	[50-255]	-	95
S777	Silent Retry Timeout (p. 6-31)	[0-255]	-	150
+CMUX	Set Forward MUX Option (p. 6-32)	[1-2]	2	2

Table 6-1. Operational AT Commands (continued)

AT Command	Brief Description (reference page)	Value Range	No Value Definition	Power-On/ Reset Default
+CRM	Rm Interface Protocol Setting (p. 6-33)	[0-1]	0	0
+GSN	Read phone ESN (p. 6-34)	-	-	-
+ICF	Character Framing Settings (p. 6-35)	[(3-3), (0-3)]	3, 3	3, 3
+IFC	Local Flow Control Settings (p. 6-36)	[(0-3), (0-2)]	2, 2	2, 2
+IPR	Rm Interface Baud Rate Setting (p. 6-38)	(300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200)	*[3]	*[4]
~+++~[5]	Direct the DCE to change from online to online-command mode (p. 6-40)	-	-	-
+CFG	Set Remote Config String Command (p. 6-41)	*[6]	*[6]	*[6]
+DS	IWF (Interworking Function) Data Compression Control (p. 6-42)	([0-3], [0-1], [512-65535], [6-250])	3, 0, 2048, 6	3, 0, 2048, 6
+ES	IWF Error Control Selection (p. 6-45)	([0-4], [0-4], [0-6])	3, 0, 2	3, 0, 2
+MS	IWF Modulation Selection (p. 6-47)	*[6]	*[6]	*[6]
+CTA	Dormant Mode Timeout Setting (p. 6-49)	[10-255]	0	0
$QCPKND	Set Packet Data Reconnect Methods (p. 6-50)	[0-2]	0	0
$QCSMSM	SMS list traversal and manipulation (p. 6-51)	([0-3], [0-1])	0,0	-

Table 6-1. Operational AT Commands (continued)

AT Command	Brief Description (reference page)	Value Range	No Value Definition	Power-On/ Reset Default
$QCSMSP	Print formatted information for current SMS message (p. 6-52)	[0-1]	0	-
$QCSMSL	Lock current SMS message (p. 6-56)	[0-1]	1	-
$QCSMSA	Set Alert on new SMS message arrival (p. 6-57)	[0-1]	0	0
$QCSMSI	Send SMS message count information to DTE (p. 6-58)	-	-	-
$QCERR	Send formatted Error Log information to DTE (p. 6-59)	-	-	-
$QCCLR	Clear Error Log (p. 6-60)	-	-	-
$QCSA	Set Alert on Service change (p. 6-61)	[0-1]	0	0
$QCSTATUS	Send formatted Service Status to DTE (p. 6-62)	-	-	-
$QCTOD	Send formatted Time-of-Day to DTE (p. 6-64)	[0-1]	0	-
$QCPLS	Send formatted Position information to DTE (p. 6-66)	([0-1], [0-1])	0,0	-
$QCMSTATS	Send formatted Markov statistics to DTE (p. 6-68)	-	-	-
$QCMODE	Set Mode: Auto, Globalstar (p. 6-69)	[1-4]	1	1[7]
$QCTCP[8]	TCP Stack Changes (p. 6-70)	([0-1][9] [0-1500] [0-1500] [0-1500] [0-120000] [0-120000] [0-1000] [0-6000] [0, 1-100])		0 536 536 536 500 6000 100 6000 0
$QCVJ[8]	Use Van Jacobsen Header Compression (p. 6-73)	[0-1]	1	1

Notes for Table 6-1

[1] The A/ command is a special function that does not require the S3 command terminator character and causes the execution of the previously entered AT command.

[2] See the D command description for details on parameters.

[3] When no parameter value is sent with the +IPR command, the Data port default baud rate of 38400 is assumed.

[4] The default baud rate is set with the +IPR command itself. When the modem is power-cycled, the Data port baud rate is reset to its power-up baud rate stored in non-volatile memory.

[5] The ~ character represents "guard-time" before and after the +++ escape sequence.

[6] This parameter is a quoted string, saved in the modem and downloaded to the Gateway Interworking Function modem when establishing an asynchronous data call.

[7] The modem will always power-on into Auto mode.

[8] This is an advanced AT command. Do not use it if you do not understand what it does.

[9] If <tcpmod> is equal to one, the values in the rest of the variables are put into effect. If <tcpmod> is set to zero, the rest of the values entered into the AT command are ignored, and the default values are restored to the internal variables.

Table 6-2. Non-Operational AT Commands

AT Command	Brief Description (reference page)	Value Range	No Value Definition	Power-On/ Reset Defaul
L	Monitor Speaker Loudness (p. 6-10)	[0-3]	0	^
M	Monitor Speaker Mode (p. 6-11)	[0-2]	0	^
P	Select Pulse Dialing (p. 6-11)	-	-	^
T	Select Tone Dialing (p. 6-13)	-	-	^

AT Commands Overview

Command Alphabet

The ASCII character set is the alphabet used for the AT command set. Only the low order seven bits of each character are considered significant.

Case Sensitivity

Although AT commands are specified in uppercase throughout this *Integrator's Reference Manual*, both uppercase and lowercase are valid. The modem does not distinguish between uppercase and lowercase letters.

Command Line Format

AT command lines are made up of three parts: the prefix, the body, and the termination character.

The command line prefix consists of the letters `AT`. The command line prefix is followed by the body, which consists of one or more AT commands. Command syntax for each specific AT command within the body is as specified in this document, for example, `E` or `$QCSTATUS`.

Space characters can be used freely within the body for formatting purposes. Command lines are terminated with the termination character specified by S-register `S3` (see *Command Line Termination Character (S3)* on page 6-25). The default value of `S3` is the carriage return character `<CR>` (ASCII value of 13 decimal).

You can use an alternate command line prefix, which causes the previously entered command line (body and terminator) to be executed. This command line prefix consists of the letters `A/`.

Note No terminator is required after entering the `/` character to begin command line execution.

Command Syntax

For AT command syntax in this chapter, the following definitions apply:

- Words enclosed in <angle brackets> identify parameters that can be specified as part of the command.
- Syntactical elements enclosed in [square brackets] are optional and may be omitted from the command line.
- Syntactical elements enclosed in {brackets} are required and must be specified as part of the command.
- The use of | between syntactical elements indicates that only one of the elements may be specified as part of the command. For example, the command syntax for S3{=<value>|?} must be either S3=<value> or S3?.
- The + and $ characters are used to identify extended AT commands. + and $ denote standard and manufacturer-specific extended commands respectively.
- A semicolon (;) is used to concatenate additional commands (basic or extended) after an extended command.

Basic AT Commands

This section defines the basic AT commands that the GSP-1620 modem currently supports and the functionality provided by each. For all basic AT commands that require a <value> parameter, if <value> is not present then a 0 is assumed by the receiver.

The basic AT commands described in this section return one of two possible result codes, which are listed in Table 6-3. Any commands with exceptions to this have separate result code tables in their sections.

Results Returned

Table 6-3. Result Codes for Basic AT Parameter Commands

Result Code	Condition
OK	The command was correctly recognized and processed with any required <value> being set.
ERROR	The command was unrecognized, the <value> parameter was out of range, or some syntactical error was encountered.

Command Echo (E)

Syntax

E[<value>]

Description

Determines whether or not the DCE echoes characters received from the DTE during the Command and Online-Command modes.

Valid Values

0	DCE does not echo characters.
1	DCE echoes characters.

Power-On/Reset Default Value(s)

1

Results Returned

OK or ERROR; see Table 6-3 on page 6-9 for details.

Get Info (I)

Syntax

I[<value>]

Description

This read-only command returns three different manufacturer information strings, depending on the <value> of the parameter sent.

Valid Values

0	MODEL NUMBER: 205
1	MODEL: GSP-1620 Satellite Data Modem
2	BUILD: <associated software build string (version information)>

Power-On/Reset Default Value(s)

None.

Results Returned

OK or ERROR; see Table 6-3 on page 6-9 for details.

Monitor Speaker Loudness (L)

Syntax

L[<value>]

Description

Controls the DCE speaker loudness. The modem has no concept of a monitor speaker. Therefore, this command is recognized, but does nothing.

Valid Values

0	Lowest speaker volume
1	Low speaker volume
2	Medium speaker volume
3	High speaker volume

Power-On/Reset Default Value(s)

None.

Results Returned

OK or ERROR; see Table 6-3 on page 6-9 for details.

Monitor Speaker Mode (M)

Syntax

```
M[<value>]
```

Description

Controls when the DCE speaker is on. The modem has no concept of a monitor speaker. Therefore, this command is recognized but does nothing.

Values

0	Speaker is always off and never turned on.
1	Speaker on until carrier has been detected.
2	Speaker is always on when OFF-Hook.

Power-On/Reset Default Value(s)

None.

Results Returned

OK or ERROR; see Table 6-3 on page 6-9 for details.

Select Pulse Dialing (P)

Syntax

```
P
```

Description

Causes subsequent dialed digits to be signaled using pulse dialing. This command is recognized but does nothing.

Valid Values

None.

Power-On/Reset Default Value(s)

None.

Results Returned

OK or ERROR; see Table 6-3 on page 6-9 for details.

Result Code Suppression (Q)

Syntax

```
Q[<value>]
```

Description

Determines whether or not result codes are transmitted from the modem (DCE) to the DTE. When result codes are suppressed, no result is transmitted to the DTE.

Note Because the modem depends on the CONNECT result code returned by the Gateway IWF (for asynchronous data calls), this command is not transmitted as part of the remote configuration.

Valid Values

0	DTE transmits result codes.
1	Result codes are suppressed and not transmitted.

Power-On/Reset Default Value(s)

0

Results Returned

Result Code	Condition
OK	The command was correctly recognized and processed with any required <value> being set.
ERROR	The command was unrecognized, the <value> parameter was out of range or some syntactical error was encountered.
(none)	No result codes are transmitted when <value> is set to 1.

Select Tone Dialing (T)

Syntax

T

Description

Causes subsequent dialed digits to be signaled using DTMF tones. This command is recognized but does nothing.

Valid Values

None.

Power-On/Reset Default Value(s)

None.

Results Returned

OK or ERROR; see Table 6-3 on page 6-9 for details.

DCE Response Format (V)

Syntax

V[<value>]

Description

Determines the contents of the DCE header and trailer transmitted to the DTE with result codes and information responses. It also determines whether result codes are transmitted in numeric or alphabetic format. The text portion of information responses is not affected by the setting of this parameter.

The following table shows the effect of setting this parameter on the format of information text and result codes. The values <S3> and <S4> represent the ASCII value of the S3 and S4 registers respectively.

	V0	V1
Information Responses	<text><S3><S4>	<S3><S4> <text><S3><S4>
Result Codes	<numeric code><S3>	<S3><S4><verbose code><S3><S4>

Values

0	DCE transmits limited headers and trailers and numeric result codes.
1	DCE transmits full headers and trailers and alphabetic result codes.

Power-On/Reset Default Value(s)

1

Results Returned

OK or ERROR; see Table 6-3 on page 6-9 for details.

Result Code Selection Command (X)

Syntax

X[<value>]

Description

Determines whether or not the DCE transmits particular result codes to the DTE when connecting asynchronous data services. This command is recognized but does nothing locally. Normally it controls whether or not the DCE verifies the presence of dial tone and/or busy signal on the line. However, it is used only to allow a non-default value to be sent to the Gateway IWF modem.

Values

0	CONNECT result code is given upon entering online data state. Dial tone and busy detection are disabled.
1	CONNECT <text> result code is given upon entering online data state. Dial tone and busy detection are disabled.
2	CONNECT <text> result code is given upon entering online data state. Dial tone detection is enabled, and busy detection is disabled.
3	CONNECT <text> result code is given upon entering online data state. Dial tone detection is disabled, and busy detection is enabled.
4	CONNECT <text> result code is given upon entering online data state. Dial tone and busy detection are both enabled.

Note In result codes, <text> is defined by the modem hardware and is not user-specifiable.

Missing Parameter Default Value(s)

0

Power-On/Reset Default Value(s)

4

Results Returned

OK or ERROR; see Table 6-3 on page 6-9 for details.

Reset to Default Configuration (Z)

Syntax

Z[<value>]

Description

Sets all modem (DCE) parameters to their factory defaults, *except* the Rm interface baud rate (set via the +IPR command) and the modem call mode (set via the $QCMODE command). Factory defaults are specified by QUALCOMM.
If the modem is in Online mode, the data call is terminated and the modem returns to Command mode. See *Set to Factory-Defined Configuration (&F)* on page 6-17 for more details on resetting the default baud rate and mode.

Values

0	Resets parameters to their factory defaults.

Power-On/Reset Default Value(s)

None.

Results Returned

OK or ERROR; see Table 6-3 on page 6-9 for details.

DCE Received Line Signal Detector Behavior (&C)

Syntax

```
&C[<value>]
```

Description

Defines how the DCE controls RLSD (circuit 109) in relation to detection of the received line signal from the far end.

Valid Values

0	DCE always places RLSD in ON state.
1	DCE places RLSD in ON state when connection is active and places in OFF state otherwise.
2	DCE winks RLSD by briefly placing RLSD in the OFF state and then back ON when a data call ends. This is a QUALCOMM-specific value.

Power-On/Reset Default Value(s)

1

Results Returned

OK or ERROR; see Table 6-3 on page 6-9 for details.

DTE Data Terminal Ready Behavior (&D)

Syntax

```
&D[<value>]
```

Description

Defines how the modem (DCE) responds when the DTE changes DTR (circuit 108/2) from ON to OFF state when a connection is active.

Valid Values

0	DCE ignores DTR state.
1	DCE transitions to from Online to Online-Command mode when DTR transitions from ON-to-OFF.
2	DCE closes connection (terminates call) when DTR transitions from ON-to-OFF.

Power-On/Reset Default Value(s)

2

Results Returned

OK or ERROR; see Table 6-3 on page 6-9 for details.

Set to Factory-Defined Configuration (&F)

Syntax

&F[<value>]

Description

Instructs the modem (DCE) to set all parameters to their QUALCOMM-defined defaults. This command performs the same operation independent of whether or not <value> is specified. QUALCOMM-defined defaults are the default values for each AT command specified in this chapter.

This command sets the modem baud rate to its power-on/reset default value (see *Set Rm Interface Command Baud Rate (+IPR)* on page 6-38), but does not reset the $QCMODE value to its power-on/reset value. (Compare the behavior of the Z command, *Reset to Default Configuration (Z)* on page 6-15.)

If the modem is in Online-Command mode, the data call is released and the modem returns to Command mode.

Valid Values

0	Resets modem parameters, except <call mode> (set via $QCMODE), to their default values.

Power-On/Reset Default Value(s)

None.

Results Returned

OK or ERROR; see Table 6-3 on page 6-9 for details.

Basic Action Commands

This section defines the basic AT action commands for the modem and the functionality provided by each.

Answer Incoming Call (A)

Syntax

A

Description

Instructs the GSP-1620 modem (DCE) to answer an incoming asynchronous data call. The modem establishes a connection with the Gateway IWF modem, transmits appropriate configuration data to the Gateway IWF modem, sends the A command to the Gateway IWF modem, telling it to connect to the host modem, and waits for the CONNECT (or other) result code.

Note Any additional commands that appear after the A command on the same command line are ignored.

Note This command can be aborted by DCE reception of any character on the Rm interface. The command is aborted only if the DCE receives the character prior to establishing the connection and sending the CONNECT result code.

Results Returned

Result Code	Description
OK	Command is aborted either by reception of an additional character from the DTE or by the DTE turning off DTR (circuit 108) for &D1 and &D2. Also returned if there is no incoming call to answer.
CONNECT	Connection is successfully established (call is active on traffic channel). This result code is transmitted when the DCD (circuit 109) is turned on.
NO CARRIER	The connection could not be established; service not activated, call cannot be completed, or service unavailable.
ERROR	Command was issued in Online-Command mode.

Repeat Last Command (A/)

Syntax

A/

Description

Although this is technically an AT command prefix and not an AT command, it is listed in the command section for easy reference.

This prefix repeats execution of the last command line entered. If no command was entered previous to entering this command, the previous command line is considered to be empty and no action is taken.

Note

Previous command line execution begins immediately after / is entered. It is not necessary to enter a termination character (carriage return; see *Command Line Termination Character (S3)* on page 6-25 for details) to begin execution of the previous command line body.

Results Returned

Result Code	Condition
OK	Previous command line is empty.
Result from re-execution of the previous command line.	Previous command line is not empty.

Dial (D)

Syntax

```
D<dial string>
```

Description

Originates a call if the dial string is valid.

Note

This command can be aborted by DCE reception of any character on the Rm interface. This command is aborted only if the DCE receives the character prior to establishing the connection and sending the CONNECT result code. The dial command can also be aborted by setting the DTR line from active to inactive when &D2 is set.

Valid Dial Strings

The dial string must be made up of valid dial string characters and dial modifiers. Valid dial string characters are:

```
#*0123456789ABCD
```

Valid dial string modifiers are

```
W,!@$TP
```

Valid dial string modifiers may be included in the dial string, although they will be ignored. Any other characters within the dial string that are not recognized as dial string characters or dial string modifiers by the DCE will be ignored. This allows characters such as hyphens and parentheses to be used in the dial string for phone number formatting purposes.

The modem supports packet data, asynchronous data, Markov, and Loopback calls. If the dial string contains one of the dial numbers listed below in Dial String Values, a packet

data, Markov, or Loopback call is initiated. All other valid dial numbers, except dial numbers 1-99, initiate an asynchronous data call and return the result code of the Gateway IWF modem.

Dial numbers 1-99 correspond to phone book entries and are translated into dial numbers stored in the specified location. If the specified phone book location is unused, no call is attempted and `NO DIALTONE` is returned. If the phone book entry exists, a call is attempted using the dial number stored. Valid phone book entries include the Dial String Values listed below.

If `ATD` is entered by itself, then the modem attempts to call the previously called number (from the call history) if one exists.

Dial string modifiers and unrecognized characters included in this dial string are ignored as stated above.

Dial String Values

`#777`	Originate a packet data call.
`#627568`	Originate a Markov call.
`#56672225`	Originate a Loopback call.

Results Returned

Result Codes	Description
`CONNECT`	Connection is successfully established (call is active on traffic channel).
`NO CARRIER`	Service not activated — call cannot be completed, service unavailable, or user has released dial command.
`NO DIALTONE`	Service not available — modem is not configured for service. Also returned if a mobile-terminated call (which sends unsolicited result code `RING` to the DTE) is answered with a `D<dial string>` command.

Result Codes	Description
BUSY	The modem is currently on traffic and cannot originate a call, the called party is busy, or the IWF returned busy.
NO ANSWER	Returned only if the IWF modem (for asynchronous data calls) returns NO ANSWER.
ERROR	Invalid dial string received or a packet data call is already active.

Hook Control (H)

Syntax

H[<value>]

Description

Controls the "Hook State" of the modem. Going "ON-Hook" (H, H0 or H777) while in Online-Command mode is used to terminate an active data or test call. The "OFF-Hook" state is not recognized by the modem, so H1 returns an ERROR result code.

The data call can be terminated in two ways: either in Online-Command mode using the H command, or in Online mode when the DTE sets its DTR line (circuit 108/2) inactive. The modem must be configured with &D2 to allow the DTE to terminate a packet data call using DTR.

Note

H777 is used to release a packet data call and have the Gateway put the call into dormant mode. Dormant mode is not supported for asynchronous data calls. Therefore, for an asynchronous call, H777 will return an OK result code and release the data call, but will not attempt to go into dormant mode.

Valid Value(s)

0	Terminates the data call and returns to Command mode.
777	Terminates the data call as above, but instructs the Gateway to transition into dormant mode for packet data calls.

Missing Parameter Default Value(s)

0

Power-On/Reset Default Value(s)

N/A

Results Returned

See Table 6-3 on page 6-9 for details.

Return to Online Data Mode (O)

Syntax

O[<value>]

Description

Returns the modem to Online mode from Online-Command mode.

Valid Value(s)

0	If in Online-Command mode, this command returns the phone to Online mode. Otherwise, the command returns NO CARRIER and takes no further action.

Missing Parameter Default Value(s)

0

Power-On/Reset Default Value(s)

N/A

Results Returned

Result Code	Condition
CONNECT	The command was correctly recognized and processed and the transition from Online-Command to Online mode was successful.
NO CARRIER	The command was correctly recognized and processed, but the connection was not successfully resumed.
ERROR	The command was not recognized, the <value> parameter was out of range or some syntactical error was encountered.

Basic S-Registers

This section defines the basic S-registers for the modem and the functionality provided by each. Table 6-4 lists the result codes common to all recognized S-register commands.

Results Returned

Table 6-4. Common Result Codes for S-Register Commands

Result	Condition
OK	The <value> sent was recognized and supported. <value> is now the new value for the specified S-register.
ERROR	<value> is not recognized. The command is ignored and the specified S-register is left unchanged.
<value> OK	Sx? is used to query S-register x's current setting.

Automatic Answer (S0)

Syntax

S0{=<value>|?}

Description

The S0 parameter sets the number of rings before the modem will auto-answer an incoming asynchronous data call.

Valid Value(s)

0	Automatic answering is disabled.
1-255	Number of rings before an incoming asynchronous call is automatically answered.

Missing Parameter Default Value(s)

N/A

Power-On/Reset Default Value(s)

0

Results Returned

See Table 6-4 on page 6-24 for result code details.

Command Line Termination Character (S3)

Syntax

S3{=<value>|?}

Description

Represents the value of the character recognized by the modem as the command line termination character. When the modem receives a command line from the DTE, this character indicates termination of the command line. This character is also transmitted by the modem to terminate the result code.

If this value is changed in the command line, the response to that command line will use the new value.

Valid Value(s)

0–127	Range of ASCII characters that can be set as the command termination character

Missing Parameter Default Value(s)

N/A

Power-On/Reset Default Value(s)

13	Carriage Return character

Results Returned

See Table 6-4 on page 6-24 for result code details.

Response Formatting Character (S4)

Syntax

S4{=<value>|?}

Description

Represents the value of the character transmitted as part of the response to commands. It is used in formatting the response and follows the S3 character in responses when V1 is in effect.

If this value is changed in the command line, the response to that command line will use the new value.

Valid Value(s)

0–127	Range of ASCII characters that can be set as the command result code termination character

Missing Parameter Default Value(s)

N/A

Power-On/Reset Default Value(s)

10	New Line character

Results Returned

See Table 6-4 on page 6-24 for result code details.

Command Line Editing Character (S5)

Syntax

```
S5{=<value>|?}
```

Description

Represents the value of the character recognized by the modem as the backspace character. When the modem receives this character, it interprets it as a request to delete the previous character in the command line currently being entered.

Valid Value(s)

0–127	Range of ASCII characters that can be set as the line editing (backspace) character

Missing Parameter Default Value(s)

N/A

Power-On/Reset Default Value(s)

8	Backspace character

Results Returned

See Table 6-4 on page 6-24 for result code details.

Pause Before Blind Dialing Time (S6)

Syntax

```
S6{=<value>|?}
```

Description

Represents the amount of time the DCE waits before dialing a valid Dial Number.

This parameter is valid only for asynchronous data services. It is sent to the Gateway IWF modem if different from the default value but is otherwise not used by the modem.

Valid Value(s)

2–10	Number of seconds to wait before blind dialing

Missing Parameter Default Value(s)

N/A

Power-On/Reset Default Value(s)

2	seconds

Results Returned

See Table 6-4 on page 6-24 for result code details.

Connection Completion Timeout (S7)

Syntax

```
S7{=<value>|?}
```

Description

Specifies the number of seconds to establish an end-to-end data connection. The modem will disconnect the line if no connection is established within this time. See *Silent Retry Timeout (S777)* on page 6-31 for similar (Globalstar-specific) control.

This parameter is valid only for asynchronous data services. It is sent to the Gateway IWF modem if different from the default value but is otherwise not used by the modem.

Valid Value(s)

1-255	Number of seconds to establish a connection or call will be disconnected

Missing Parameter Default Value(s)

N/A

Power-On/Reset Default Value(s)

50	seconds

Results Returned

See Table 6-4 on page 6-24 for result code details.

Comma Dial Modifier Time (S8)

Syntax

```
S8{=<value>|?}
```

Description

Specifies the amount of time, in seconds, that the modem pauses, during dialing, when a "," (comma) is encountered in the dial string.

This parameter is valid only for asynchronous data services. It is sent to the Gateway IWF modem if different from the default value but is otherwise not used by the modem.

Valid Value(s)

0	Disabled. Modem does not pause when "," is encountered.
1-255	Number of seconds to pause.

Missing Parameter Default Value(s)

N/A

Power-On/Reset Default Value(s)

2	seconds

Results Returned

See Table 6-4 on page 6-24 for result code details.

Carrier Detect Threshold Timeout (S9)

Syntax

```
S9{=<value>|?}
```

Description

Specifies the amount of time, in 0.1 second increments, that the modem should wait before dropping DCD after the signaling carrier is lost.

This parameter is valid only for asynchronous data services. It is sent to the Gateway IWF modem if different from the default value but is otherwise not used by the modem.

Valid Value(s)

0	Disabled
1-255	Number of tenths of a second delay

Missing Parameter Default Value(s)

N/A

Power-On/Reset Default Value(s)

6	tenths of a second

Results Returned

See Table 6-4 on page 6-24 for result code details.

Carrier Loss to Disconnect Timeout (S10)

Syntax

S10{=<value>|?}

Description

Specifies the amount of time, in 0.1 second increments, that the DCE will remain connected before dropping DCD after the signaling carrier is lost.

This parameter is valid only for asynchronous data services. It is sent to the Gateway IWF modem if different from the default value but is otherwise not used by the modem.

Valid Value(s)

1-254	Number of tenths of a second to wait
255	Disable timeout

Missing Parameter Default Value(s)

N/A

Power-On/Reset Default Value(s)

14	tenths of a second

Results Returned

See Table 6-4 on page 6-24 for result code details.

DTMF Tone Duration and Spacing (S11)

Syntax

```
S11{=<value>|?}
```

Description

Specifies the duration and spacing, in milliseconds, of DTMF tones while dialing a valid number.

This parameter is valid only for asynchronous data services. It is sent to the Gateway IWF modem if different from the default value but is otherwise not used by the modem.

Valid Value(s)

50–255	Number of milliseconds of delay

Missing Parameter Default Value(s)

N/A

Power-On/Reset Default Value(s)

95	milliseconds

Results Returned

See Table 6-4 on page 6-24 for result code details.

Globalstar-Specific S-Register Extensions

This section defines the GSP-1620 modem-specific S-register extensions for the modem and their functionality.

Silent Retry Timeout (S777)

Syntax

```
S777{=<value>|?}
```

Description

Represents the duration of the “call origination silent retry timer.” This specifies the amount of time (in seconds) the modem will attempt to originate a call before giving up and performing reacquisition of the Globalstar system.

Valid Value(s)

0–255	Silent-Retry timeout in seconds

Missing Parameter Default Value(s)

N/A

Power-On/Reset Default Value(s)

150	seconds

Results Returned

See Table 6-4 on page 6-24 for result code details.

Extended Configuration AT Commands

This section defines the extended AT configuration commands for the modem and the functionality provided by each.

Set Forward MUX Option (+CMUX)

Syntax

`+CMUX[=<value>|?|=?]`

Description

Sets the modem's multiplex option for packet data calls. The multiplex option selects the requested rateset for IS-95 calls. This command affects IS-95 packet data calls only. This command does not apply to Globalstar mode, which can only operate at 9600 baud.

`+CMUX?` queries the current `<mux>` setting. `+CMUX=?` queries for the acceptable range of `<value>`.

Valid Value(s)

1	Selects IS-95 rateset 1. This is roughly equivalent to 9600 baud.
2	Selects IS-95 rateset 2. This is roughly equivalent to 14.4K baud.

Missing Parameter Default Value(s)

2

Power-On/Reset Default Value(s)

2

Results Returned

Result	Condition
OK	A valid <value> was received and processed.
ERROR	<value> is not supported.
+CMUX:<value> OK	? is used to query current setting.
+CMUX: (1-2) OK	=? is used to query acceptable range of <value> parameter.

Set Rm Interface Protocol (+CRM)

Syntax

+CRM[=<value>|?|=?]

Description

Sets the Rm interface protocol. When no <value> is specified, <value> is assumed to be 1.

+CRM? queries for the current setting of the <value>.

+CRM=? queries for the acceptable range of <value>.

Valid Value(s)

0	Asynchronous Data Services
1	Packet Data Services

Missing Parameter Default Value(s)

0

Power-On/Reset Default Value(s)

0

Results Returned

Result	Condition
OK	A valid <value> was received and processed.
ERROR	<value> is not supported.
+CRM:<value> OK	? is used to query current setting.
+CRM: (0-1) OK	=? is used to query acceptable range of <value> parameter.

Get Modem User Terminal ESN (+GSN)

Syntax

+GSN[=<value>|?|=?]

Description

This read-only command returns the modem's ESN only when the bare command (AT+GSN) is entered. All other legal syntax forms simply return an OK result code.

Valid Value(s)

N/A. This parameter is read only.

Missing Parameter Default Value(s)

N/A.

Power-On/Reset Default Value(s)

N/A.

Results Returned

Result	Condition
+GSN: OK	This is considered the OK response for any legal syntax that does not return the phone's ESN.
ERROR	An illegal syntax was entered.
+GSN: <Hex ESN> OK	ESN is all uppercase Hex character with no 0x prefix, or h or H suffix.

Set Character Framing (+ICF)

Syntax

`+ICF[=<format>|=[<format>],[<parity>]|?|=?]`

Description

Sets the modem local serial port asynchronous character framing (start/stop bits) used for transmitting and receiving information between modem and DTE on the Data port of the Rm interface.

Note

This command has no effect on the configuration of the Control port of the modem's Rm interface. The Control port has a fixed configuration of 8 data bits, 1 stop bit and no parity running at 9600 baud.

As shown in the syntax above, either `<format>` or `<parity>` can be optionally specified. If only one value is specified then the other is left unchanged. If both values are left unspecified then both are reset to their power-on default values.

Optional parameters must be separated by commas. The commas act as place holders (in the command parser) for any missing optional parameters.

`+ICF?` queries the current setting of `<format>` and `<parity>`. `+ICF=?` queries for the acceptable ranges of `<format>` and `<parity>`.

Valid Value(s)

`<format>`:

`3`	8 data bits, 1 stop bit and no parity

`<parity>`:

`0`	Even parity
`1`	Odd parity
`2`	Mark parity
`3`	Space parity

Missing Parameter Default Value(s)

See "Description" above for values assumed when optional parameters are missing.

Power-On/Reset Default Value(s)

<format> = 3 (for format 3 parity value is ignored)

<parity> = 3 (no parity is actual configuration)

Results Returned

Result	Condition
OK	<format> and/or <parity> are recognized and supported, and have been processed correctly.
ERROR	A parameter value was out of range or a syntax error was encountered.
+ICF: <format>, <parity> OK	? is used to query current setting.
+ICF: (3), (0-3) OK	=? is used to query acceptable range of parameters.

Set Local Flow Control (+IFC)

Syntax

+IFC[=<DCE_by_DTE>|=[<DCE_by_DTE>],
[<DTE_by_DCE>]|?|=?]

Description

Controls the operation of local flow control between the modem (DCE) and DTE:

- <DCE_by_DTE> specifies the method of flow control to be used by the DTE to control the flow of data from the modem.
- <DTE_by_DCE> specifies the method of flow control to be used by the modem to control the flow of data from the DTE.

Note This command has no effect on the configuration of the Control port of the modem's Rm interface. The Control port's configuration is fixed with no flow control.

As shown in the syntax above, either <DCE_by_DTE> or <DTE_by_DCE> can be optionally specified. If only one value is specified then the other is left unchanged. If both values are left unspecified then both are reset to their power-on default values.

Optional parameters must be separated by commas. The commas act as place holders (in the command parser) for any missing optional parameter.

+IFC? queries for the current settings of <DCE_by_DTE> and <DTE_by_DCE>. +IFC=? queries for the acceptable ranges of <DCE_by_DTE> and <DTE_by_DCE>.

Valid Value(s)

<DCE_by_DTE>:

0	No flow control
1	Software (XON/XOFF) flow control, stripping XON/XOFF characters from stream
2	Hardware (RFR/RTS) flow control
3	Software flow control, no stripping

<DTE_by_DCE>:

0	No flow control
1	Software XON/XOFF flow control, stripping XON/XOFF characters from stream
2	Hardware (CTS) flow control

Missing Parameter Default Value(s)

See “Description” above for values assumed when optional parameters are missing.

Power-On/Reset Default Value(s)

<DCE_by_DTE> = 2

<DTE_by_DCE> = 2

Results Returned

Result	Condition
OK	Parameters are recognized and supported, and have been processed correctly.
ERROR	A parameter value was out of range or a syntax error was encountered.
+IFC:<DCE_by_DTE>, <DTE_by_DCE> OK	? is used to query current setting.
+IFC: (0-3),(0-2) OK	=? is used to query acceptable range of parameters.

Set Rm Interface Command Baud Rate (+IPR)

Syntax

+IPR[=<rate>|?|=?]

Description

Specifies the baud rate at which the modem communicates with the DTE over the Data port of the Rm interface (see Figure 5-2 on page 5-7). If <rate> is not specified, <rate> is set to the power-on/reset default value. When the modem is power-cycled, the Data port baud rate is reset to its power-up baud rate stored in non-volatile memory.

The +IPR command does not affect the modem's call mode (set by the $QCMODE command, as described on page 6-69).

? syntax queries for the current setting of the Data port baud rate. =? syntax queries for the acceptable range the <rate> parameter can be set to.

Note The modem does not support automatic baud rate detection.

Valid Value(s)

<rate>:

300	300 baud (bits/second)
1200	1200 baud
2400	2400 baud
4800	4800 baud
9600	9600 baud
19200	19200 baud
38400	38400 baud
57600	57600 baud
115200	115200 baud

Missing Parameter Default Value(s)

See “Description” above for values assumed when optional parameters are missing.

Power-On/Reset Default Value(s)

See “Description” above for a discussion of power-on/reset defaults.

Results Returned

Result	Condition
OK	Parameters are recognized and supported.
ERROR	Parameters are not recognized or supported.
+IPR: <baudrate> OK	? is used to query current setting.
+IPR: ( ), (<baud> range) OK	=? is used to query acceptable range of parameters.

Online-Command Mode Commands

Online-Command mode allows the Online mode data stream to be interrupted so that AT commands are recognized and processed. An escape sequence, injected into the data stream, directs the modem to enter Online-Command mode from Online mode.

All AT commands recognized in Command mode are also recognized in Online-Command mode. The H command and the O command are of particular use in Online-Command mode.

When the Control port is active, the +++ escape sequence and the O command return their normal success status, even though the Control port's operating mode has not changed from Command mode.

Change from Online to Online-Command Mode (+++)

Syntax

~+++~

Description

The escape sequence that directs the modem to change from Online to Online-Command mode. Although this is not an AT command, it is necessary to support Online-Command mode and is, therefore, listed here for easy reference.

The ~ character indicates the "guard-time" both before and after the escape sequence. This "guard-time" is necessary to differentiate between the escape sequence +++ and any other string of three + characters inside the Online data stream.

EIA/TIA/IS-707A defines the length of the "guard-time" as "an appropriate time." The modem defines the "guard-time" to be 1 second.

Note The "+++" string is transmitted through to the host side, even if the escape sequence is recognized.

Valid Value(s)

N/A.

Missing Parameter Default Value(s)

N/A.

Power-On/Reset Default Value(s)

N/A.

Results Returned

Result Code	Condition
OK	Escape sequence recognized. Online-Command mode is active.
None. Continue in Online mode.	Escape sequence was not recognized.

Asynchronous Data through Gateway IWF Commands

These commands support asynchronous data connections. They have no effect locally. They are merely collected locally and sent to the Gateway IWF for processes at the beginning of an asynchronous data call.

Set Remote Config String (+CFG)

Syntax

+CFG[=<string>|?]

Description

Sets the remote configuration string sent to the IWF. The string, up to and including the termination character but excluding the quote ("") characters, is stored by the modem and sent to the Gateway IWF prior to connecting an asynchronous data call (either mobile-originated or mobile-terminated).

Each transmission of a +CFG command from the DTE replaces the contents of the previous string. The string may be up to 248 characters long.

+CFG? queries the current setting of the config <string>. +CFG=? is not a valid query and will return an ERROR result code.

Valid Value(s)

Any valid combination of AT commands used to configure the IWF modem of an asynchronous data call.

Missing Parameter Default Value(s)

N/A

Power-On/Reset Default Value(s)

`""` empty string

Results Returned

Result Code	Condition
`OK`	A valid quoted `<string>` was received and processed.
`ERROR`	Badly formatted `<string>` or syntax is not supported.

`+CFG: <string>`
 	
`OK`
	`?` is used to query current setting enclosed in quotes (`""`).

Data Compression Control Command (+DS)

Syntax

```
+DS[=[<dir>[,<comp_neg>[,<max_dict>[,<max_string>]]]
]|?|=?]
```

Description

This extended-format compound parameter controls the V.42bis data compression function on the PSTN link between the Gateway IWF and the host modem (if provided in the IWF). It accepts four numeric subparameters:

`<dir>`	Specifies the desired direction(s) of operation of the data compression function from the DTE point of view.
`<comp_neg>`	Compression negotiation specifies whether or not the DCE should continue to operate if the desired result is not obtained.

<max_dict>	Specifies the maximum number of dictionary entries which should be negotiated (may be used by the DTE to limit the codeword size transmitted, based on its knowledge of the nature of the data to be transmitted).
<max_string>	Specifies the maximum string length to be negotiated (V.42bis P2).

As shown in the syntax above, any of <dir>, <comp_neg>, <max_dict> or <max_str> may be optionally specified. If any parameter is left unspecified, its value is left unchanged. If all values are left unspecified then all are reset to their power-on default values.

Optional parameters must be separated by commas. The commas act as place holders (in the command parser) for the missing optional parameter.

+DS? queries for the current parameter value settings.

+DS=? queries for the acceptable parameter ranges.

Valid Value(s)

<dir>:

0	Negotiated...no compression (V.42bis P0=0)
1	Transmit only
2	Receive only
3	Both directions, accept any direction (V.42bis P0=11)

<comp_neg>:

0	Do not disconnect if V.42bis is not negotiated by the remote DCE as specified in <dir>.
1	Disconnect if V.42bis is not negotiated by the remote DCE as specified in <dir>.

<max_dict>	512-65535
<max_string>	6-250

Missing Parameter Default Value(s)

See "Description" above for values assumed when optional parameters are missing.

Power-On/Reset Default Value(s)

<dir>	= 3
<comp_neg>	= 0
<max_dict>	= 2048
<max_string>	= 6

Results Returned

Result Code	Condition
OK	Parameters are recognized and have been processed correctly.
ERROR	A parameter value was out of range or a syntax error was encountered.
+DS: <dir>,<comp_neg>, <max_dict>, <max_string>	? is used to query current settings.
+DS: (0-3),(0-1), (512-65535),(6-250) OK	=? is used to query acceptable range of parameters.

Error Control Selection Command (+ES)

Syntax

+ES[=[<orig_rqst>[,<orig_fbk>[,<ans_fbk>]]]|?|=?]

Description

This extended-format compound parameter controls the manner of operation of the V.42 protocol on the PSTN link between the Gateway IWF and the host modem (if provided in the IWF). It accepts three numeric sub-parameters:

<orig_rqst>	Specifies the initial requested mode of operation when the IWF is operating as the originator.
<orig_fbk>	Specifies the acceptable fallback mode of operation when the IWF is operating as the originator.
<ans_fbk>	Specifies the acceptable fallback mode of operation when the IWF is operating as the answerer.

As shown in the syntax above, any of <orig_rqst>, <orig_fbk> or <ans_fbk> may be optionally specified. If any parameter is left unspecified, its value is left unchanged. If all values are left unspecified then all are reset to their power-on default values.

Optional parameters must be separated by commas. The commas act as place holders (in the command parser) for the missing optional parameter.

+ES? queries for the current parameter value settings.

+ES=? queries for the acceptable parameter ranges.

Valid Value(s)

<orig_rqst>:

0	Direct mode.
1	Initiate call with Buffered mode only.
2	Initiate V.42 without Detection Phase. If V.8 is in use, this is a request to disable V.42 Detection Phase.
3	Initiate V.42 with Detection Phase.
4	Initiate Alternative Protocol.

<orig_fbk>:

0	Error control optional (either LAPM or Alternative acceptable); if error control not established, maintain DTE-DCE data rate and use V.14 buffered mode with flow control during non-error-control operation.
1	Error control optional (either LAPM or Alternative acceptable); if error control not established, change DTE-DCE data rate to match line rate and use Direct mode.
2	Error control required (either LAPM or Alternative acceptable); if error control not established, disconnect.
3	Error control required (only LAPM acceptable); if error control not established, disconnect.
4	Error control required (only Alternative protocol acceptable); if error control not established, disconnect.

<ans_fbk>:

0	Direct mode.
1	Error control disabled, use Buffered mode.
2	Error control optional (either LAPM or Alternative acceptable); if error control not established, maintain DTE-DCE data rate and use local buffering and flow control during non-error-control operation.
3	Error control optional (either LAPM or Alternative acceptable); if error control not established, change DTE-DCE data rate to match line rate and use Direct mode.
4	Error control required (either LAPM or Alternative acceptable); if error control not established, disconnect.
5	Error control required (only LAPM acceptable); if error control not established, disconnect.
6	Error control required (only Alternative protocol acceptable); if error control not established, disconnect.

Missing Parameter Default Value(s)

See "Description" above for values assumed when optional parameters are missing.

Power-On/Reset Default Value(s)

`<orig_rqst>` = 3

`<orig_fbk>` = 0

`<ans_fbk>` = 2

Results Returned

Result Code	Condition
`OK`	Parameters are recognized and have been processed correctly.
`ERROR`	A parameter value was out of range or a syntax error was encountered.
`+ES: <orig_rqst>, <orig_fbk>, <ans_fbk>`	`?` is used to query current settings.

`+ES: (0-4),(0-4),(0-6)`
 	
`OK`
	`=?` is used to query acceptable range of parameters.

Modulation Selection Command (+MS)

Syntax

`+MS[=[<carrier>[,<automode>[,<min_rate>[,<max_rate>[,<min_rx_rate>[,<max_rx_rate>]]]]]]|?|=?]`

Description

This extended-format compound parameter is used to control the manner of operation of the of the modulation capabilities in the IWF (if provided in the IWF). It accepts a single, user-definable, string parameter that contain the parameters listed above. This string is sent to the Gateway IWF during configuration by the modem, but is otherwise not used locally.

Valid Value(s)

`<string>` <user defined download string>

Missing Parameter Default Value(s)

" " empty string

Power-On/Reset Default Value(s)

" " empty string

Results Returned

Result Code	Condition
`OK`	Parameters are recognized and have been processed correctly.
`ERROR`	A parameter value was out of range or a syntax error was encountered.
`+MS: <string>`	? is used to query current settings.

Dormant Mode Commands

Dormant mode allows the modem to disconnect the active data call, to save on over-the-air usage and charges, while allowing the Gateway to maintain the state of the current data call (e.g., assigned IP address). This allows for faster reconnects when more data packets need to be sent or received.

The dormant mode AT commands are `+CTA` and `$QCPKND`. Also see *DCE Received Line Signal Detector Behavior (&C)* on page 6-16.

Note Dormant mode is not available for asynchronous calls.

Set Dormant Mode Timeout Value (+CTA)

Syntax

```
+CTA[=<timeout>|?|=?]
```

Description

Sets/tests the number of seconds of inactivity (no incoming or outgoing PPP data) before the modem times out the active data call and transitions to dormant mode.

This timeout is only valid while in Online mode of a data call. While in Online-Command mode, the +CTA idle timer is disabled. Upon re-entering Online mode the dormant mode timer is enabled and reset to restart the timeout period.

Valid Value(s)

0	Dormant mode timeouts are disabled. The Traffic Channel is not released during inactivity periods.
10-255	Release the Traffic Channel after <timeout> 1-second intervals have elapsed since last sending or receiving RLP data frames on the Um interface.

Missing Parameter Default Value(s)

0

Power-On/Reset Default Value(s)

0

Results Returned

Result	Condition
OK	<timeout> is supported and set as the dormant mode timeout period.
ERROR	<timeout> is not supported and the dormant mode timeout period is left unchanged.
+CTA: <timeout> OK	? is used to query current setting.
+CTA: (0, 10-255) OK	=? is used to query acceptable range of the <timeout> parameter.

Packet No Dial ($QCPKND)

Syntax

```
$QCPKND[=<mode>|?|=?]
```

Description

Modifies the behavior of the modem when it receives a data packet, while *not* in a data call. This allows the modem to originate (or not originate) a packet data call upon receipt of a packet without first receiving a Dial command. This feature is necessary for modem-reestablished dormant-mode packet data calls.

Select option `0` if you are making only packet data calls. Select option `2` if mixing packet data calls and other types of data calls (e.g., asynchronous data). If you do not want dormant mode, select option `1`.

Valid Value(s)

`0`	Disable Packet No Dial. If a packet is received by the modem while not in a data call, the modem originates a packet data call in the current mode, even though a Dial command was not received.
`1`	Enable Packet No Dial. If a packet is received by the modem while not in a data call, the modem discards the packet and does nothing.
`2`	Selective Packet No Dial. If the last data services call initiated with the Dial command was a packet data call, then upon receipt of a packet the modem originates a packet data call in the current mode. If the last data services call was NOT a packet data call (for example it was an asynchronous call), then upon receipt of a packet the modem discards the packet and does nothing.

Missing Parameter Default Value(s)

`0`

Power-On/Reset Default Value(s)

`0`

Results Returned

Result Code	Condition
OK	<mode> is supported and the PPP behavior is set.
ERROR	<mode> is not supported and the PPP behavior is left unchanged.
$QCPKND: <mode> OK	? is used to query current setting.
$QCPKND: (0-2) OK	=? is used to query acceptable range if the <mode> parameter

SMS Commands

The following commands access the Short Messaging Services (SMS) of the modem. SMS messages are stored in the modem until the user has retrieved and deleted them. They are presented through this interface as a list, sorted in the order received. The application can navigate the list and manipulate the list (print, lock and erase messages) using the following AT commands.

SMS Move/Delete ($QCSMSM)

Syntax

$QCSMSM[=<move>|=[<move>],[<del>]|=?]

Description

Traverses the list of SMS messages, optionally moving in a specifiable direction and/or optionally deleting the current message before the move.

This command takes up to two optional arguments for movement direction (<move>) and delete current message before move (<del>). If left unspecified, the <move> is assumed to be forward with no <del>.

Values

`<move>`

`0`	Move to the next message in the list.
`1`	Move to the previous message in the list.
`2`	Move to the top of the list.
`3`	Move to the end of the list.

`<del>`

`0`	NO — Do NOT delete current message before movement.
`1`	YES — DO delete current message before movement.

Default Value(s)

`0,0`	Move to the next message and do not delete.

Power-On Default

None.

Results Returned

Result Code	Description
`OK`	The move and/or delete operation was completed successfully.
`ERROR`	Incorrect syntax; unsupported `<move>` or `<del>` values; or the move or delete operation failed.

SMS Print ($QCSMSP)

Syntax

`$QCSMSP[=<tformat>]`

Description

Sends a formatted, multi-line string representing the contents of the current SMS message to the DTE. As in the `$QCTOD` command, an optional parameter can specify the format to be used when displaying the SMS message arrival time (see *Time of Day ($QCTOD)* on page 6-64).

Values

0	Same as Time-of-Day format '0'.
1	Same as Time-of-Day format '1'.

Default Value

0

Power-On Default

None.

Results Returned

Result Code	Description
<formatted message> OK	If a current message exists then it will be formatted as described below with field definitions also given. The format of the message will be: INDEX:<Hexadecimal index> NEW:[<YES|NO>] LOCKED:[<YES|NO>] NUMBER:[<Call back #>] TYPE:[<Type>] PRIORITY:[<priority (4 levels)>] TIME:[<Time Stamp>] LENGTH:[<decimal length of message>] MESSAGE:[<Message Data>] OK Each field of the given format is defined in Table 6-5, "SMS Print Command Field Definitions," on page 6-54. This format was chosen to avoid confusion between message text and the OK. The LENGTH field specifies the number of 8-bit bytes in the MESSAGE field.
ERROR	Unrecognized or unsupported syntax; or there are no messages in the phone.

Format Field Definitions

See Table 6-5.

Table 6-5. SMS Print Command Field Definitions

Field Name	Description
INDEX:	This field is a unique 32-bit value (expressed in Hex) given to each SMS message stored. It allows the SMS messages to be sorted according to their arrival time and not their time stamp. See the TIME field for a description of the issues around time stamps. **NOTE:** Although the INDEX field is unique for SMS messages currently stored (it is initialized to a value one greater than the highest index currently stored), it can be repeated. **Example:** When the highest indexed SMS message is erased and the phone is immediately reset, then that index will be used again.
NEW:	The field indicates whether this message is a newly arrived (<NEW:YES>) message or one that has been previously read (<NEW:NO>). A message is marked read (<NEW:NO>) after the $QCSMP command is issued.
LOCKED:	This field indicates that the user has set the LOCK flag of the SMS message (See *SMS Lock ($QCSMSL)* on page 6-56 for details). The LOCK flag prevents a previously read message (<NEW:NO>) from being "autodeleted" from internal storage. Autodeletion is a mechanism by which old SMS messages are deleted without user intervention, when the SMS storage memory is full, to make room for a newly arrived message. **NOTE:** Locked messages (<LOCKED:YES>) can be manually deleted, by the user, without first unlocking the message (<LOCKED:NO>).
NUMBER:	This field is a sender- and application-specific "call back" phone number.

Table 6-5. SMS Print Command Field Definitions (continued)

Field Name	Description
TYPE:	This field represents the SMS message type. Possible values are: SMSI_CPT_95 SMSI_CMT_95 SMSI_VMN_95 SMSI_CMT_91_CLI SMSI_CMT_91_VOICE_MAIL SMSI_CMT_91_SHORT_MSG SMSI_AWI_95
PRIORITY:	This field represents the priority of the received SMS message. The IS-637 standard allows for four (4) levels of priority; 0 being the lowest and 3 being the highest.
TIME:	This field is a time stamp placed on the SMS message, either by the Message Center (that sent it) or by the modem (if the message was received with no time stamp attached). If the Message Center attached the time stamp it will represent the time the message was initially sent. If, however, the modem attaches the time stamp, it will represent the time the message was received (for storage). Although the IS-637 standard requires the message center time stamp to be specified in UTC, it is known that some Service Providers' message centers use local time. Because this condition cannot be detected and/or corrected automatically, a user-selectable (per NAM) switch was implemented to set whether the received time stamp was adjusted to UTC or not. **NOTE:** Whether the time stamp represents time sent or arrival time is not stored, and so cannot be determined by the user.

Table 6-5. SMS Print Command Field Definitions (continued)

Field Name	Description
LENGTH:	This field is the decimal count of the number of 8-bit bytes in the SMS message MESSAGE field.
MESSAGE	This field is the user data payload sent in the SMS message. Normally this field is text data such as a page or e-mail. However, for purposes of the Data Services it can contain application-specific binary data as well.

SMS Lock ($QCSMSL)

Syntax

```
$QCSMSL[=<lock>]
```

Description

Lock or unlock (that is, set or clear the LOCK flag of) the current SMS message. When a message is locked, it will not be "autodeleted."

"Autodelete" is a mechanism used to make room for newly arriving SMS messages, if storage memory is needed, by erasing OLD (previously read) text messages.

Note The user may delete locked messages without unlocking them.

Values

0	Unlock the current message (clear the lock flag).
1	Lock the current message (set the lock flag).

Default Value

1	Lock the current message.

Power-On Default

N/A.

Results Returned

Result Code	Description
OK	The requested operation was successful.
ERROR	If an illegal value is detected or any error associated with changing the value of the LOCK flag.

SMS Alert ($QCSMSA)

Syntax

$QCSMSA[=<alert>|?|=?]

Description

This command sets whether the DTE is "alerted" of the arrival of a new SMS message. This "Alert" takes the form of sending an unsolicited result code (SMS) out the Rm interface to the DTE (much the same as a RING indication for incoming calls). The destination port for the SMS result code is the active AT command port.

Values

0	Asynchronous messaging will be turned OFF.
1	Asynchronous messaging will be turned ON.

Default Value

0

Power-On Default

0

Results Returned

Result Code	Condition
OK	<alert> is recognized and supported.
ERROR	<alert> is not supported and ignored.

SMS Info ($QCSMSI)

Syntax

$QCSMSI

Description

Returns the current state of the SMS database. This state includes the counts of the list storage areas: NEW URGENT, NEW, OLD and VMN. The VMN count will always be 0 because any arriving VMN messages will not be stored.

Values

None.

Default Value

None.

Power-On Default

None.

Results Returned

Result Code	Condition
<SMS Info> OK	The operation completed successfully (see below for details on format). Where <SMS Info> is a series of formatted lines indicating the current state of the SMS message database. The format is given below with field descriptions given in Table 6-6, "SMS Info Command Field Definitions," on page 6-59. TOTAL:<total saved> URGENT:<total new urgent> NEW:<total new> OLD:<total old> VMN:<total vmn> (always '0') LOCKED:<total locked> OK
ERROR	An unrecognized or unsupported syntax was entered.

Format Field Definitions

Table 6-6. SMS Info Command Field Definitions

Field Name	Description
TOTAL:	The total number of SMS messages saved in internal storage.
URGENT:	The total number of NEW SMS messages marked URGENT.
NEW:	The total number of NEW SMS messages not marked URGENT.
OLD:	The total number of OLD/Read messages.
VMN:	The total number of VMN messages (always '0').
LOCKED:	The total number of messages (OLD or NEW) that have been LOCKED against "autodelete."

Error Log Services Commands

Retrieve Error Log ($QCERR)

Syntax

$QCERR

Description

Returns the modem's error log and build information.

Values

None.

Default Value

None.

Power-On Default

None.

Results Returned

Result Code	Description
<Error Log Info> OK	If the requested operation was performed.
ERROR	An unrecognized syntax was entered.

Clear Error Log ($QCCLR)

Syntax

$QCCLR

Description

Clears the error log.

Values

None.

Default Value

None.

Power-On Default

None.

Results Returned

Result Code	Condition
OK	The Error Log was successfully cleared.
ERROR	An unrecognized syntax was entered.

Service Status Commands

Service Alert ($QCSA)

Syntax

```
$QCSA[=<alert>|?|=?]
```

Description

Turns ON or OFF the unsolicited result code “alerting” the DTE of service changes. Changes may include items such as fade, acquisition, roaming, etc. This “Alert” takes the form of sending an unsolicited result code (`SERVICE`) out the Rm interface to the DTE (much the same as a `RING` indication for incoming calls). The destination port for the `SMS` result code is the active AT command port.

Values

`0`	Turns OFF service alert.
`1`	Turns ON service alert.

Default Value

`0`

Power-On Default

`0`

Results Returned

Result Code	Condition
`OK`	`<alert>` is recognized and supported
`ERROR`	An unrecognized syntax or an invalid `<alert>` value was entered.

Service Status ($QCSTATUS)

Syntax

```
$QCSTATUS
```

Description

Returns the current status of the modem. Information returned includes whether the modem sees a Gateway, the signal strength (RSSI), registration status, current call state, roaming, and so on.

Values

None.

Default Value

None.

Power-On Default

None.

Results Returned

Result Code	Condition
<Service Status> OK	The operation completed successfully (see below for format; see Table 6-7 for output values).
ERROR	An unrecognized or unsupported syntax was entered.

Where <Service Status> is a series of formatted lines indicating the Service State of the modem. The format and description of the output elements are:

```
SERVICE AVAILABLE:<YES|NO>
SERVICE MODE:<mode>
PROVIDER:<provider>
GATEWAY:<gateway>
RSSI:<rssi>
REGISTRATION:<reg_status>
ROAMING:<YES|NO>
CALL STATE:<state>
CALL TYPE:<call_type>
CALL DURATION:<duration>
CALL NUMBER:<number>
BATTERY CHARGE:<percentage>
OK
```

Table 6-7. Modem Status Information

SERVICE AVAILABLE:	YES if the modem has acquired Globalstar service; otherwise NO.
SERVICE MODE:	Current service mode: NO_MODE AUTOMATIC GLOBALSTAR DEEP_SLEEP SHUTDOWN SOFT_RESET LPM ANY_MODE RESELECTION_NEXT
PROVIDER:	Current Service Provider; or blank.
GATEWAY:	Gateway number in decimal; or -1.
RSSI:	Received signal strength, from 0 to 4: 0=no signal 4=strong signal
REGISTRATION:	Current registration status of the modem with the Gateway: NO=not registered YES=registered
ROAMING:	YES if roaming. NO otherwise.

Table 6-7. Modem Status Information (continued)

CALL STATE:	Current call state: IDLE SETUP_ORIG SILENTRETRY SETUP_TERM AUTORETRY CALLINPROG HPSE_RESUME MULTITONE TIMEPAUSE
CALL TYPE:	Service Option used in the current call: SIGNALING VOICE (not applicable for data modem) MARKOV LOOPBACK TIA_PPP TIA_ASYNC (or blank if no call is in progress)
CALL DURATION:	Duration of the ongoing call or the last completed call; or 0 if no call has been made since power up
CALL NUMBER:	Most recently called or currently calling number.
BATTERY CHARGE:	Percentage of battery life remaining.

Special Calls and Services Commands

Time of Day ($QCTOD)

Syntax

$QCTOD[=<tformat|=?>]

Description

Exports the time of day as received from the Globalstar system. The application can use this to obtain an accurate time.

Values

0	Format type 0 [see below]
1	Format type 1 [see below]

Default Value

0

Power-On Default

None.

Results Returned

Result Code	Condition
<Formatted TOD> OK	<tformat> was a valid format specifier. The TOD string has two possible formats: **NOTE:** The time is reported in UTC. Format 0: <YYYY>:<DOY> <HH:MM:SS> Format 1: <DD> <MM> <YYYY> <HH:MM:SS> The format fields have the following definitions: <YYYY> Year <DOY> Day of Year (starting with 0 for Jan 1) <HH> Hours, 24 hour format <MM> Minutes <SS> Seconds <DD> Day of month, same as standard calendar days <MM> Numeric month, starting at 1
ERROR	An unsupported syntax or <tformat> was entered. Or unable to report time because the system has not been acquired yet.

Position Location Service ($QCPLS)

Syntax

```
$QCPLS[=<position type>|=[<position type>],[<time format>]|=?]
```

Description

Returns the current position of the modem and the time (in UTC) that the position information was acquired. `$QCPLS=?` queries for the acceptable ranges of `<position type>` and `<time format>`.

Note If additional characters are received on the same port while this command is processing, the command will be aborted.

Note As shown in the syntax above, either `<position type>` or `<time format>` can be optionally specified. If only one value is specified then the other is left unchanged. If both values are left unspecified then both are reset to their power-on default values. Optional parameters must be separated by commas. The commas act as place holders (in the command parser) for the missing optional parameter.

Values

`<position type>`

`0`	Request the current position.
`1`	Get the last position successfully obtained.

`<time format>`

`0`	TOD format '0' (See *Time of Day ($QCTOD)* on page 6-64.)
`1`	TOD format '1' (See *Time of Day ($QCTOD)* on page 6-64.)

Default Value(s)

`<position type>`

`0`

`<time format>`

`0`

Power-On Default

None.

Results Returned

Result Code	Condition
N: DDD MM SS W: DDD MM SS	<position type> was a valid position type specifier. The format of position is given as DEGREES (DDD), MINUTES (MM) and SECONDS (SS) for both Longitude (N:) and Latitude (W:) coordinates.
TIME:<time of position>	The time of the position measurement (TIME:) is also returned to the DTE and follows the format of the Time of Day (TOD) return value (specified in *Time of Day ($QCTOD)* on page 6-64). The requested format is specified using the second <time format> parameter to the command.
ERR:<positioning error>	The positioning error (i.e., estimated accuracy) of the returned position. (ERR:) is specified in units of distance rather than percent. The possible return values are:
OK	< 300m (meters) < 1km < 2km < 5km < 10km < 20km < 100km
ERROR	An unsupported syntax was entered. Or unable to determine the current position, or there is no previous position to fetch.

Markov Statistics ($QCMSTATS)

Syntax

`$QCMSTATS`

Description

Returns the statistics from the last Markov call, or the current statistics from a Markov call in progress.

Values

None.

Default Value

None.

Power-On Default

None.

Results Returned

Result Code	Condition
`<Markov Stats>`	The statistics of the previous Markov call (or current call if one is in progress).

`OK`	**Note:** The statistics may not be saved over a power-down or reboot of the modem.
	The format of the `<Markov Stats>` return strings is as follows (all returned statistics are in Hex):
	`<Markov Stats>`
	`MARKOV RATE:`
	`BIT FRAMES:`
	`BAD FRAMES:`
	`TOTAL FRAMES:`
	`TOTAL FRAMES:`
	`EXPECTED/RECEIVED RATE:`
	(expected rates frames are on the vertical axis; received rate frames are on the horizontal axis, going from zero to full in each case)
	`GOOD FRAMES:`
	(frame rate order: zero quarter half full)
	`ERASURES:`
	(frame rate order: zero quarter half full)
	If no current `<Markov Stats>` are available (either from a previous or current call) for whatever reason, the `<Markov Stats>` table is filled with zeros.

`ERROR`	An unsupported syntax was entered.

Set Mode ($QCMODE)

Syntax

`$QCMODE[=<mode>|?|=?]`

Description

This command sets the modem's call mode. It does not affect the Rm interface baud rate (set by the `+IPR` command, as described on page 6-38).

Note

When the modem is powered up, the modem call mode is set to `1` (auto-detect mode). However, when the modem is reset by the `Z` command, the current call mode is left unchanged. Resetting with the `&F` command does reset the call mode.

Values(s)

`1`	Auto-detect Mode
`2`	Globalstar Only Mode

Note

Since the GSP-1620 modem is single-mode (Globalstar only), "Auto-detect Mode" has the same effect as "Globalstar Only Mode." The GSP-1600 Tri-Mode Phone has two additional modes: digital cellular and analog cellular.

Missing Parameter Default Value(s)

`1`

Power-On/Reset Default Value(s)

`1`

Results Returned

Result	Condition
`OK`	`<mode>` is supported and Call Mode is set.

Result	Condition
ERROR	<mode> is not supported and Call Mode is left unchanged.
$QCMODE:<mode> OK	? is used to query current setting.
$QCMODE:(1-2) OK	=? is used to query acceptable range of the <mode> parameter.

Protocol Stack Modification Commands

Caution We strongly recommend that you do not use these commands if you do not have a thorough understanding of what they do and of how TCP networking works.

TCP is used to ensure end-to-end integrity of data on the over-the-air link in an asynchronous data call. These commands allow modification of the TCP stacks between the modem and the Gateway IWF.

Caution Improperly setting these commands can cause severe performance degradation.

TCP Stack Changes ($QCTCP)

Syntax

```
$QCTCP[=<tcpmod>|[=<tcpmod>[,<lowertxmss>[,
<uppertxmss>[,<rxmss>[,<minrto>[,<maxrto>[,<minato>[
,<maxato>[,<maxtcpbackoff>]]]]]]]]]|?|=?]
```

Description

Allows you to modify the behavior of the TCP stack by accessing to several variables that control it. This includes the ability to change the maximum segment size for both transmit and receive, as well as the ability to change the values controlling the retransmit timer, and the acknowledgment timer.

Note As shown in the syntax above, any of the parameters can be optionally specified. Any unspecified value is left unchanged. Optional parameters must be separated by commas. The commas act as place holders (in the command parser) for the missing optional parameters.

<tcpmod>	Defines whether or not to use the default TCP values, or to use the values passed in.
<lowertxmss>	Sets the lower bound for outgoing TCP packet sizes.
<uppertxmss>	Sets the upper bound for outgoing TCP packet sizes. The variable can be overwritten during TCP negotiation if the other end of the connection sets a TCP MSS lower than this value.
<rxmss>	Sets the size for the incoming TCP MSS.
<minrto>	Sets the minimum value for the range used to calculate the retransmit timeout.
<maxrto>	Sets the maximum value for the range used to calculate the retransmit timeout.
<minato>	Set the minimum value for the range used to calculate the acknowledgment timeout.
<maxato>	Sets the maximum values for the range used to calculate the acknowledgment timeout.
<tcpmaxbackoff>	Sets the number of TCP backoffs allowed before tearing down the connection. A value of zero will keep the phone from tearing down the call based on the number of TCP backoffs.

If <tcpmod> is equal to one, the values in the rest of the variables are put into effect. If <tcpmod> is set to zero, the rest of the values entered into the AT command are ignored, and the default values are restored to the internal variables.

Valid Value(s)

<tcpmod>

0	Use the default values for the TCP stack.
1	Use the values passed in for the TCP stack.

<lowertxmss>

0-1500	Lower bound for the transmit MSS

<uppertxmss>

0-1500	Upper bound for the transmit MSS

<rxmss>

0-1500	Receive MSS requested

<minrto>

0-120000	Minimum Retransmit Timeout (in ms)

<maxrto>

0-120000	Maximum Retransmit Timeout (in ms)

<minato>

0-1000	Minimum Acknowledgment Timeout (in ms)

<maxato>

0-6000	Maximum Acknowledgment Timeout (in ms)

<maxtcpbackoff>

0	TCP backoffs will never release call.
1-100	Number of TCP backoffs before terminating call.

Missing Parameter Default Value(s)

See "Description" above for values assumed when optional parameters are missing.

Power-On/Reset Default Value(s)

<tcpmod>	= 0
<lowertxmss>	= 536
<uppertxmss>	= 536
<rxmss>	= 536
<minrto>	= 500
<maxrto>	= 6000
<minato>	= 100
<maxato>	= 6000
<tcpmaxbackoff>	= 0

Results Returned

Result Code	Condition
OK	The values entered into the command were correct.
ERROR	Incorrect syntax, value out of range, or incorrect number of parameters
$QCTCP: <tcpmod>, <lowertxmss>, <uppertxmss>, <rxmss>,<minrto>, <maxrto>,<minato>, <maxato>, <tcpmaxbackoff>	? is used to query current setting.
$QCTCP: (0-1), (0-1500), (0,1500), (0-1500),(0-54464), (0-54464),(0-1000), (0-6000),(0-100)	=? is used to query acceptable range if the <value> parameter

Use Van Jacobsen Header Compression ($QCVJ)

Syntax

$QCVJ[=<usevj>|?|=?]

Description

Allows Van Jacobsen header compression to be turned on or off for the next negotiated connection.

Valid Value(s)

<usevj>

0	Turn Van Jacobsen header compression off.
1	Use Van Jacobsen header compression.

Missing Parameter Default Value(s)

1	Use Van Jacobsen header compression.

Power-On/Reset Default Value(s)

<usevj> = 1

Results Returned

Result Code	Condition
OK	The requested operation was successful.
ERROR	If an illegal value is detected
$QCVJ: <usevj>	? Is used to query current <usevj> value.
$QCVJ: (0-1)	=? is used to query acceptable range of parameters.

7 INTEGRATING GSP-1620 MODEMS INTO OEM PRODUCTS

OEMs can buy QUALCOMM Globalstar GSP-1620 Satellite Data Modems in bulk direct from QUALCOMM, then integrate them into market-specific products. Bulk modems come with antennas, but not cables.

As an OEM, you provide custom modem and antenna cables as appropriate to your specific products. You must also mount the modem boards in protective enclosures, which field technicians can then install on-site, connected to antennas.

This chapter is intended for

- OEMs who integrate GSP-1620 modem hardware into products (for example, oil pipeline monitors)
- Field technicians who install those products on site

It is assumed that OEMs and field technicians can work directly from the technical specifications. This chapter contains the following information:

- Integrating modems into products
  - Hardware description of the modem, including mechanical descriptions; specifications; Data, Control and Diagnostic port signaling and pinouts; DC power; and grounding information
  - Guidelines for mounting modems in enclosures
- Mounting antennas on-site
  - Antenna specifications
  - Antenna cable specifications and lengths

  - Positioning antennas for Globalstar service, and mounting and sealing antennas
- Environmental specifications for the GSP-1620 modem and antenna

Caution For your safety and to avoid potential damage to the equipment, observe the *Cautions and Warnings* on page xxiv.

Caution When integrating the GSP-1620 modem and its antenna into OEM products, be sure to abide by all RF restrictions as described in Appendix B.

Integrating Modems into Products

This section describes the QUALCOMM Globalstar GSP-1620 Satellite Data Modem hardware, including mechanical descriptions of the modem, its Data, Control and Diagnostic port signals and pinouts, DC power, and grounding.

Using this information for your specific products, you can create custom cables, which connect a modem (the DCE) to:

- A terminal or processor (the DTE) running custom application software for your product — using the Data port only, or both Data and Control ports
- An appropriate DC power source
- A Dielectric Resonator Antenna (DRA) — for information about installing antennas and calculating cable lengths, see *Mounting Antennas On-Site* on page 7-22.

Note This section also describes the Diagnostic port, although typically it is used only during development and for service programming.

Modem Mechanical Description

The GSP-1620 modem is a sandwich made of two circuit card assemblies (CCAs) that are open and unprotected. As a result, the GSP-1620 modem must be shielded from direct impacts, precipitation, and particulates.

I/O is obtained through four connectors:

- Power, Data, and Control functions are accessed via a 25-pin “D” style connector.
- Globalstar RF transmit signals are routed to an MCX-style coaxial connector (labeled J3 on the board).
- Globalstar RF receive signals are routed to an MCX-style coaxial connector (labeled J7 on the board).
- The Diagnostic port interface is a 9-pin “D” style connector.

Modem Board Layout

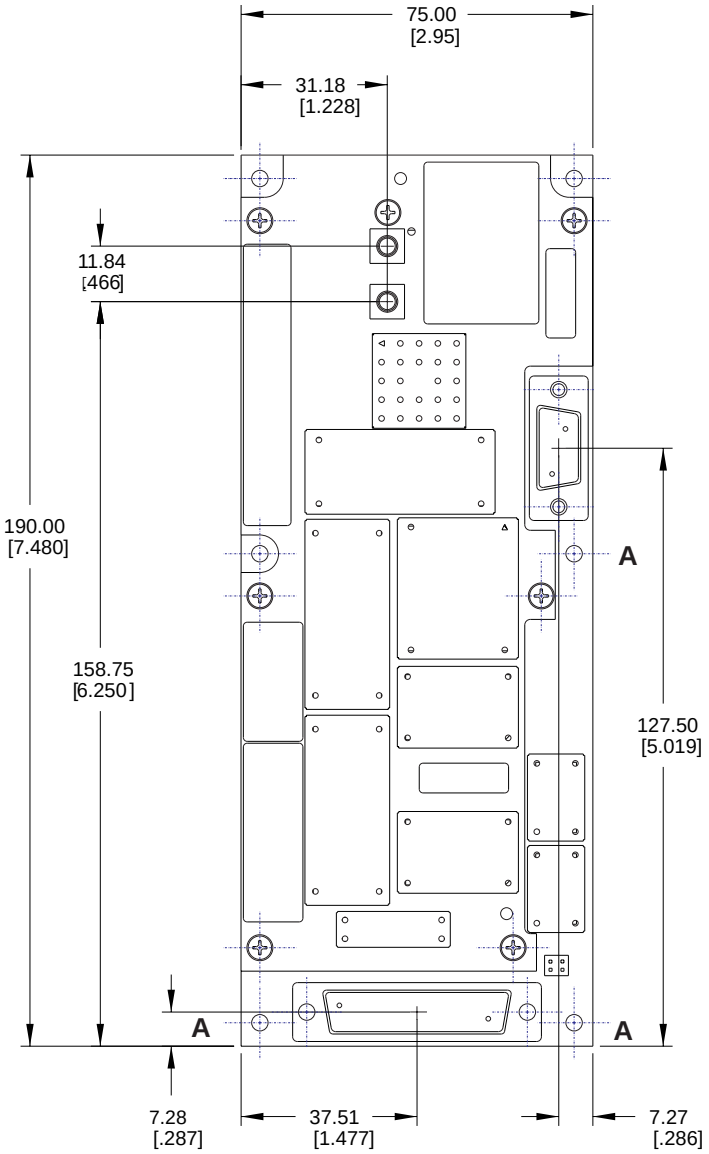
This section includes the following technical drawings depicting the modem:

- GSP-1620 Modem Board Layout (Top View), Figure 7-1
- GSP-1620 Modem Board Layout (Side and Bottom View), Figure 7-2

Note

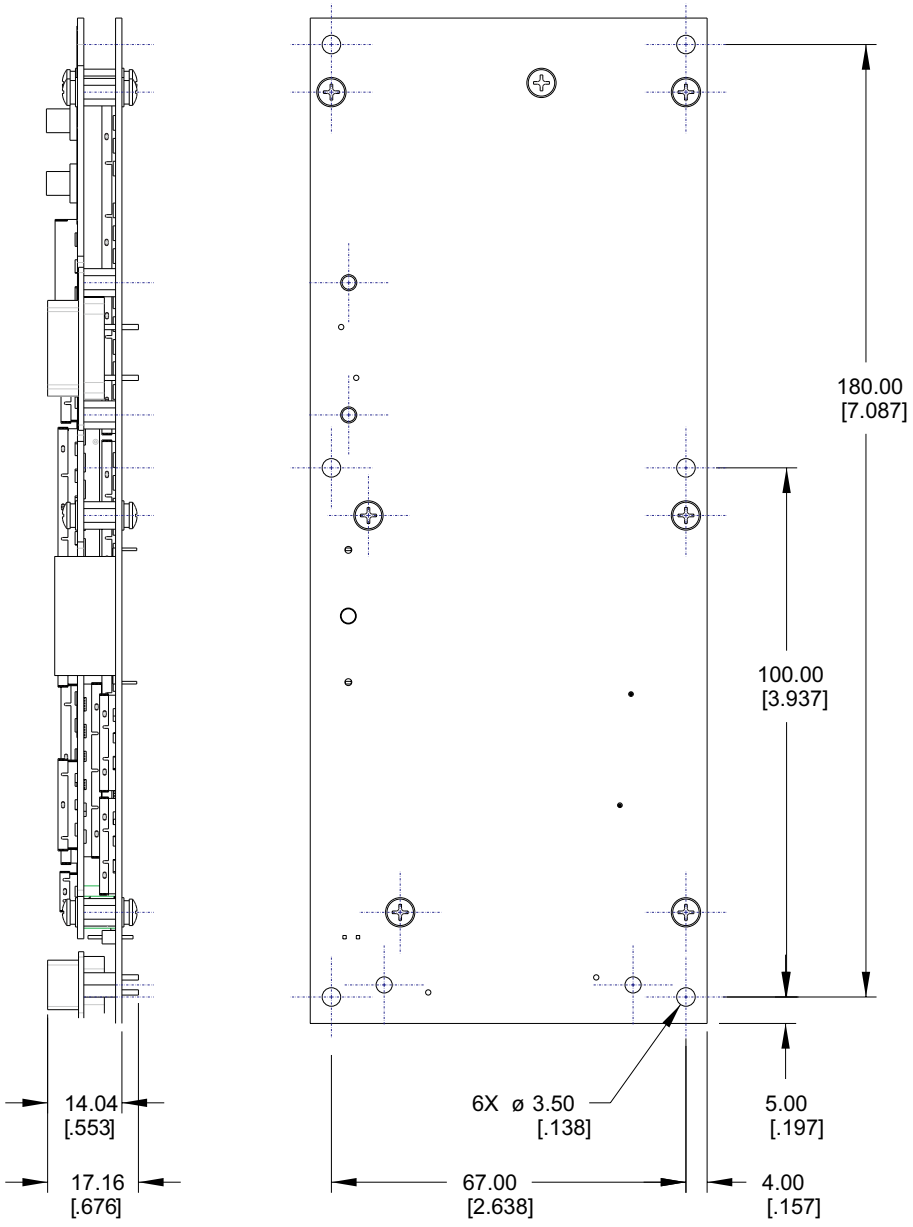
In Figure 7-1 and Figure 7-2, dimensions are shown as: millimeters [inches]. Millimeters are the controlling dimensions on these drawings. Inch dimensions are for reference only.

Figure 7-1. GSP-1620 Modem Board Layout (Top View)



Holes marked "**A**" connect to chassis ground.

Figure 7-2. GSP-1620 Modem Board Layout (Side/ Bottom Views)



Modem Dimensions and Weight

Modem dimensions are 190 x 75 x 17 millimeters (7.48 x 2.95 x 0.68 inches).

Modem weight is less than 180 grams (6.3 ounces).

Modem Antenna Connectors

The GSP-1620 modem has two (2) MCX snap-in connectors for the antenna leads, connecting the DRA antenna to the modem:

- Transmit (Tx) lead is labeled **J3**.
- Receive (Rx) lead is labeled **J7**.

Caution

When you connect antenna cables, be careful to connect the Tx connector on the antenna to the Tx connector (J3) on the modem, and the Rx connector on the antenna to the Rx connector (J7) on the modem. Crossing the Tx and Rx cables can damage the modem.

Caution

The MCX connectors are secured only by a solder joint and are not designed to withstand excessive force. When cables are connected to these connectors, care must be taken to ensure adequate strain relief is provided.

Data and Control Ports

The Data and Control ports are combined into a single DB-25 male upright connector, which provides the primary user interface:

- The connector contains two (2) 9-pin serial ports, DC power leads, and a reset lead.
- Line speed for the Data port is variable between 300 bps and 115.2 kbps. (This is different from the over-the-air Data port rate, which is 9600 bps.)
- Line speed for the Control port is fixed at 9600 bps.
- Signaling uses 8 bits, no parity and 1 stop bit (8,N,1).
- All ports are ESD and short-circuit protected.

Note The modem signal naming convention assumes that the modem is the DCE and that the user application is the DTE.

DTR/DSR Signal and Power On/Off

An active DTR on any of the three serial ports (Data, Control or Diagnostic) turns on the GSP-1620 modem (if DC power is applied first). The modem then boots up from the shut-down state and asserts DSR to indicate that it is booted up and ready to communicate.

The modem starts its power-down sequence only after the DTR lines on all three serial ports connected to the modem are de-asserted for a minimum of one second. Just before the modem powers off, it de-asserts DSR to let the application know that it is okay to remove DC power to the modem without risk of losing volatile data.

This mode of operation is useful in cases where power to the modem as well as the rest of the system might be turned off periodically to conserve battery power.

In case the modem "hangs up" and the watchdog circuit does not reset the modem, you can reset the modem by pulling the `MODULE_RESET_N` low for a period of 5 seconds or more and releasing it to allow it to float. Pulling the line low has the effect of a power-on reset and not just a watchdog reset.

Caution The watchdog circuit is internal to the modem and is a protection against a possible crash of the modem software. The RESET line should be used only as a last-resort method of resetting the modem when the application is sure that the modem is not responding to any commands. Asserting the RESET line can result in loss of non-volatile data, including the current state of the modem.

Changing Data and Control Port Configuration

You may change the Data and Control port configuration at any time, provided that the following requirements are met:

- The minimum hold time for both asserting and de-asserting either port DTR is 10 milliseconds.
- The minimum time from asserting DTR to data transmission is 10 milliseconds.

If these minimum times are not observed, AT command processing may be affected. The maximum time for holding all DTRs de-asserted is one second. If this time is exceeded, the modem will begin its power-down sequence.

Whenever the DTR signal of the Data or Control port has been de-asserted for a period of 10 seconds, the GSP-1620 modem shuts down the port's RS-232 transmitter to conserve power. This causes the port's DSR signal to be de-asserted.

The effects of changing the port configuration are detailed in *Port Activation (DTR) Changes during Operation* on page 5-15.

Control Port Signals

The Control port (CP) is an RS-232-level asynchronous interface operating at 9600 bps using Transmit Data (TxD), Receive Data (RxD), Data Terminal Ready (DTR), Data Set Ready (DSR), and Signal Common (GND).

RxD and TxD perform data transfer and handshaking, while DTR is used to turn on the modem and to let it know that there is an application waiting to talk to it.

The Control port specifically allows dedicated usage of the Data Port by the application. It allows all AT commands, modem alerting, and SMS messages to be sent simultaneously via a separate "control" port to/from the modem. This separation of functionality is especially useful in dormant mode, when the application and host sessions are active, and thus the Data port appears active/in use, although a Globalstar traffic channel is not up (no "In Call Status Message").

The Control port is “enabled” by asserting DTR on the Control port.

In case of a reboot (due to fatal errors or any other reason), the DSR line will be set inactive so that the user application can detect a reset condition and take the necessary action.

Data Port Signals

The Data port (DP) is a hardware-flow controlled, RS-232 level, asynchronous serial interface:

- The Data port uses the following RS-232 leads for operations: Transmit Data (TxD), Receive Data (RxD), Clear To Send (CTS), Data Terminal Ready (DTR), Data Set Ready (DSR), Ready to Send (RTS), Data Carrier Detect (DCD), Ring Indicator (RI), and Signal Common (GND).
- The format for data on the Data port is 8 bits, no parity and 1 stop bit.
- The baud rate is user-configurable to selected rates from 300 bps to 115.2 kbps. The baud rate is adjustable in software.
- In case of a reboot (due to fatal errors or any other reason), the DCD and DSR lines will be set inactive so that the user application can detect a reset condition and take the necessary action.
- Functionally, the Data port integrates AT commands and alert messages as well as application data traffic.

DB-25 Data and Control Port Pinouts

Table 7-1 provides detailed information about the Interface connector pinouts.

Table 7-1. Interface Connector Pinouts

Pin Number	Signal Name	Signal Level	Direction User <-> Modem	Description
1	Chassis Ground	-	Chassis Ground	Isolated chassis ground
2	DP_TXD	RS-232	DTE -> DCE	Data port TXD
3	DP_RXD	RS-232	DTE <- DCE	Data port RXD
4	DP_RTS	RS-232	DTE -> DCE	Data port RTS
5	DP_CTS	RS-232	DTE <- DCE	Data port CTS
6	DP_DSR	RS-232	DTE <- DCE	This pin is the DSR for the Data port and is asserted when the modem detects activity on the Data port and is ready to communicate with the DTE over this port. This signal is de-asserted when the modem detects no activity on the Data port; or is de-asserted as an acknowledgment to the user, indicating that the modem has completed its power- down sequence after the DTR lines of all serial ports have de-asserted.
7	Ground	Ground	Ground return	Ground return
8	DP_DCD	RS-232	DTE <- DCE	Data port DCD
9	DC_POWER	5.6V-16V		Modem power
10	DC_POWER	5.6V-16V		Modem power
11	Ground	Ground	Ground return	Ground return
12	CP_DTR	RS-232	DTE -> DCE	Control port DTR
13	Reserved	Reserved	Reserved	
14	CP_TXD	RS-232	DTE -> DCE	Control port TXD

Table 7-1. Interface Connector Pinouts (continued)

Pin Number	Signal Name	Signal Level	Direction User <-> Modem	Description
15	CP_DSR	RS-232	DTE <- DCE	This pin is the DSR for the Control port and is asserted when the modem detects activity on the Control port and is ready to communicate with the DTE over this port. This signal is de-asserted when the modem detects no activity on the Control port; or is de-asserted as an acknowledgment to the user, indicating that the modem has completed its power- down sequence as no active DTR lines were seen on the serial ports.
16	CP_RXD	RS-232	DTE <- DCE	Control port RXD
17	MIC_P	Analog	Input to modem	Analog Microphone Input (Reserved for Future Use)
18	MIC_N	Analog	Input to modem	Analog Microphone Input (Reserved for Future Use)
19	Reserved	Reserved	Reserved	
20	DP_DTR	RS-232	DTE -> DCE	Data port DTR
21	Ground	Ground	Ground return	Ground return
22	DP_RI	RS-232	DTE <- DCE	Data Port RI
23	SPKR_P	Analog	Output from modem	Analog speaker output (Reserved for Future Use)

Table 7-1. Interface Connector Pinouts (continued)

Pin Number	Signal Name	Signal Level	Direction User <-> Modem	Description
24	SPKR_N	Analog	Output from modem	Analog speaker output (Reserved for Future Use)
25	MODULE_ RESET_N	TTL	Input to modem	Hard reset of the modem, inverted logic. This line should be left floating for normal modem operation. In case the application detects that the modem is not responding, it can initiate a hard reset of the modem by pulling this line low (below 0.3V) for more than 5 seconds. The modem will reboot after the line is allowed to float.

Diagnostic Port

The Diagnostic port consists of a single DE-9 male upright connector, located on the right side of the GSP-1620 modem (see Figure 7-1).

By connecting a Diagnostic cable (included in the Modem Integrator's Kit) or a custom cable to the Diagnostic port, you can:

- Service-program a modem or upgrade its software, using the Globalstar User Terminal Program Support Tool (UTPST).
- Monitor or verify some modem functions, using the QUALCOMM Globalstar Modem Operation Monitor.

Note Normal field usage does not require that a cable be connected to the Diagnostic port on the modem, since the port is typically used for development and programming only.

The Diagnostic cable includes a switch box that controls whether the cable's DTR (Data Terminal Ready) signal is asserted ("POS 1 DTR to GND") or de-asserted ("POS 2 DTR Open" or "POS 3 Not Used"). When DTR is asserted, the modem powers up immediately if power is provided. Before

powering down the modem with this cable attached, you must set this switch to “POS 2” or “POS 3.” (“POS 2” and “POS 3” are functionally equivalent.) For more information about using the Diagnostic cable, see *Connecting the Diagnostic Cable* on page 2-7.

Note

For more information about the UTPST, see *UTPST Overview* on page 3-2. For more information about the Operation Monitor, see the *QUALCOMM Globalstar Modem Operation Monitor User Guide (*80-99399-1).

Diagnostic Port Pinouts

Table 7-2 on page 7-14 provides detailed information about the Diagnostic port pinouts.

The Diagnostic port uses un-translated 3.3V TTL levels. In Table 7-2, all signals are TTL levels unless otherwise specified.

Caution

All pins on the Diagnostic port are ESD protected but not short-circuit protected. Care must be taken when using these pins to avoid any short circuits to Ground/Power.

Note

Hardware flow control is required on the Diagnostic port. If the two flow control pins are not implemented by the user, the Diagnostic port may not function correctly.

Table 7-2. Diagnostic Port Pinouts

Pin Number	Signal Name	Direction User <-> Modem	Description
1	Ground	Ground return	Ground return
2	DM_RXD	Output from modem	Diagnostic port RXD
3	DM_TXD	Input to modem	Diagnostic port TXD
4	DM_DTR_N	Input to modem	Diagnostic port DTR The DTR line has only one function: to turn on the modem when power is applied but no other device is connected. When DTR is asserted, the modem powers up immediately if power is provided. Pulled high to input voltage through a 47K resistor in the modem.
5	Ground	Ground return	Ground return
6	Input DC POWER	Input/Output	Used for an active translator Diagnostic cable. 5.6V-16V, unfiltered in the modem. If this pin is used as the source of power to the modem, users must provide sufficient filtering to comply with conducted EMI specifications; see *DC Power* on page 7-15.
7	DM_RTS_N	Input to modem	Diagnostic port RTS Used for hardware flow control.
8	DM_CTS_N	Output from modem	Diagnostic port CTS Used for hardware flow control.
9	DM_PROGRAM_ FLASH		Allows programming of the modem. Apply 13V +/- 10%, 50mA (maximum) to program the flash in the modem. This is required for all software upgrades as well as service programming.

DC Power

The GSP-1620 modem requires input DC power ranging from 5.6 V to 16 V, with 1 Amp (maximum). The modem DC input power must be clean (maximum of 50 mV peak-peak ripple and noise) and must be within the absolute maximum voltage range of 5.6 V to 16 V under all conditions. For typical DC power consumption limits, see *Power Consumption* on page 7-16.

The GSP-1620 modem uses a DC/DC converter to source its internal operating voltages and behaves like a constant power load over varying input voltages that has a varying input impedance when the modem is transmitting data. This creates a potential for oscillations on the DC power line if the input impedance of the modem is lower than that of the power supply sourcing the power.

The approximate minimum input impedance of the modem is given by $R = V^2/P_{max}$ where V is the operating voltage of the modem and P_{max} is the maximum power consumed by the modem. For example, the minimum input impedance of the modem at 12V would be approximately 12*12/5.4 = 26.7 Ohms. Any DC power supply capable of supplying the peak demand of 5.4W at 12V would have this output impedance. Additional design margin of at least 20% is recommended beyond this minimum value.

Care should be taken that if additional EMI filtering is added (see *EMI Filtering* on page 7-16), the impedance as seen by the modem's input power supply does not exceed this value.

Warning

Do not unplug the power cables while the modem is powered up. This can cause ESD damage to the modem and also presents a danger of electrical shock.

Caution

You must ensure that the output impedance of the power supply sourcing DC power to the modem is always less than that of the input impedance of the modem. Otherwise, a potential exists for oscillations on the DC power line and the GSP-1620 modem will not operate as designed.

Caution

You CANNOT have both a DC power supply and an AC adapter connected to the modem at the same time. This may cause the modem to fail to power up and may damage the modem. If you connect the Diagnostic cable to service-program the modem while using a DC power source, make sure the AC wall adapter of the Diagnostic cable is *not* plugged in to an AC outlet.

Surge Protection

As an OEM, you are responsible for ensuring that the input voltage specification will never be exceeded.

Minimal transient protection is provided on the GSP-1620 modem board but this is intended only for low energy/duration events (total transient power less than 1 kW). It is not intended to protect the modem in case of a sustained over-voltage/lightning condition.

The use of a fuse is strongly recommended in the power supply connecting to the GSP-1620 modem. The input surge current requirements of the GSP-1620 modem are such that a fuse with a minimum melting I^2t rating of 0.02 A^2 seconds will be sufficient.

EMI Filtering

Adequate conducted EMI filtering has already been provided in the GSP-1620 modem to pass FCC and ETSI limits. Additional filtering should not be necessary to meet these requirements.

Caution

Should additional filtering be necessary, you must take precautions to ensure that the above criteria are not violated. Please contact QUALCOMM Incorporated for further details in such a case.

Power Consumption

Power consumption depends on a variety of factors such as transmit power, input voltage, and data rate. Table 7-3 summarizes the power consumption of the GSP-1620 modem at an input voltage of +12 V DC. All power estimates include

the DC power consumption of the ODU antenna's receive section.

Table 7-3. Modem DC Power Consumption Estimates at 12 V DC Input

Mode	Minimum	Typical	Maximum
Shutdown	1.2 mW	2.4 mW	6 mW
Standby	280 mW	500 mW	2.4 W
Transmit	3.6 W	4.8 W	5.4 W

The power modes in Table 7-3 are as follows:

- **Shutdown** — The modem is not operational in this state and reverts to this state when DTR lines are inactive.
- **Standby** — The receiver section in the modem is active during this time and the modem is ready to transmit/receive data.
- **Transmit** — The modem's transmitter is active in this state and may be in the process of transmitting/receiving data.

Power-On

Power-on is controlled via OR'd DTR signals from any port (Data, Control or Diagnostic). When DTR is asserted on one or more of the ports, the GSP-1620 modem powers up. Upon successful power-up, the modem asserts the DSR line of each active port to let the user know that it has booted up successfully and is ready to accept commands. Only the Data and Control ports include DSR lines.

Note At least one port DTR signal must remain asserted during the entire power-on sequence, until a DSR signal is asserted.

Power-Off

Power-off is also controlled via the OR'd DTR signals. When all port DTRs have been de-asserted for a minimum of one second, the GSP-1620 modem begins its power-down sequence. After all software processing has concluded, the modem powers off. This causes loss of power to the Data and Control port RS-232 transmitters, de-asserting the ports' DSR lines and informing the user it is safe to remove power.

Caution Removing power before the DSR signals are de-asserted can corrupt the modem's service programming parameters and other data stored in non-volatile memory.

Note All port DTR signals must remain de-asserted during the entire power-down sequence, until the DSR signals are de-asserted.

Note DSR/DCD will also go inactive in case of a fatal error that causes the modem to reboot.

Hard Power Reset

Provisions equivalent to power cycling (see Pin 25 in Table 7-1) are included to "hard reset" a GSP-1620 modem under user control. This pin is pulled low for a minimum of five seconds to reset the modem. The line is normally left floating.

Grounding

The GSP-1620 modem has been designed to provide flexibility in the area of grounding, with options to make connections between digital ground and the OEM-provided chassis ground (metallic enclosures). These grounding options are also independently available for the DB-25 user interface, Diagnostic port, and associated cable shields.

The GSP-1620 modem has been certified in accordance with the technical and regulatory requirements of the FCC and the European Union. The modem was tested in a configuration that did not include, or require, an enclosure or specially

shielded cable configuration in order to demonstrate compliance with the requirements.

Your OEM application may need different grounding configurations. The options are as follows:

- **Option 1** — A chassis ground connection to the modem may be established using conductive support posts/ screws between the modem mounting holes, where the solder mask is exposed on both sides of the board, and the OEM-provided chassis (metallic enclosure or base).
- **Option 2** — DNI (do not install) resistors (R216 and R217) on the modem circuit card allow for the option of connecting digital ground and chassis ground together.
- **Option 3** — The user interface DB-25 cable shield termination is provided through Pin 1 of the DB-25 connector. The cable shield drain wire may be connected to this pin to provide a termination of the cable shield to either chassis or digital ground (options 1 & 2 dependency).

Caution

The RF connector ground is the same as the signal and power ground. As an OEM, you should understand this when designing an integrated product for use in environments where surge protection may be required. You should also be aware of this fact to avoid ground loops in the final installation.

Modem Mounting Guidelines

QUALCOMM offers the GSP-1620 modem without a mechanical enclosure, anticipating that OEMs will integrate and package the modem into an enclosure or cabinet appropriate to the end-user's application. The enclosure must shield the GSP-1620 modem from direct impacts, precipitation, vibration, acoustic noise, and particulates.

The GSP-1620 modem has six mounting holes sized for M3 screws. All six mounting locations of the modem must be fastened to a rigid structure to meet the vibration and shock requirements specified in *Integrating Modems into Products* on page 7-2.

For hole size and locations, connector locations, and overall envelope dimensions, see Figure 7-1 on page 7-4 and Figure 7-2 on page 7-5.

Caution

When you mount the GSP-1620 modem into an enclosure or onto a surface, you must exercise care during the process. Adhere to the following recommendations:

- Observe handling precautions necessary to avoid damage by ESD.
- Fasten the modem to a planar surface of sufficient flatness and rigidity to prevent flexing of the modem.
- Use shock mounts when the environment includes vibration in excess of that shown in Figure 7-9 on page 7-33.
- Use acoustic dampening material when the environment includes acoustic noise in excess of 110 dB OSPL (Overall Sound Pressure Level).
- Do not use fasteners that will damage the grounding areas around the through holes.
- Do not fasten the modem using tools with speed and/or torque that will cause damage to the printed circuit board.
- Do not fasten the modem with enough clamping force to damage the printed circuit board.
- Exercise caution and do not damage components on the modem during handling.

Note

The GSP-1620 modem meets or exceeds all operational vibration requirements defined in Table 7-5 when E-A-R damping feet (MF-100-UC04-H, black) are used as shock mounts.

QUALCOMM Mark on OEM Enclosures

Each GSP-1620 based product and its packaging shall bear the "CDMA by QUALCOMM" mark and such other mark(s) of QUALCOMM, or those which QUALCOMM has the right to use and permit the use of, as QUALCOMM may designate

from time to time upon notice to the buyer. The product markings shall appear in a size and location reasonably agreed to by both parties.

Figure 7-3 shows the QUALCOMM marking suitable for OEM enclosures (included on the Modem Integrator's Kit CD as an Encapsulated PostScript [EPS] file).

Figure 7-3. QUALCOMM Mark for OEM Enclosures

Integrated Product Regulatory Labeling

The GSP-1620 modem as delivered by QUALCOMM Incorporated is approved and labeled in accordance with the requirements of the FCC and the European Union (see Appendix B, *RF Certification / Restrictions*).

If the regulatory labeling is not visible when the modem is integrated into the final product, then the labels must be applied to the product enclosure. QUALCOMM Incorporated authorizes the duplication and use of these regulatory approvals on the integrated product provided that the modem has not been modified or altered to the extent that the electromagnetic performance has been degraded (see *Modem Mounting Guidelines* on page 7-19 and Appendix B, *RF Certification / Restrictions*).

The OEM or integrator is responsible for ensuring that the product complies with all the regulatory requirements for their target market and labeled accordingly.

The label must be located on the product in an area that can be easily viewed and the type size must be large enough to be legible without the aid of magnification. The integrator labeling may be worded as follows:

> "This Product Contains a Globalstar Radio Transceiver
> FCC ID: J9CGSPDM1; CE 168"

Mounting Antennas On-Site

This section describes the Dielectric Resonator Antenna (DRA, also called an Outdoor Unit or ODU) hardware, including specifications for antennas and antenna cable. It also describes how to calculate antenna cable length and mount antennas.

Modem Antenna Specifications

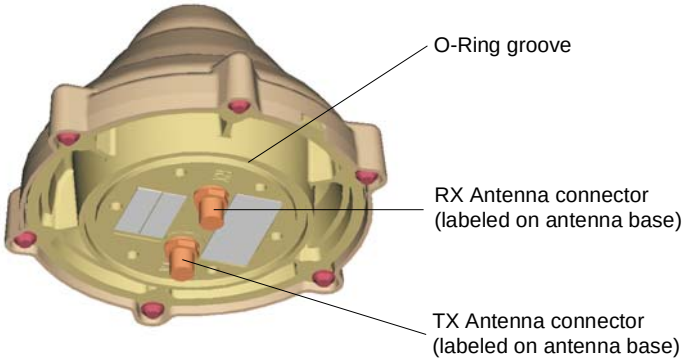
The GSP-1620 modem is to be used with an aluminum Dielectric Resonator Antenna (DRA), as shown in Figure 7-4 and Figure 7-5. The modem DRA has a passive transmit and an active receive section. The transmit (Tx) and receive (Rx) connectors are labeled on the antenna.

Caution

You must be careful to connect the Tx connector on the DRA to the Tx connector on the modem, and the Rx connector on the DRA to the Rx connector on the modem. Crossing the Tx and Rx cables can damage the modem.

Figure 7-4. DRA Side View

Figure 7-5. DRA View Showing Connectors



Antenna Dimensions and Weight

The DRA antenna is 103 millimeters diameter by 63 millimeters tall (4.1 inches diameter by 2.5 inches tall).

The weight for the antenna is less than 250 grams (8.8 ounces).

Antenna Depiction

This section includes the following technical drawings that depict the antenna:

- GSP-1620 Antenna: DRA Top and Side Views, Figure 7-6
- GSP-1620 Antenna: DRA Bottom View, Figure 7-7

Note

In Figure 7-6 and Figure 7-7, dimensions are shown as: millimeters [inches]. Millimeters are the controlling dimensions on these drawings. Inch dimensions are for reference only.

Figure 7-6. DRA Top and Side Views

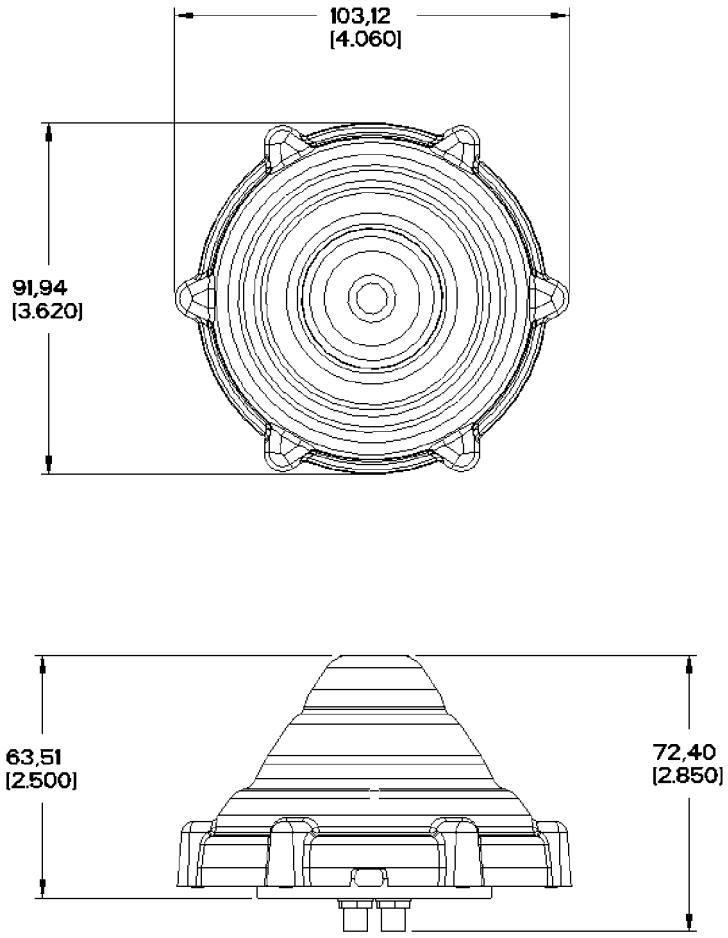
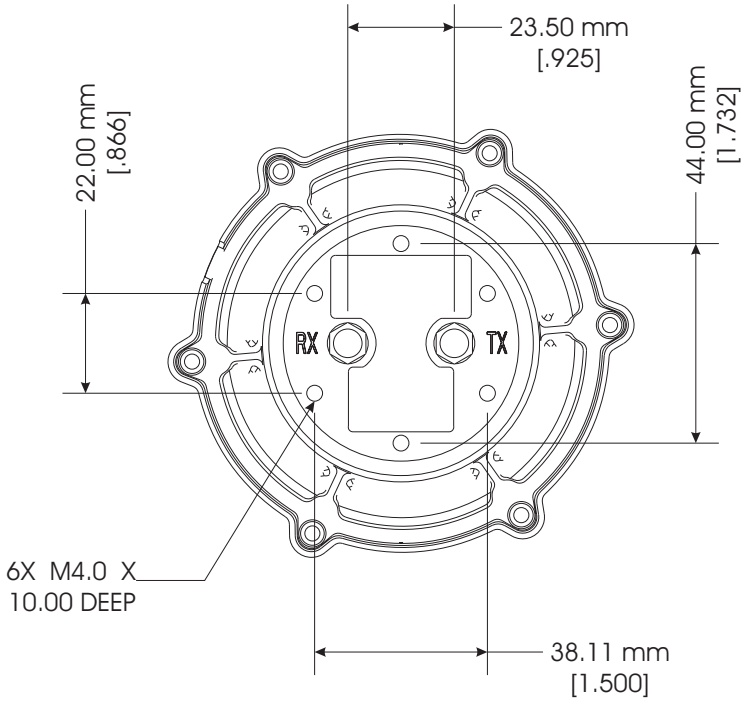


Figure 7-7. DRA Bottom View and Mounting Hole Locations



Antenna Cable Specifications

The DRA antenna requires two (2) cables, one for transmit and one for receive:

- The required connectors are plug SMA (DRA bulkhead) to plug MCX (modem).
- Transmit cable maximum 0.6 dB insertion loss @ 1618 MHz is required for the cable.
- Receive cable maximum 3.0 dB insertion loss @ 2492 MHz is required for the cable.

QUALCOMM does not provide cables for OEM bulk applications since OEMs may need cables of different lengths for particular applications. Table 7-4 lists potential suppliers of RF and microwave connectors and cable assemblies.

Table 7-4. Suggested RF Cable and Connector Suppliers

Volex Inc.:	
Company: Volex Inc. 1 Batterymarch Park, Quincy, MA 02169 USA Tel: +1 617 376-0555 Fax: +1 617 376-0590 Email: jim_stout@volexna.com Web: http://www.volex.com/	
Times Microwave:	
Company: Times Microwave Systems 358 Hall Avenue P.O. Box 5039 Wallingford, CT 06492-5039 Tel:1(800)TMS-COAX (867-2629) Tel: +1 203 949-8400 Fax: +1 203 949-8423	*Sales Representative:* Dave Murray 505 W. Ray Road Suite #3 Chandler, AZ 85225-7283 Phone: +1 480 786-1656 Fax: +1 480 786-3684 Page: +1 800 618-6140 email: timeswest@aol.com
JPM:	
Company: JPM Corporate 155 North 15th Street Lewisburg, PA 17837 USA Tel: +1 570 524-8225 Fax: +1 570 524-5660 Web: http://www.jpmco.com/	

Calculating Antenna Cable Length

The maximum loss for an antenna cable of any length is 0.6 dB at 1.6 GHz for modem transmit and 3 dB at 2.5 GHz for modem receive.

You must take these losses into account when calculating antenna lengths for a GSP-1620 modem installation. For example, the GSP-1620 Modem Integrator's Kit utilizes three feet of LMR 195 cable, which has a loss of 0.6 dB at 1.6 GHz.

Mounting Antennas at the Field Site

When mounting an antenna on-site, you must position it properly to obtain Globalstar satellite signals. You can mount the antenna on a flat surface or on a pole. In either case, you should seal the antenna connectors against dirt and moisture.

Caution The ODU antenna must be installed in a configuration that ensures a minimum line-of-sight separation distance of 21.5 centimeters (8.5 inches) is maintained at all times between the ODU antenna and any personnel.

Finding a Good Antenna Location

When installed in the field, the antenna of a GSP-1620 modem product must have a direct line of sight to the Globalstar satellites. Keep in mind that Globalstar satellites follow different paths across the sky, and you cannot predict where they will be.

Position the DRA antenna outdoors where it has a clear view of the sky, unimpeded by tall obstacles such as buildings and trees.

Signal fading associated with trees, buildings, and other obstacles that prevent a clear line-of-sight to the satellite can cause degraded operation in a mobile environment.

Note Globalstar frequencies are attenuated by wet snow. When mounting the antenna in a snowy location, you must make provisions to prevent snow buildup on the antenna. Wet ice/snow must be restricted to a maximum thickness of 20 centimeters (8 inches) by suitably mounting the antenna. See *Mounting and Sealing Antennas on Poles* on page 7-29.

Securing Antenna Cables

When connecting the antenna cables, the recommended torque for the SMA connectors is 0.79 to 1.13 N·m (7 to 10 in·lb).

Mounting and Sealing Antennas on Flat Surfaces

You can mount the modem antenna (DRA) on a flat surface with six M4 screws. Depending on whether the surface is smooth or rough, different methods are recommended for sealing out moisture and dirt from the antenna's SMA connectors, which are not sealing connectors.

If the surface is smooth, flat, and solid, you can use an O-ring to protect the antenna's connectors. The O-ring should be 2.050 inches in diameter by 0.103 inch wide, to fit within the groove on the bottom of the antenna. Silicone or ethylene-propylene is the preferred material.

A recommended source is:

Parker Seal Group
18321 Jamboree Rd.
Irvine, CA 92612-1073
Tel: 800/272-7537
Fax: 949/851-2127
Parker part number: 2-137 E515-80
Description: O-ring, ethylene-propylene, 2.050 inches diameter by 0.103 inch thick, 80 durometer

If you are mounting the antenna on rough surfaces, surfaces which have already suffered significant environmental damage (pitting, peeling paint, etc.), or surfaces that are not sufficiently flat, it is recommended that you do not use an O-ring. O-rings need smooth, flat surfaces to work.

Instead, you should fill the groove on the antenna, which is normally used for the O-ring, with an adhesive caulking material that can bond to the aluminum antenna base and the surface to which you are mounting the antenna. The caulk seals out moisture and dirt.

Tip For extra protection on either flat or rough surface mounts, you can coat the antenna's SMA connectors before sealing the antenna base; for details, see *Mounting and Sealing Antennas on Poles*.

Mounting and Sealing Antennas on Poles

Instead of mounting the modem antenna (DRA) on a flat surface or bulkhead, you can mount it on a pole with six M4 screws. A pole mount may be desirable in snowy locations, to prevent wet ice or snow from building up to more than the maximum allowable thickness of 20 centimeters (8 inches).

In a pole mounting, the antenna's SMA connectors, which are not self-sealing, are exposed to weather and precipitation. Therefore, you should seal the SMA connectors with a commercially available coating for outdoor cable or electrical connectors. For example, you could use a product such as "Liquid Electrical Tape" from PDI Inc., which is weather and corrosion resistant.

Mounting Multiple Antennas

If required for your application, you can mount multiple antennas within several feet of each other without creating significant interference.

QUALCOMM testing has determined that if two antennas are placed near each other and transmit on different frequencies, only a barely perceptible (1 dB or less) increase in 1605 emission occurs when tested at full jamming power. This maps to isolation between antennas of 20 dB. Even for antennas whose bases were touching (zero inches separation) the isolation was 22 dB in the worst case of rotation with respect to one another.

Environmental Specifications

This section describes environmental specifications for both the QUALCOMM Globalstar GSP-1620 Satellite Data Modem and its Dielectric Resonator Antenna (DRA).

The environmental requirements specified herein are under development and are subject to change without notice.

GSP-1620 Modem Environments

Environments affecting the GSP-1620 modem include temperature/humidity, thermal radiation, altitude, vibration, mechanical shock, and acoustic noise. This section also discusses connector durability, materials, and shipping.

Temperature/Humidity

Operational

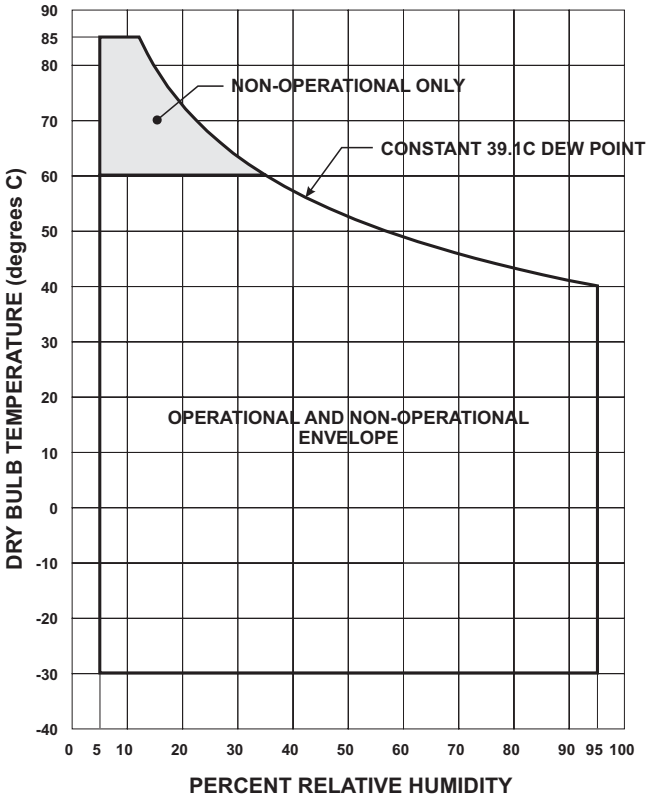
The GSP-1620 modem operates as specified during exposure to the operational temperature/humidity envelope shown in Figure 7-8.

Caution Condensation on the GSP-1620 modem is not permissible.

Non-Operational

The GSP-1620 modem operates as specified after exposure to the operational and non-operational temperature/humidity envelopes shown in Figure 7-8.

Figure 7-8. GSP-1620 Modem Temperature/Humidity Envelope



Thermal Radiation

The temperature profile shown in Figure 7-8 includes temperature rise due to thermal radiation, solar radiation, and other heat loads. The GSP-1620 modem dissipates heat that is dependent on the mode and the transmit power. The dissipated heat is the difference between the DC input power and the RF transmitted power.

Altitude

Operational

The GSP-1620 modem operates at standard atmospheric pressure altitudes between 0 and 15,000 meters (50,000 feet).

Non-operational

The GSP-1620 modem operates as specified after storage at pressure altitudes ranging from 0 to 15,000 meters (50,000 feet).

Vibration

Operational - Random

The GSP-1620 modem operates as specified during exposure to the random vibration spectrum defined in Figure 7-9.

Non-Operational - Random

The GSP-1620 modem operates as specified after exposure to the random vibration spectrum defined in Figure 7-9.

Operational - Sinusoidal

The GSP-1620 modem operates as specified after exposure to the swept sinusoidal vibration environment defined in Table 7-5 when E-A-R damping feet (MF-100-UC04-H, black) are used as shock mounts.

Non-Operational - Sinusoidal

The GSP-1620 modem operates as specified after exposure to the swept sinusoidal vibration environment defined in Table 7-5.

Figure 7-9. GSP-1620 Modem Random Vibration Spectra

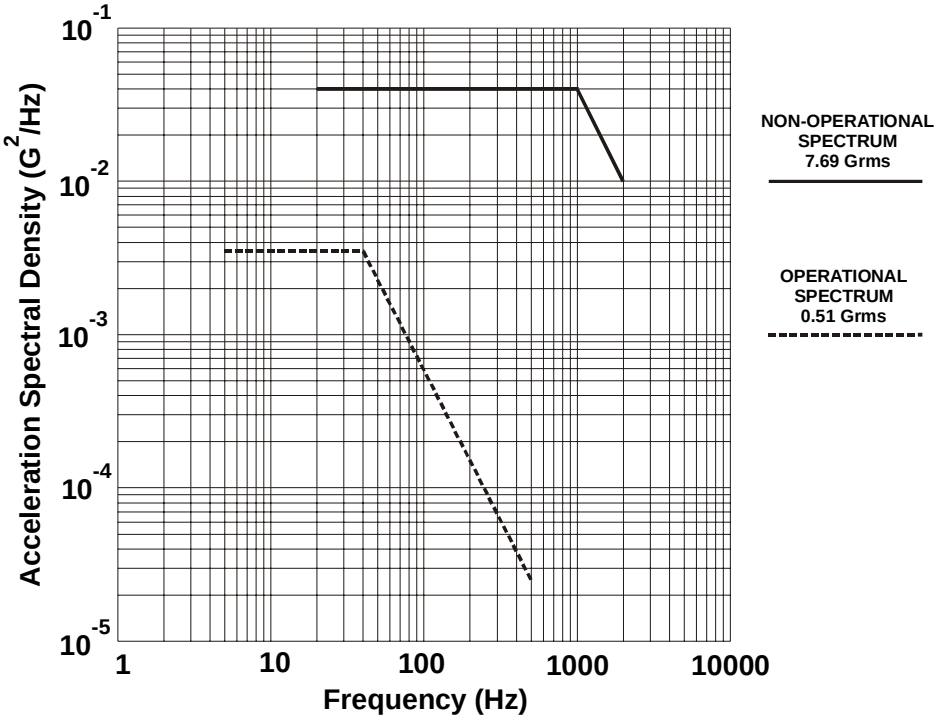


Table 7-5. Swept Sine Vibration Definition

	Double Amplitude Displacement (inch)	Acceleration (Gs)	Frequency Range (Hz)
Operational	0.28		2 to 6
		0.5	6 to 500*
Non-Operational	0.59		2 to 8
		2.04	8 to 200
		4.08	200 to 500

* E-A-R damping feet (MF-100-UC04-H, black) used as shock mounts

Mechanical Shock

Operational

The GSP-1620 modem operates as specified while being subjected to a half sine pulsed acceleration wave form of 11 milliseconds in duration, 2 Gs peak.

Non-Operational

The GSP-1620 modem operates as specified after being subjected to a half sine pulsed acceleration wave form of 6 milliseconds in duration, 30 Gs peak.

Acoustic Noise

The GSP-1620 modem is sensitive to very high ambient noise levels. Exceeding specified levels will cause degraded performance. Steps must be taken to ensure that the noise level at the module does not exceed 110 dB OSPL (Overall Sound Pressure Level).

Digital Data Connector Durability

Applied Forces

The digital data connector meets all performance requirements after application of a 24.5 newton force on the mating connector, applied in six directions—two opposite directions along each of three mutually perpendicular axes.

Mating cycles

The digital data connector meets all performance requirements after a minimum of 3,000 connect/disconnect cycles.

RF Connector Durability

The GSP-1620 modem RF connectors meet all performance requirements after 500 connect/disconnect cycles at a maximum rate of 12 cycles per minute.

Materials

The GSP-1620 modem is manufactured of non-nutrient materials with respect to fungal growth.

Shipping

The GSP-1620 modem as packaged for shipment meets the pre-shipment test procedures specified in the National Safe Transit Association, Project 1A.

Dielectric Resonator Antenna (DRA) Environments

Since the GSP-1620 Dielectric Resonator Antenna (DRA) communicates with Globalstar satellites, it must be positioned outdoors where it has a clear view of the sky.

As a result, environments affecting the DRA include temperature/humidity, thermal radiation, icing/freezing rain/snow, altitude, vibration, and mechanical shock. This section also discusses RF connector durability, materials, and shipping.

Temperature/Humidity

Operational

The DRA operates as specified during exposure to the operational temperature/humidity envelope shown in Figure 7-10.

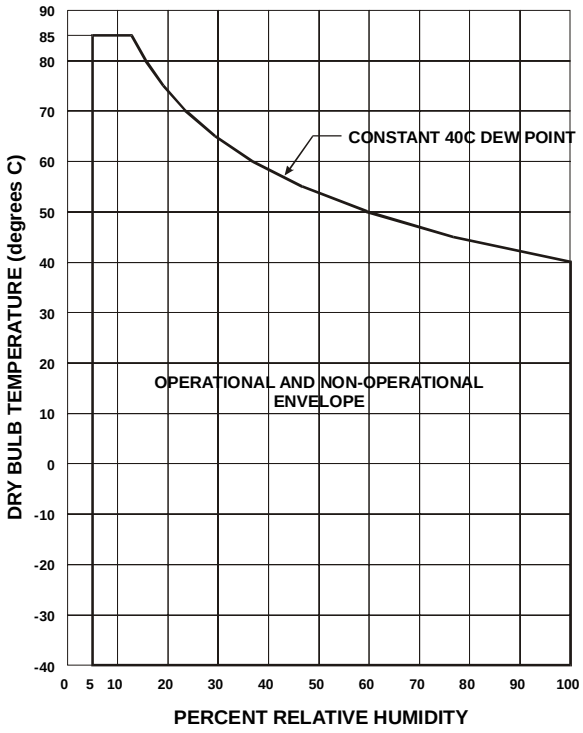
Non-Operational

The DRA operates as specified after exposure to the operational and non-operational temperature/humidity envelopes shown in Figure 7-10.

Thermal Radiation

The temperature profile shown in Figure 7-10 includes temperature rise due to thermal radiation, solar radiation, and other heat loads.

Figure 7-10. DRA Temperature/Humidity Envelope



Icing/Freezing Rain/Snow

Any ice or freezing rain on the radome of the ODU will cause degraded performance. Steps must be taken to ensure that ice formation is kept to a minimum on the ODU.

Globalstar frequencies are attenuated by wet ice and snow and OEMs must make provisions (such as installing the antenna on a pole) to prevent snow buildup on the antenna. Wet ice/snow must be restricted to a maximum thickness of 20 centimeters (8 inches) by suitably mounting the antenna (see *Mounting Antennas at the Field Site* on page 7-27).

Altitude

Operational

The DRA operates at standard atmospheric pressure altitudes between 0 and 15,000 meters (50,000 feet).

Non-Operational

The DRA operates as specified after storage at pressure altitudes ranging from 0 to 15,000 meters (50,000 feet).

Vibration

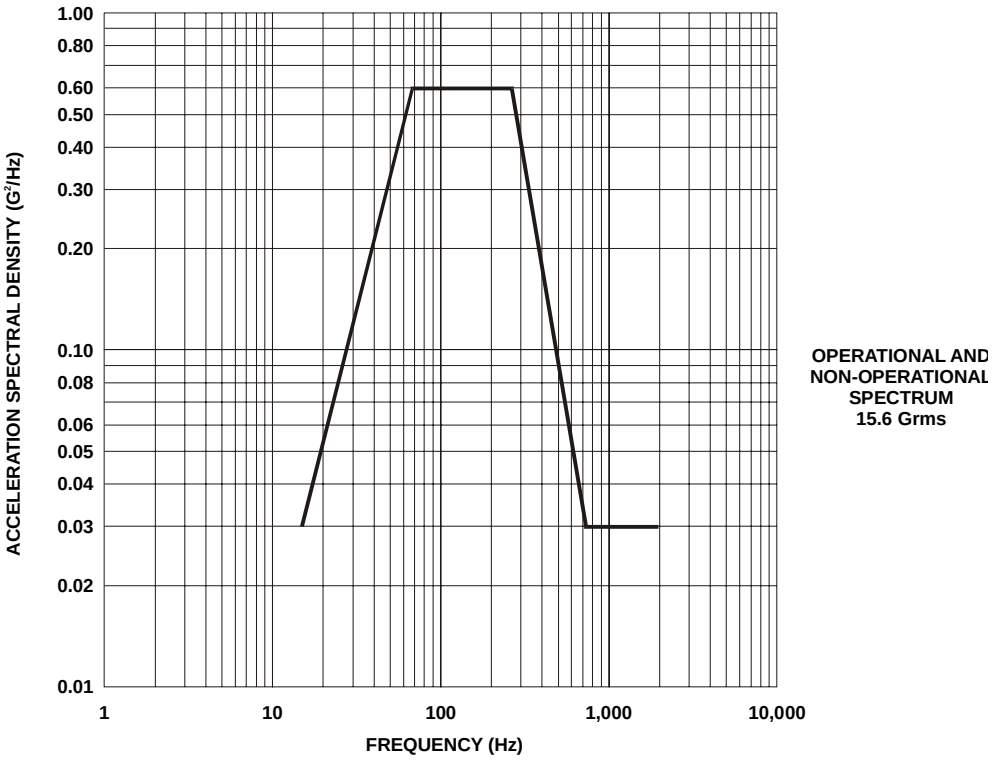
Operational - Random

The DRA operates as specified during exposure to the random vibration spectrum defined in Figure 7-11.

Non-Operational - Random

The DRA operates as specified after exposure to the random vibration spectrum defined in Figure 7-11.

Figure 7-11. DRA Random Vibration Spectrum



Mechanical Shock

Operational

The DRA operates as specified while being subjected to a half sine pulsed acceleration waveform of 6 milliseconds in duration, 30 Gs peak.

Non-Operational

The DRA operates as specified after being subjected to a half sine pulsed acceleration waveform of 6 milliseconds in duration, 100 Gs peak.

RF Connector Durability

The DRA RF connectors meet all performance requirements after 500 connect/disconnect cycles at a maximum rate of 12 cycles per minute.

Materials

The DRA is manufactured of non-nutrient materials with respect to fungal growth.

Shipping

The DRA as packaged for shipment meets the pre-shipment test procedures specified in the National Safe Transit Association, Project 1A.

8 TROUBLESHOOTING

If you are having a problem with a QUALCOMM Globalstar GSP-1620 Satellite Data Modem, try the troubleshooting tips in Table 8-1. If that does not solve the problem, you can contact QUALCOMM Globalstar Customer Service, as described in Appendix D.

Table 8-1. Troubleshooting Modem Problems

Problem	Possible Solutions
`AT$QCSTATUS` command returns `RSSI: 0` *-or-* DTE application determines, after a service alert, that there is no Globalstar signal. *-or-* Current consumption of the modem with antenna connected is lower by about 30mA.	■ The antenna is not properly connected, or is not outside with a clear view of the sky. ■ Antenna cables may be crossed (that is, the modem Rx cable may be connected to the antenna Tx Transmit connector, and vice versa). Make sure modem Tx is connected to the antenna Tx connector and the modem Rx is connected to the antenna Rx connector.
`AT$QCSTATUS` command returns `Registration: No`	■ The modem may not be service-programmed correctly. See *Service-Programming Modems* on page 3-1 and consult your SP to make sure you have the correct service programming values.
Upon attempting a connection, the `SELF TEST RESULT` is not received within a few seconds.	■ HyperTerminal is connected to the wrong COM port. ■ The modem is not plugged in to a power source.

Table 8-1. Troubleshooting Modem Problems (continued)

Problem	Possible Solutions
The modem does not seem to be getting power, even though it is plugged in.	■ Both the AC power connector on the diagnostic cable and the DC power connector on the interface cable are plugged in. Only one can be used at a time. ■ DTR is not asserted on a serial port. Connect one of the modem's serial ports (Data, Control, or Diagnostic).
AT commands that you type in HyperTerminal do not appear on the screen.	■ Command echoing has been turned off. Type `ATE1` or `ATZ` to turn echoing back on.
AT commands are not recognized on the Data port.	■ Check to see if the Control port is active. AT commands will not work on the Data port when the Control port is active.
HyperTerminal or Dial-Up Networking cannot talk to the modem.	■ Make sure the baud rate in HyperTerminal or Dial-Up Networking matches that for the modem port. The Control port is 9600 only; the Data port default is 38400 but can be set to selected rates from 300 to 115200.

A GLOBALSTAR BACKGROUND

Globalstar is a voice and data telecommunications system utilizing a constellation of 48 low-Earth-orbit (LEO) satellites, providing nearly world-wide coverage (70^{o} N to 70^{o} S latitudes).

Globalstar Limited Partnership (GLP), the owner/operator of the LEO constellation, is a strategic partnership composed of many of the world's leading telecommunications providers:

- Alenia Marconi
- China Telecom
- DACOM
- Daimler-Chrysler Aerospace
- Elsacom
- Globalstar USA, Canada, and Mexico (formerly known as Vodaphone/Airtouch)
- Hyundai
- QUALCOMM Incorporated
- Space Systems/Loral
- TESAM (joint venture between France Telecom and ALCATEL)
- Vodaphone

The Globalstar system consists of a space segment, and a ground or earth segment.

Space Segment

The space segment consists of 48 LEO satellites (and eight additional in-orbit spares) built by Loral Space Systems and operated by Globalstar Limited Partnership (GLP) in San Jose, CA.

Compared to medium-Earth-orbit or geostationary-Earth-orbit (MEO/GEO) satellites, LEO satellites offer several advantages: minimal delay (~250 ms or comparable to terrestrial digital cellular), multi-satellite handoff, extremely small antenna, lower power consumption, and lower cost.

Ground Segment

The ground segment consists of Earth stations called Gateways, which provide service in specific geographical areas. The Gateways are deployed worldwide and communicate via C-band frequencies to/from the LEO satellites, which serve as "bent pipe" transponders.

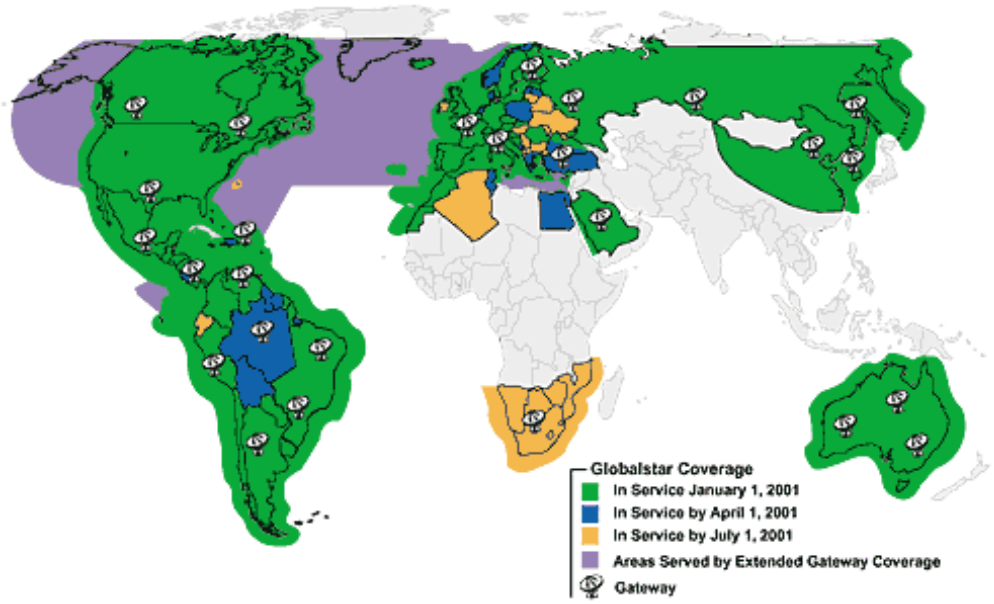
User Terminals communicate to/from a Gateway ground station using L- and S-band frequencies, via the LEO satellites.

A User Terminal can be either a QUALCOMM Globalstar GSP-1600 Tri-Mode Phone, or QUALCOMM Globalstar GSP-1620 Satellite Data Modem.

Coverage

Figure A-1 shows Globalstar coverage areas and availability dates.

Figure A-1. Globalstar Coverage Availability



The following list details Globalstar's expected service coverage as of January 1st:

Andorra	Chile	Italy	San Marino
Antigua & Barbuda	China	Liechtenstein	Saudi Arabia
Argentina	Colombia	Mexico	Slovakia
Australia	Croatia	Monaco	Slovenia
Austria	Czech Republic	Morocco	South Korea
Azores	El Salvador	Netherlands Antilles	Spain
Bahamas	Estonia	Nicaragua	Sweden
Belgium	Finland	Panama	Switzerland
Bosnia-Herzegovina	France	Paraguay	United Kingdom
Brazil	French Guyana	Peru	United States
British Virgin Islands	Germany	Portuga	Uruguay
Canada	Gibraltar	Puerto Rico	Vatican City
	Guatemala	Romania	Venezuela
	Honduras	Russia	
	Iceland		

The map and list in Figure A-1 depict current and planned Globalstar service coverage. Actual coverage may vary because of Gateway deployment, local licensing and other factors, including environmental conditions. "Service" means that a phone can be purchased and activated in that country.

You may be able to use your Globalstar phone in areas of extended Gateway coverage; however, neither Globalstar nor your Service Provider warrants that call duration or quality in these areas will meet normal system standards.

Globalstar roaming is not included. Please contact your Service Provider for information about roaming availability.

Carriers

Each coverage territory is typically aligned with country boundaries. A coverage territory has one or more Service Providers (SPs) or carriers that offer service to users, similar to a "cellular" model. Globalstar licenses the Service Provider or carrier to offer service in a part of the worldwide coverage area (one or more countries).

The Service Provider offers "airtime" to the OEM or end user. It also provides a customer care center and keeps billing records for the satellite airtime used and the data traffic sent and received.

Service Providers vary by region around the world.
To identify the correct Service Provider in your area, refer to the Globalstar Web page: **http://www.globalstar.com**.

Distributors and OEMs for User Terminals

Customers access the Globalstar system by means of User Terminals, either QUALCOMM Globalstar GSP-1600 Tri-Mode Phones, or QUALCOMM Globalstar GSP-1620 Satellite Data Modems.

- For Tri-Mode Phones, cellular and satellite distributorships serve as retail sales conduits where customers can purchase, provision, and repair Tri-Mode Phones throughout the world.
- For the GSP-1620 Satellite Data Modem, OEMs directly integrate the modem into a market-specific product, which is then resold to a business/industrial customer.

B RF CERTIFICATION/RESTRICTIONS

This appendix discusses certification compliance for the QUALCOMM Globalstar GSP-1620 Satellite Data Modem as well as restrictions relating to RF, RF exposure, and electronic devices.

Certification

The QUALCOMM Globalstar GSP-1620 Satellite Data Modem, antenna, and cabling as supplied by QUALCOMM Incorporated shall be compliant with the following International standards when configured in accordance with the QUALCOMM recommendations. Any deviation from the guidelines or modifications to the product performed without the permission of QUALCOMM Incorporated will invalidate all regulatory approvals.

Compliance to the technical requirements shall be demonstrated with the product installed in a non-metallic enclosure, which provides no additional shielding or RF protection. An OEM-supplied enclosure is required to protect the product from the effects of electrostatic discharge (ESD) and environmental conditions that result in the product operating within its specified range.

Compliance to the technical requirements shall be demonstrated with the product powered by a power supply that is compliant with the rules and regulations of the FCC and the European Community. The OEM manufacturer is required to provide a power supply that ensures the product continues to meet the applicable regulatory requirements for the specific application.

QUALCOMM Incorporated does not accept any responsibility for regulatory compliance of the OEM product. It is the responsibility of the OEM manufacturer to ensure that all regulatory requirements (e.g., FAA, Hazardous Location) have been met for the specific application.

Federal Communications Commission (FCC)

The GSP-1620 modem configured with the QUALCOMM-supplied antenna and RF cabling is compliant and approved in accordance with the FCC Code of Federal Rules (CFR) 47 parts:

- Part 1 Para 1.1310 Radio Frequency Radiation Exposure Limits
- Part 15 Radio Frequency Devices
- Part 25 Satellite Communications

European R&TTE Directive 1999/5/EC

The GSP-1620 modem configured with the QUALCOMM-supplied antenna and RF cabling is compliant and approved in accordance with the essential requirements of the European Community, under European Directive 1999/5/EC On Radio Equipment & Telecommunications Terminal Equipment (R&TTE Directive).

The supporting technical standards used to demonstrate compliance are:

- EN 300 831 Electromagnetic Compatibility
- EN 301 441 (TBR 041) Essential Terminal Requirements

RF Restrictions

The GSP-1620 modem must be used with the QUALCOMM-provided antenna, and no modification to the RF transmit or receive path is permitted in the form of amplifiers.

QUALCOMM Incorporated must be consulted before any changes can be made in the RF path, including cable length deviations from the QUALCOMM-provided or recommended cabling. Failure to do so may result in non-compliance with the Globalstar communications network and Government Radio Regulations.

Radio Astronomy Zones

Radio Astronomy exclusion zones may be blacked out of Globalstar service. The OEM manufacturer should consult with the Globalstar Service Provider to ensure that service is available in the location(s) of the installed OEM product.

GPS Interference Elimination

The modem antenna must be installed a minimum distance of 30 inches from a GPS antenna to ensure compatibility between the two satellite systems.

Radio Frequency Exposure Restrictions

The GSP-1620 modem incorporates a relatively low-power radio transmitter, receiver, and antenna (the DRA). When it is ON it receives and sends radio frequency (RF) signals. In August 1996, the Federal Communications Commission (FCC) adopted RF exposure guidelines with safety levels for portable wireless phones and devices. Those guidelines are consistent with the safety standards previously set by both US and international standards bodies:

- ANSI/IEEE C95.1-1992 Standard [American National Standards Institute / Institute of Electrical and Electronic Engineers]
- NCRP Report 86 (1986) [National Council on Radiation Protection and Measurements]

- ICNIRP (1996) [International Commission on Non-Ionizing Radiation Protection]
- IRPA (1991) [International Radiation Protection Association]

The GSP-1620 modem is designed to comply with the established ANSI, FCC, and international safety standards for safe levels of human exposure to RF energy. Maintaining a minimum line-of-sight separation distance of 21.5 centimeters (8.5 inches) between the transmitting antenna and all personnel will ensure that the General Population/Uncontrolled Exposure maximum permissible exposure (MPE) limits are not exceeded.

This satisfies the MPE limits mandated by the FCC in 47 CFR Ch. 1 (10-1-99 Edition), Part 1, §1.1310 and defined in the ANSI/IEEE C95.1-1992 standard, and also satisfies the more-stringent European and international exposure limit recommendations of IRPA (1991) and ICNIRP (1996).

Caution The ODU antenna must be installed in a configuration that ensures a minimum line-of-sight separation distance of 21.5 centimeters (8.5 inches) is maintained at all times between the ODU antenna and any personnel.

Electronic Device Restrictions

Most modern electronic equipment is shielded from RF signals. However, certain electronic equipment may not be shielded against the RF signals from wireless phones and modems.

Pacemakers

The Health Industry Manufacturers Association recommends that a minimum separation distance of 15.24 centimeters (6 inches) be maintained between a handheld wireless phone and a pacemaker to avoid potential interference with the pacemaker.

For a wireless modem, which has a higher power output than a wireless phone, the distance must be increased. For a GSP-1620 modem, a minimum separation distance of 22.67 centimeters (9 inches) should be maintained between the transmitting modem antenna and all pacemakers. These recommendations are consistent with the independent research by and recommendations of Wireless Technology Research, L.L.C.

Persons with pacemakers should follow these guidelines:

- Always keep the modem antenna more than 22.67 centimeters (9 inches) from your pacemaker when the modem is turned ON.
- If you have any reason to suspect that interference is taking place, turn your modem OFF immediately.

Hearing Aids

Some digital wireless phones and other wireless devices (including wireless modems) may interfere with some hearing aids. If interference occurs, you may want to consult your Service Provider (or call the QUALCOMM Globalstar Customer Support line to discuss alternatives).

Other Medical Devices

If you use any other personal medical device, consult the manufacturer of your device to determine if it is adequately shielded from external RF energy. Your physician may be able to assist you in obtaining this information.

Do not operate your GSP-1620 modem (that is, turn your modem OFF) in health care facilities when any regulations posted in these areas instruct wireless phone users to do so. Hospitals or health care facilities may be using equipment that could be sensitive to external RF energy.

C WARRANTY

The warranty for the QUALCOMM Globalstar GSP-1620 Satellite Data Modem and GSP-1620 Modem Integrator's Kit (MIK) will be as provided for in the Supply Agreement.

D PRODUCT SUPPORT

This appendix provides support information for the QUALCOMM Globalstar GSP-1620 Satellite Data Modem hardware and software. It contains a description of the support available from QUALCOMM Globalstar Customer Service and how to contact the Technical Support and Order Fulfillment teams.

QUALCOMM Globalstar Customer Service

The QUALCOMM Globalstar Customer Service Center, located in the United States, provides skilled Technical Support and Order Fulfillment staff to support customers with technical issues, purchase order requests, and Return Material Authorizations (RMA) for QUALCOMM-warranted equipment. The QUALCOMM Customer Service Website provides online information and forms for technical support and RMA requests. See “Contacting QUALCOMM Customer Service” on page D-3 for details.

Technical Support Information

QUALCOMM Customer Service Technical Support is available 24 hours per day, every day, to provide troubleshooting assistance for all QUALCOMM-provided Globalstar products. Technical Support creates a case to track each issue or request and works to provide a resolution. For more information on technical support, refer to Data Modem Troubleshooting information on the QUALCOMM Customer Service Website.

Contact Technical Support for any Satellite Data Modem related issue, including when you need to:

- Troubleshoot a problem.
- Inquire about a software or hardware upgrade.
- Report a documentation issue.
- Request a Return Material Authorization (RMA).
- Find out the status of a technical issue or of an RMA.
- Follow a procedure that requires Technical Support direction.

Prior to contacting Technical Support, please do the following:

- Repeat the steps or procedures to resolve the problem.
- Check the Website and documentation for solutions.
- Identify the software version and hardware version.
- Document steps or procedures taken.
- Prepare to describe the problem in detail.

Order Fulfillment Information

QUALCOMM Customer Service Order Fulfillment is available between 8 a.m. and 5 p.m. Pacific Time, Monday through Friday, for Return Material Authorization (RMA) assistance on QUALCOMM equipment and to request a purchase order. To repair, replace, or upgrade parts, request an RMA from QUALCOMM. Submit RMA requests to Technical Support to create a case to track the request. Technical Support approves RMA requests, and Order Fulfillment validates the warranty and processes the RMA. For more information on the RMA process, refer to RMA information on the QUALCOMM Customer Service Website.

Website Information

The QUALCOMM Customer Service Website is located at **http://www.gstechsupport.qualcomm.com**.

Only registered customers may use the QUALCOMM Customer Service Website. For details on registering, go to the login page of the Website, click "Website Registration," then follow the instructions to become a registered user.

The QUALCOMM Globalstar Customer Service Website provides several resources including the following:

- Product information for the Satellite Data Modem
- Frequently asked questions
- Troubleshooting information
- Forms for technical support requests to submit a case electronically
- Forms for RMA requests to submit a case electronically

Contacting QUALCOMM Customer Service

QUALCOMM Globalstar Customer Service is located in the United States and may be contacted via the Website, phone, email, or facsimile (FAX). Skilled staff are available to assist with technical issues and Return Material Authorizations (RMA) processing for QUALCOMM equipment.

Technical support personnel are available 24 hours per day, every day. Order Fulfillment personnel are available between 8 a.m. and 5 p.m. Pacific Time, Monday through Friday, to process RMA and purchase order requests. A case number is assigned to track each technical issue or request.

Contact information

- Website

  The following Website address is available to registered users. Forms are available for submitting Technical Support issues and RMA requests.

  http://www.gstechsupport.qualcomm.com

- Phone

  +1 858 651 4911

  - Select 1 for Globalstar Gateway Products.
  - Select the appropriate option for RMA or Technical Support troubleshooting assistance.

- Email

  The following email addresses are available to registered customers.

  - **gstechsupport@qualcomm.com**

    Submit technical support issues and RMA requests to this email address. Be sure to provide your name, company, location, telephone number, description of the problem, part information, and details about the error messages and/or log information.

  - **status.techsupport@qualcomm.com**

    Obtain information on the status of an existing technical case by sending an email to this address. Be sure to include the case number in the subject line in the following format *Case Number:12345*.

  - **status.rma@qualcomm.com**

    Obtain information on the status of an existing RMA case request by sending an email to this address. Be sure to include the case number and the RMA number, if available, in the subject line in the following format *Case Number:12345 RMA Number:67890*.

The following email address is available to all customers.

- **gs.modules.info@qualcomm.com**

  Obtain answers for all product information questions by sending an email to this address.

- Facsimile (FAX)

  +1 858 651 2345

  Submit technical support issues and new RMA requests to this facsimile number. Be sure to provide your name, company, location, telephone number, description of the problem, part information, and details about the error messages and/or log information.

E SPECIFICATION SUMMARY

This appendix summarizes the specifications for the QUALCOMM Globalstar GSP-1620 Satellite Data Modem and its Dielectric Resonator Antenna (DRA).

For further discussion of hardware issues, see Chapter 7, *Integrating GSP-1620 Modems into OEM Products*.

Table E-1. Specification Summary — GSP-1620 Modem

Operating Frequencies	Transmit: 1610-1625 MHz Receive: 2484-2499 MHz			
Maximum Transmit Power	+26 dBm EIRP (0.4 W)			
DC Input Voltage	+5.6 V to + 16 V			
Power Consumption Estimates @ 12V Input	**State**	**Min**	**Typical**	**Max**
	Shutdown	1.2 mW	2.4 mW	6 mW
	Standby	280 mW	500 mW	2.4 W
	Transmit	3.6 W	4.8 W	5.4 W
Interfaces:				
User Port	DB25 Serial RS-232 with pin-outs for data, control, and power			
Modem Antenna Connectors	TX MCX Female RX MCX Female			
Antenna Connectors	TX SMA Female RX SMA Female			
Provisioning and Software Upgrade	DE9 Connector			
Modem Dimensions	190 x 75 x 17 mm (7.48 x 2.95 x 0.68 in)			
Modem Weight	Less than 180 grams (6.3 ounces)			
Antenna (included)	103 mm (4.1 in) diameter by 63 mm (2.5 in) tall Estimated weight is less than 250 grams (8.8 ounces)			

Table E-1. Specification Summary — GSP-1620 Modem

Antenna Cable (not included)	Two cables required: transmit and receive Male SMA to Male MCX Transmit cable maximum 0.6 dB insertion loss @ 1618 MHz Receive cable maximum 3.0 dB insertion loss @ 2492 MHz
Certification	FCC CE
Modem Environmental Conditions	Operating: -30 °C to +60 °C Storage: -40 °C to +85 °C Relative Humidity: 5% to 95% (under 40 °C) The data modem is sensitive to very high ambient noise levels. Steps must be taken to ensure that the noise level at the modem does not exceed 110 dB OSPL (Overall Sound Pressure Level). Shock mounts must be used when the environment includes excessive vibration. The GSP-1620 modem will meet or exceed all operational vibration requirements defined in Table 7-5 when E-A-R damping feet (MF-100-UC04-H, black) are used as shock mounts.
Antenna Environmental Conditions	Operating/Storage: -40 °C to +85 °C Relative Humidity: 5% to 100% (under 40 °C) Signal fading associated with trees, buildings, and other obstacles that prevent a clear line-of-sight to the satellite can cause degraded operation. Any ice or freezing rain on the radome of the Outdoor Unit (ODU) will cause degraded performance. Steps must be taken to ensure that ice formation is kept to a minimum on the ODU.
Supporting Products	GSP-1620 Modem Integrator's Kit (MIK) Globalstar User Terminal Program Support Tool (UTPST) (modem provisioning tool)

Table E-2. Specification Summary — Dielectric Resonator Antenna (DRA)

Parameter	TX Specification	RX Specification
Frequency Range (MHz)	1610.0-1626.5	2483.5-2500.0
Polarization	LHCP	LHCP
VSWR (50 ohm)	<2.0:1	<2.0:1
Isolation (TX→RX) (dB)	>40	>0
Maximum Gain (0°<θ<80°) (dBic) [1]	< 6.5	–
Average Gain (0°<θ<80°) (dBic)	>1.5	>1.5 (passive antenna)
Minimum Gain (0°<θ<80°) (dBic)	>-4.0	>-4.0 (passive antenna)
Maximum Axial Ratio @ zenith (dB)	<3.0	<3.0
RX LNA/Filter Gain (dB)	–	27 (typical at 25×C)
RX Noise Figure (dB) [2]	–	<2.1
(G/T)avg (dB/K) [3]	–	> -26
(G/T)min (dB/K) [3]	–	> -31
RX Bias DC Voltage (V)	–	+3.6
Rx DC Current (mA)	–	25 (typical)
Power Handling (Watts)	<4	–
Operating Temperature (×C)	-40 to +85	-40 to +85
Altitude (ft)	50,000	50,000
Vibration(Grms) [4]	15.6	15.6

Table E-2. Specification Summary — Dielectric Resonator Antenna (DRA) (continued)

Parameter	TX Specification	RX Specification
Connector	SMA (F)	SMA (F)
Dimensions	103 mm (4.1 in) diameter by 63 mm (2.5 in) tall	
Weight	< 250 g (8.8 ounces)	

[1] q = 0 is zenith.
[2] combined LNA and Filter over the operating temperature
[3] at Tsky = 200 K
[4] random, 3-axis, over 15 – 2000 Hz

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