Part Number 69520

Installation and Management

Tsunami.GX

Model 32 (5.8 GHz) and Model 90 (5.3/5.8 GHz)

Installation and Management

PROXIM WIRELESS NETWORKS

Second Edition

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Regulatory Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Shielded cables and I/O cords must be used for this equipment to comply wit the relevant FCC regulations.

Changes or modifications not expressly approved in writing by Proxim may void the user's authority to operate this equipment.

This device complies with Part 15 of FCC rules and RSS-210 of Industry Canada. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

The UL certification for this Tsunami.GX product covers only the IDU and RFU components of the radios themselves and bundled power supplies. Certification does not necessarily extend to optional accessories Proxim may sell or provide for use with this Tsunami.GX product. Such optional accessories include but are not limited to cable kits, cable termination kits, and lightning arrestor kits. Use of any non-UL approved accessories, purchased from either Proxim or a third party, can result in the complete system (Lynx.GX radio plus non-UL approved accessories) not meeting UL certification criteria.

WARNING!

This device must be professionally installed. Instructions for setting the transmitter RF output power are referenced in "Adjusting Output Power" on page 25. This device is to be used exclusively for fixed point-to-point operation that employs directional antennas. Be sure to read "Product Safety Instructions" above before installing this product.

Product Safety Instructions

This product must be installed, used, and maintained by experienced telecommunications personnel only.

When installed, this equipment is to be connected to a lightning/surge protection device that meets all applicable national safety requirements.

WARNING!

To avoid injury, risk of fire, and damage, do not connect this product directly to an antenna. Ensure that proper lightning isolation also is provided between this unit and other equipment.

Equipment is to be used and powered by the type of power source indicated on the marking label only.

Tsunami.GX radios are intended to be connected to a ± 24 VDC or ± 48 VDC power source, which must be electrically isolated from any AC sources and reliably earthed.

Only a DC power source that complies with the Safety Extra Low Voltage (SELV) requirements in the Standard for the Safety of Information Technology Equipment, including Electrical Business Equipment, CAN/CSA C22.2, No. 950-95 * UL 1950, Third Edition, can be used with this product.

A 5-Amp circuit breaker or fuse is required at the DC power source. If using the Proxim optional power supply (P/N 201-31075-1), use a 15-Amp circuit breaker or fuse on the AC input. In addition, an easily an easily accessible disconnect device should be incorporated into the facility wiring.

Always use copper conductors only for all power connections.

Do not connect or disconnect the power cable to the equipment when the other end of the cable is connected to the DC power supply.

WARNING! This product must be serviced by trained personnel only.

Do not:

- Disassemble this product. Opening or removing any covers voids the warranty for this product. Furthermore, by opening or removing any covers, you could expose yourself to hazardous energy parts. Incorrect reassembly of this product can cause a malfunction or electrical shock when the unit subsequently is used.
- Insert any objects of any shape or size inside this product while powered. Objects could contact hazardous energy parts, resulting in a risk of fire or personal injury.
- Spill any liquids of any kind on or inside this product.
- Cover or block any of the openings (to protect this product from overheating). Side and top cover openings on the IDU are provided for ventilation.

Always ensure the following:

- That sufficient space is provided surrounding this product.

  This product can be installed in a standard 19-inch rack. Check the size and clearance requirements for this product and ensure that enough clearance is provided for installation. Consideration should be given to the mechanical loading of the rack and the equipment to avoid potential hazards.
- If this product is to be powered from the same source as other units, ensure that the power supply circuit is not overloaded.
- When installed in a rack, always ensure that proper air flow is provided for this product. Mount as shown in this manual.
- If you are using a standard telephone (for orderwire function) not provided by Proxim with this product, ensure that the telephone has a ringing equivalency specification of 1.0 Baud and is a UL-Listed (ITE) device that has been evaluated to the Standard for the Safety of Information Technology Equipment, including Electrical Business Equipment, CAN/CSA C22.2, No. 950-85 * UL 1950, Third Edition.

The maximum room ambient temperature for the IDU is 50° C. When installed in a closed or multi-unit rack, consideration should be given to installing this equipment in an environment compatible with the maximum room ambient temperature.

Equipment is suitable for mounting on concrete or other noncombustible surfaces only.

Contents

FIGURES

Chapter 1. Introduction

Proxim Corporation introduces the GX platform of wireless Ethernet bridges with wayside T1 or E1 products—Tsunami.GX. The split-box design lets you install both units indoors, or one unit indoors (the IDU, or Indoor Unit) and one unit outdoors (the RF Unit, or RFU).

The units can be mounted in a 19-inch or 23-inch rack; each unit is 1.75" high, occupying one rack unit (RU). Two pieces fit in two RU spaces for indoor installation, or you can mount the RFU outdoors on a tower or pole.

The IDU and RFU are connected with a single coaxial cable that carries power, telemetry, TX IF and RX IF signals; the antenna is connected to the RF unit with a coaxial cable. Outdoor placement of the RFU can directly contribute to significant cost savings of cable and antennas, improved system availability, and enhanced path performance.

A standardized and easy-to-use interface is provided, with a full network management system (NMS) for remote equipment management.

INTENDED AUDIENCE

This book is designed for network engineers and field service personnel responsible for installing, maintaining, and troubleshooting the Tsunami.GX radios. It is assumed you have an understanding of networks in general and a basic understanding of the following subjects:

- Microwave fundamentals
- Antenna systems
- Transmission line systems
- Electrical grounding
- Microwave test equipment
- T1, E1, DS-3
- Ethernet, Fast Ethernet
- IP networking

EQUIPMENT FEATURES

The following features apply to the Tsunami.GX product series:

- Split-box design with IDU and RFU for addressing budget, maintenance, and performance requirements
- User-selectable frequency plans (for those models that support more than one frequency plan)
- Full-featured Fault and Configuration Management through Web browser, SNMP, Telnet, or serial connection
- Advanced diagnostics (such as RSL time-strip charting and alarm logging) for troubleshooting the equipment and the microwave path, including a spectrum analyzer to check remote transmitter function and possible interference
- Auxiliary interfaces include a serial data port and orderwire connection (VF bridge)
- Link ID authentication algorithm to ensure highly secure link transmission.
- User selects either T1 or E1 wayside channels.

PLANNING FOR INSTALLATION

There are several planning factors to be considered prior to installing the radio system. In addition to selecting the installation site, you must:

Calculate:

- Required RSL and fade margin to achieve availability objectives
- Required path availability
- Anticipated Multi-Path Reflection Points

Determine:

- System Frequency Plan
- Required Antenna Size and Type
- Required Antenna Mounting Height to obtain proper Path Clearance
- Required Transmission Line Types and Lengths

Plan for:

- The unit's continuous power consumption needs
- Antenna installation
- Lightning protection and system grounding
- Radio hardware mounting
- Cable installation including egress
- Pre-testing Radio Equipment (back-to-back test procedure)

For detailed information regarding these planning items, see "Installation Planning" on page 47.

TROUBLESHOOTING HINTS

- Most common problems are poor transmission line connector terminations.
  - Best way to test is a return loss measurement (VSWR).
  - Basic function can be tested using a continuity and short test with DMM.
  - The transmission line can be evaluated with a network analyzer connected to both ends of cable through the cable and comparing when spectrum analyzer is connected directly to the radio without the cable.
  - Transmission line loss can be evaluated with a back-to-back Receive Signal Level (RSL) test.
  - "Tap and wiggle" testing of all terminations while monitoring RSL and alarms can expose poor terminations.
- Could be a faulty antenna.
  - Very hard to tell without swapping.
  - VSWR test on antenna feed can identify antenna problems.
  - "Tap" test can expose a faulty feed for moisture or connector problems.
- Could be a faulty radio.
  - Back-to-back RSL testing normally exposes a faulty radio.
- Could be a path obstruction or multipath reflection
  - Re-evaluate path clearance including Fresnel zone criteria.
  - Driving or walking the path may be required to identify potential obstructions.
  - Re-check path calculations for multipath reflection points along the paths

Chapter 2. Installing the IDU and RFU

The following sections describe how to install the GX radios.

STEP 1. GATHER REQUIRED TOOLS

The following sections list the tools required when installing the radios.

IDU Installation Tools (Indoor)

You must obtain the following tools before installing the IDU:

- Phillips (cross-tip) screwdrivers (for 19-inch rack-mounting and attachment of brackets)
- Small blade (1/8") standard screwdriver (for power supply connector)
- Wire crimpers (if using any 8-pin modular 2-wire or 4-wire connectors that are not pre-made)
- Soldering iron (if using any D-type connector)
- Adjustable 6" wrench to attach the chassis ground wire (7/16" for RFU and1/4" for IDU)

No additional tools are required from the above list if the RFU is mounted indoors.

RF Unit Installation Tools (Outdoor)

You must obtain the following before installing the RF Unit outdoors:

- RFU outdoor mounting kit (NOT INCLUDED WITH SHIPMENT; order separately)
- Adjustable 6-inch wrench (for installing the mounting bolts)
- Large blade standard screwdriver (for pole mounting clamps)
- Additional weatherproofing material for sealing the IDU and antenna connectors. (Butyl tape supplied with RFU mounting kit.)

Test and Configuration Tools

The following tools, which are necessary and useful to have available for testing and configuring the radios:

Digital Multi Meter	To measure RSL, DC power
RF power meter	To measure transmitter output power.
Cellular telephone or 2-way radio	For talking with far-end crew and tower crew.
Bit Error Rate test set	To test link after installation.
Computer*	For NMS access.
Pair of touch-tone telephones 1.4 B or less REN	To test Orderwire circuits and for communication with far-end.
Digital multi meter	For antenna alignment.

*with 10/100 Ethernet Network Interface Card, CAT5 straight or cross-over cable, and Internet browser

Additional tools may be needed for antenna and transmission line installation and antenna alignment as well as the lightning arrestor mounting and grounding. Consult the antenna manufacturer documentation and review “Installing and Adjusting the Antenna” on page 18.

STEP 2. UNPACK SHIPPING BOX CONTENTS

The boxes should be left intact and sheltered until arrival at the installation site.

If the shipping container shows signs of damage, notify the transportation company immediately. Upon receipt, inspect contents to make sure no parts are missing or damaged.

You should retain all the packaging materials (including all internal boxes). In the unlikely event that you must return the equipment to the factory, use the original packing materials for return shipment. The packaging materials also are recommended for transporting the equipment from location to location.

Shipment Contents

Each Tsunami.GX shipment includes one GX Indoor Unit (IDU), one GX RF Unit (RFU), and the following accessory kits.

Item Number	Accessory Kit
67262	GX RFU Indoor Installation Kit
67263	GX IDU Installation Kit

See “Tsunami.GX Specifications” on page 88 for specific information about individual Tsunami.GX models.

Tsunami.GX 90 5.8 ISM Shipment Contents

Tsunami.GX 90 5.8 GHz ISM System, Hi, Model 301-57710-61H0 (Item Number 67254)	
Item Number	**Description**
62300	Indoor Unit, 301-57710-51
62138	Hi RF Unit, 301-52000-H
Tsunami.GX 90 5.8 GHz ISM System, Lo, Model 301-57710-61L0 (Item Number 67255)	
Item Number	**Description**
62300	Indoor Unit, 301-57710-51
62137	Lo RF Unit, 301-52000-L

Tsunami.GX 90 5.3 UNII Shipment Contents

Tsunami.GX 90 5.3 GHz UNII System, Hi, Model 301-57750-51H0 (Item Number 66723)	
Item Number	**Description**
62300	Indoor Unit, 301-57710-51
69075	Hi RF Unit, 301-52053-H

Tsunami.GX 90 5.3 GHz UNII System, Lo, Model 301-57750-51L0 (Item Number 66722)	
Item Number	**Description**
62300	Indoor Unit, 301-57710-51
69074	Lo RF Unit, 301-52053-L

Tsunami.GX 32 Shipment Contents

Tsunami.GX 32 5.8 GHz ISM System, Hi, Model 301-51145-61H0 (Item Number 64766)	
Item Number	**Description**
67645	Indoor Unit, 301-51145-61
62138	Hi RF Unit, 301-52000-H
Tsunami.GX 32 5.8 GHz ISM System, Lo, Model 301-51145L-61L0 (Item Number 64765)	
Item Number	**Description**
67645	Indoor Unit, 301-51145-61
62137	Lo RF Unit, 301-52000-L

GX Accessory Kit Contents

- GX RFU INSTALLATION KIT
  - GX RFU Rack Mount Kit (19” or 23”) (1 ea.)
  - RFU Grounding Cable (1 ea.)
- GX IDU INSTALLATION KIT
  - GX IDU Rack Mount Kit (19” or 23”) (1 ea.)
  - IDU Grounding Cable (1 ea.)
  - IDU-to-RFU Interface Cable 12” (1 ea.)
  - IDU DC Power Cord with CD 3-Pin Terminal Block (1 ea.)
  - Custom Cable Kit RJ-45 (1 ea.)
  - Custom Cable Kit DB9 (1 ea.)
  - Rubber Table Mount Feet (4 ea.)
- DOCUMENTATION AND SOFTWARE CD-ROM (1 EA.)
  - Release Notes
  - Installation and Maintenance Manual
  - Quick Install Guide
  - MIBs
- GX QUICK INSTALL GUIDE, PRINTED (1 EA.)
- GX IDU RACK MOUNT KIT (19” OR 23”)
  - “L” IDU Rack Mount Brackets (2 ea.)
  - 2-inch Extender Brackets (2 ea.)
  - GX Rack Mount Screw Pack (1 ea.)
- GX RFU RACK MOUNT KIT (19” OR 23”)
  - “L” RFU Rack Mount Brackets (2 ea.)
  - 2-inch Extender Brackets (2 ea.)
  - GX Rack Mount Screw Pack (1 ea.)
- GX RACK MOUNT SCREW PACK
  - Rack Mount Screws (4 ea.)
  - Small Extender Bracket Screws (8 ea.)
- CUSTOM CABLE KIT RJ-45
  - RJ-45 Connectors (2 ea.)
- CUSTOM CABLE KIT DB9
  - Metal DB9 Connectors (2 ea.)
  - DB9 Cable Sheaths (2 ea.)

STEP 3. TEST RADIOS BACK-TO-BACK

Before installing the radios, Proxim recommends a back-to-back test of the radio pair. Back-to-back testing is a simple way to verify that the radios are fully operational before they are installed. The process of installation adds several variables that can lead to system turn-up delays during troubleshooting (such as antenna alignment, cabling, and path dynamics). By pre-testing the radios, you reduce the chance of the radios being the cause of system turn-up problems, and you can focus on other factors, such as the transmission line, antenna alignment, and path clearance.

Note: Back-to-back testing must be performed to verify a radio problem before returning any radio to the factory for repair.

Required Equipment for Test

Back-to-back testing must be performed with both radios at the same location. The following test equipment is required:

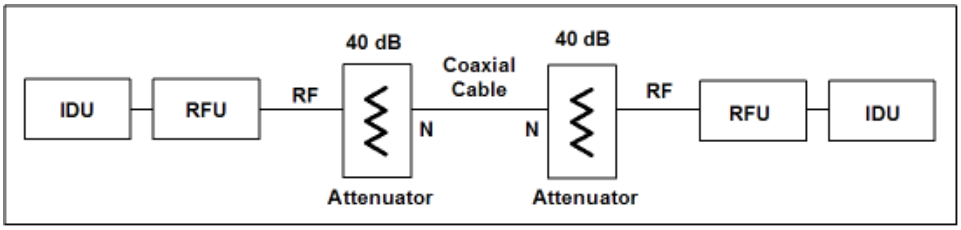
- DC power source capable of supplying approximately 200 Watts (total) to the radios (or two radio AC adapters)
- One low-loss coaxial cable, N-to-N male
- One (or more) coaxial in-line fixed attenuators, 50 to 100 dB total attenuation

The following test equipment may also be useful for further testing of the radio:

- Bit Error Rate (BER) tester
- Variable RF attenuator (60 dB range or more, rated for the proper frequency, 5.8/5.3 GHz) or multiple coaxial inline fixed attenuators (of 10 dB and 20 dB each, totaling up to 100 dB) are recommended.
- RF power meter

Back-to-Back Test Configuration

When the equipment is connected as shown in the following figure, both radios should have no alarm conditions. (Data Input and AIS OUT are exceptions, if any of the Ethernet or Wayside channels are not connected.) If these conditions have been met, it is likely that the radio is operating in accordance to specifications. If errors or alarms occur during this test, verify alarm status. If alarms or errors are still present, one or both of the radio terminals is likely to be faulty.



Back-to-Back Test Configuration

It can be helpful to insert a variable RF attenuator or a set of fixed attenuators between the radios to fade down the path to determine that the threshold specification is being met. You can run the threshold tests in both directions to isolate the radio problem (if any). See “Link Testing” on page 13 for more information.

You can use an RF power meter to individually test each radio’s output power to test the transmitter functions. You can also use the radio’s output transmitter attenuation to help precisely lower the link to threshold level after inserting attenuation.

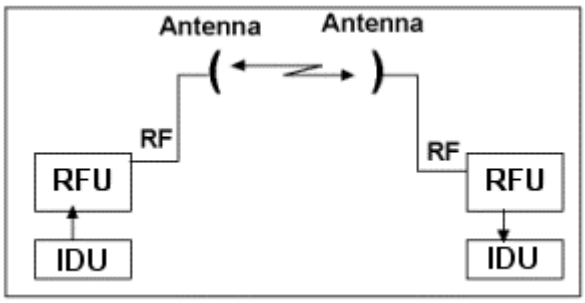
If the transmitter output power has been verified (by the mathematics of the back-to-back test or by a power meter) and the threshold is not meeting specification, the side whose threshold is diminished is the likely radio at fault. Swapping IDUs from one end to the other can help determine whether the problem is with the IDU or the RF Unit.

WARNING!

The radios will be damaged if appropriate attenuation is not supplied between radios. You must provide a minimum of 50 dB between the two radios. At 50 dB attenuation, output power can be left at maximum output power.

Link Testing

Link testing is the preferred way to evaluate a radio link's performance. It can be performed from end-to-end or in link test mode (which tests both directions of the radio path). The following figure illustrates a typical test configuration (which may include the radio's path instead of in-line attenuators).



Link Testing

When performing testing, verify all configuration settings.

Note: If link testing indicates an unacceptable level of errors, follow the instructions in "RF Link Alarms" on page 98.

Several built-in wayside loopback functions are implemented in the radio. They are:

Local LB

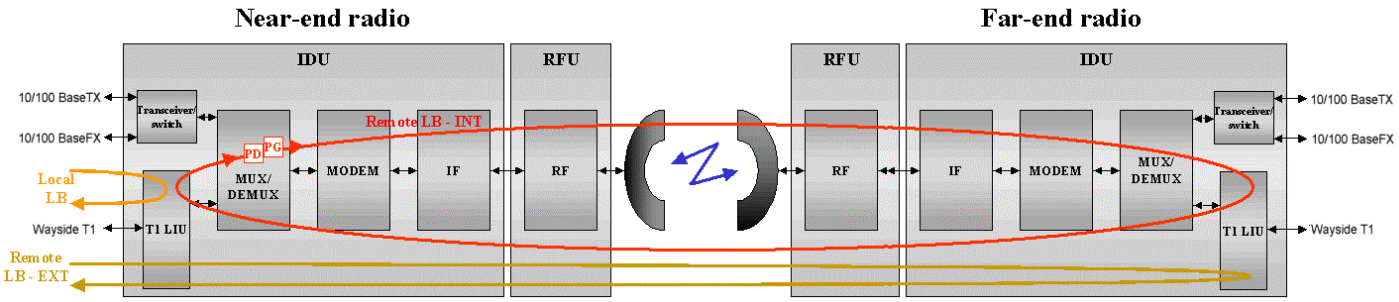
Local radio line interface is in loopback to the line connector (does not test the wireless link). This is useful for external equipment or circuit testing, including an external BER tester.

Remote LB-int

The far end or remote radio is set to loopback data. The radio uses an internally generated signal and external signals are ignored. This is useful for testing the entire radio link without using external test equipment.

Remote LB-ext

Similar to Remote LB-int, but an external T1/E1 signal is required locally. This is useful for testing the entire radio link and includes testing the physical connector to which the external test equipment is connected. Running this test on every interface from both ends of the radio link would completely test every interface connector and the complete radio link.



Tsunami Loopback Mode

Only one loopback can be enabled per link at a time; that is, only one channel can be tested at a time and configuring a channel in loopback disables the current loopback. The front panel and Web interface loopback LED on the near-end and far-end radios informs the operator that the radio is configured in loopback mode.

STEP 4. INSTALL THE RADIO UNITS

There are two primary ways to install the radio system.

IDU and RFU Indoor Mounting

Both units (the IDU and the RF Unit) are mounted indoors or in a suitable enclosure, stacked on top of one another, in a rack.

IDU Indoor Mounting / RFU Outdoor Mounting

The IDU is mounted indoors and the RF Unit is mounted outdoors, either near the antenna or simply at a location somewhere between the enclosure/structure egress point and the antenna.

Complete the installation of all cables and the antenna system prior to connecting power; refer to “Installing and Adjusting the Antenna” on page 18 for important information.

Installing Both the IDU and RFU Indoors

Although rack-mounting of the IDU is the ideal configuration; the radio can be placed on a tabletop or a cabinet shelf. To prevent movement, apply the rubber table mount feet, found in the GX IDU Installation Kit, under the bottom of the radio at each corner.

For rack mounting, to optimize cabling and to avoid interference with the RFU or antenna cables, mount the IDU high in a standard 19-inch rack. Empty rack-mounting spaces above and below the unit are recommended, especially if the surrounding equipment dissipates a considerable amount of heat (over 40W).

When mounting both the IDU and the RFU indoors, mount the IDU immediately below the RFU with no gap between the units. (The IDU provides required forced-air cooling of a rack-mounted RFU). Leave the equivalent of one rack space above the total 2-unit space for the radio if any equipment is mounted above the radio system.

Set up the radio for mounting (using the rack mounting brackets enclosed with the screws in the shipping container) with the front edge projecting from the front face of a standard 19-inch rack. Alternatively, you can reverse the rack-mounting brackets to install the unit at a flush position. Additional extension brackets are provided for 23-inch rack mounting and are attached to the standard 19-inch rack flanges with screws provided.

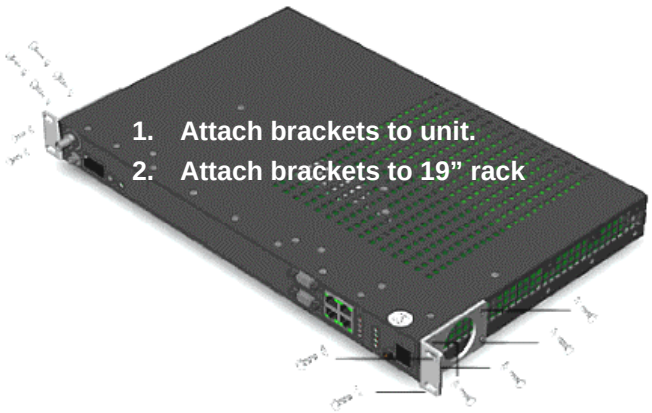
The radio has internal fans that intake on the left side and exhaust on the right side of the chassis. When rack mounting, leave a small gap between the outer edges of the radio and the inside edge of the rack.

A short 12” IDU-to-RFU interface cable (TNC to TNC) is included in the GX IDU Installation Kit. Use this cable to connect the IDU to the RFU when both are installed indoors.

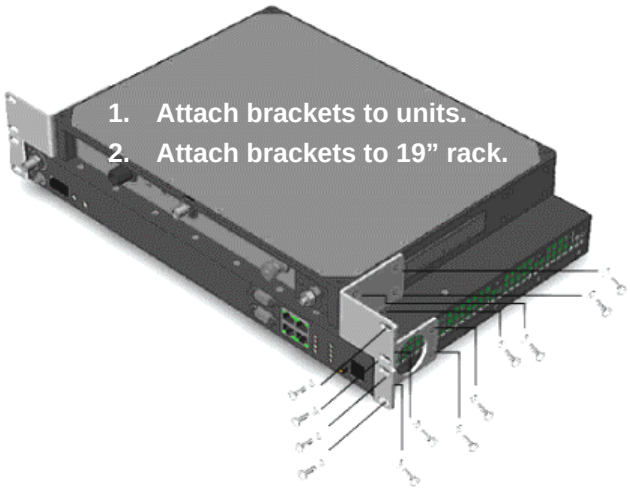
To rack-mount the IDU and RFU:

1. Gather all the parts contained in the GX IDU Installation Kit.
2. Set the unit on a flat surface and, using a screwdriver, remove the front screws on each side of the unit that match up to the holes of the rack mounting flange. You must remove these screws to prepare the unit for bracket attachment.
3. Attach the “L” IDU Rack Mount Brackets to each side of the IDU using the long mounting screws that are contained in the GX Rack Mount Screw Pack.

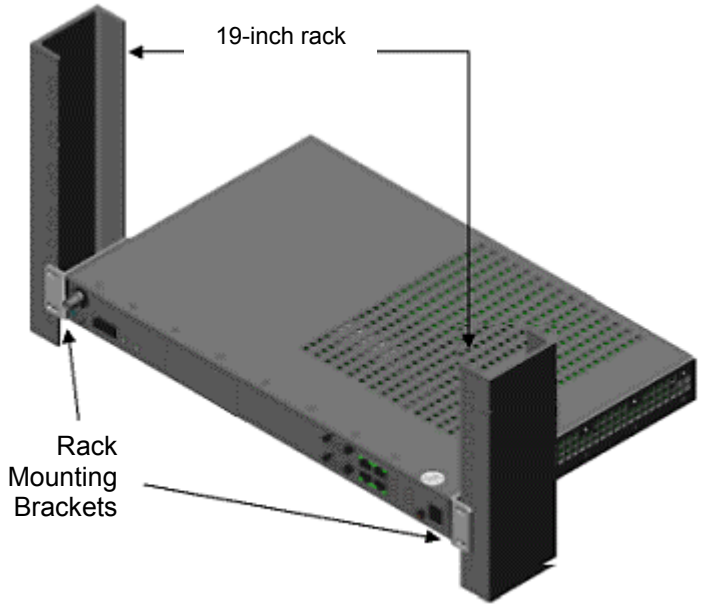
   The following figure illustrates mounting bracket attachment for the IDU only (occupying one space in a 19-inch rack).



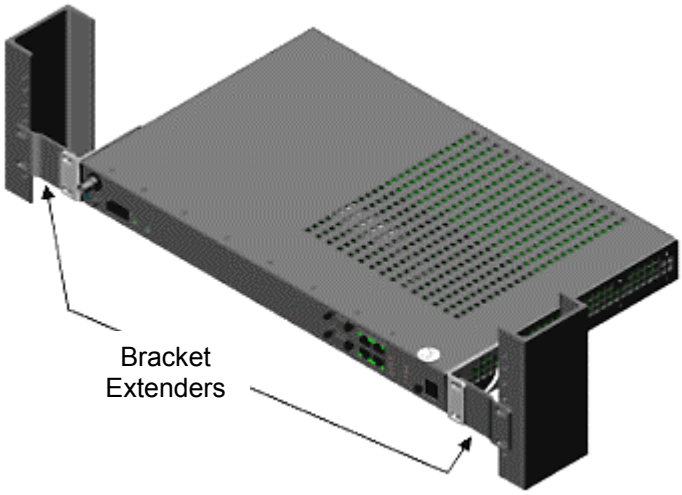
   Attach the “L” RFU Rack Mount Brackets to each side of the RFU using the long mounting screws that are contained in the GX Rack Mount Screw Pack. The following figure illustrates mounting bracket attachment for the combined IDU and RFU (occupying two spaces in a 19-inch rack).



4. Position the radio in the rack and align the holes in the mounting bracket with the holes in the rack. Two screws for each bracket should be used into the rack (these screws are not included).



If you are installing the IDU in a 23-inch rack, you must use the 2-inch extender brackets and attach them to the rack mounting brackets (with the screws provided in the GX Rack Mount Screw Pack), as shown in the following figure:



5. Insert two screws and lock washers, appropriate for your rack, into each of the mounting brackets and tighten.

IMPORTANT!

When the RFU is rack mounted, it must be mounted directly above the IDU and facing with the connectors forward in the same direction as the connector panel of the IDU (as shown).
The IDU fan exhaust is used to cool the RFU in a rack mount configuration. Also, if one unit is projection mounted, both units should be projection mounted. In either configuration, an empty rack mount space is required above and below the configuration.

Installing the RFU Outdoors

The outdoor RFU installation consists of these tasks:

- Installing the mounting brackets and mounting plate onto the pole (using two band clamps).
- Mounting and securing the RFU on the mounting plate.

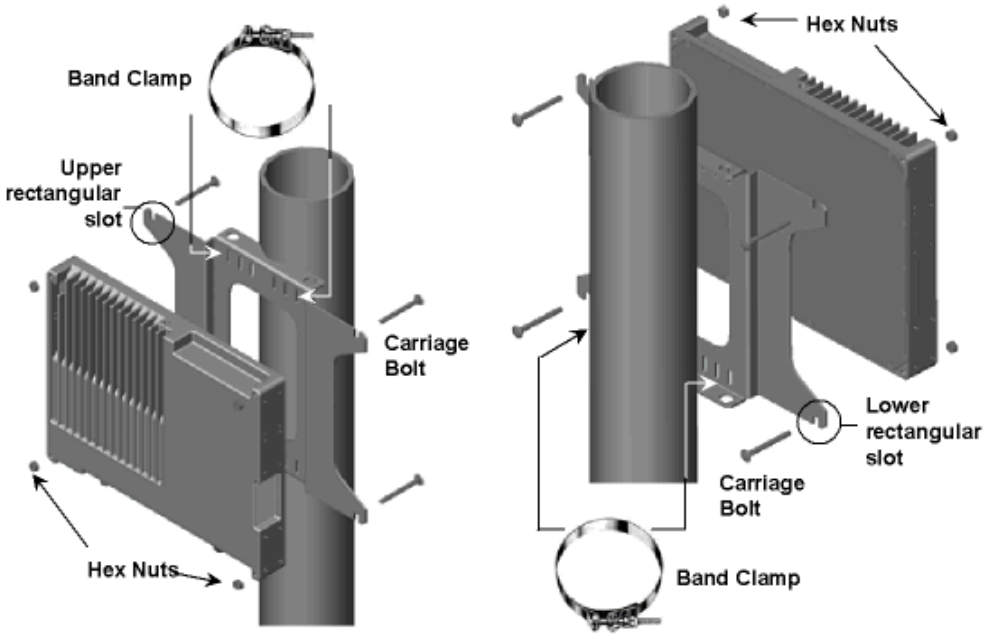
Notes:

(1) Installing the RFU outdoors requires the use of the optional GX RF UNIT Outdoor Mounting Kit (Proxim part ACC-GX-RF-2, item number 61688), sold separately. The GX RF UNIT Outdoor Mounting Kit contains the items necessary for secure pole mounting of the RFU. See "Tsunami.GX Spares and Accessories" for part numbers and ordering information. If the RFU is mounted outdoors on both ends of the link, you must order two outdoor mounting kits.

(2) To facilitate assembly, installing the carriage bolts to the top holes of the RFU can be partially completed on the ground before being raised to the pole assembly.

Installing the Mounting Plate

1. Obtain the optional GX RF UNIT Outdoor Mounting Kit (Proxim part ACC-GX-RF-2, item number 61688).
2. Hold the mounting plate with the upper and lower V-cut tabs in contact with the pole.
3. Wrap a band clamp around pole/mast and through the vertical slots near the top of the mounting plate. Repeat for lower slots.



4. Tighten both band clamps sufficiently to prevent the mounting plate from rotating on the pole/mast; you can now mount the RFU onto the bracket assembly.

Mounting the RFU

1. Orient the RFU for mounting onto the mounting plate so that the connectors are pointed down and the heatsink fins are facing away from the bracket.
2. Insert carriage bolts into the upper holes of the RFU with the head of the bolt facing the flat side (back) of the RFU.

   When facing the unit, place both thumbs over the hex nuts to hold the bolt in place; place the RFU onto the mounting plate by setting the square portion of the carriage bolts into the upper, rectangular slots on the mounting plate. Loosely attach the self-locking hex nuts without tightening.
3. Insert carriage bolts into the lower holes. Loosely attach the self-locking hex nuts.
4. Tighten all hex nuts sufficiently to prevent the RFU from any movement. Ensure the heads of the carriage bolts are properly aligned with the notches in the mounting plate and placed firmly against the mounting plate prior to tightening the self-locking hex nuts.
5. Install an RF lightning arrestor that connects to the antenna cable to the RFU Type-N connector labeled To Antenna and seal the connectors using weatherproofing material (butyl and electrical tape, butyl tape or self-vulcanizing adhesive). A short jumper cable can be used to connect the RF lightning arrestor, if necessary. The lightning arrestor must be properly grounded.
6. Install the IF/DC-passing lightning arrestor that connects to the IDU cable to the RFU TNC connector labeled To IDU and seal the connectors using weatherproofing material. A short jumper cable can be used to connect the IF/DC lightning arrestor, if necessary. The lightning arrestor must be properly grounded.
7. Attach a grounding wire to the ground post of the RUF and route to a proper low impedance ground point. Wire of at least 10 AWG should be used; a braid or strap conductor is the preferred choice.

STEP 5. INSTALL THE ANTENNA

The installation information discussed in this section is generic. For installation procedures specific to the antenna you are installing, refer to the antenna manufacturer's documentation.

WARNING (FCC requirement for implementation in the USA):

Any antenna used for the transmitter must be fix-mounted on outdoor permanent structures with a separation distance of at least 1.5 meters from all persons during normal operation. Antennas must be professionally installed. Installers must be provided with antenna installation instructions and transmitter operating conditions, including antenna co-location requirements of CFR47 Part 1.1307(b)(3), for satisfying RF exposure compliance.

Helpful Hints—Mounting Antennas

- Proper system and path engineering is required to determine antenna mounting location.
- Antenna height is critical for achieving path clearance, ensuring line of sight, and addressing potential path reflections.
- Ensure that the antennas will not be blocked by people during normal operation.
- Antenna structure must be secure for wind load and whatever climbing may be necessary.
- When mounting the antenna, sufficient clearance must be allocated to swing the antenna at least ±20° from the desired bearing.

Mounting the Antenna

This section describes how to permanently mount the antenna to the mast, pole, or tower, and how to attach the antenna to the RFU.

The antenna must be mounted outdoors on a tower, building roof, or other location that provides line-of-sight path clearance to the far-end location. In general, antennas smaller than two feet in diameter, or one-foot panels, are not recommended for use with these radios.

Antennas should be ordered with the suitable mounting kit specific to the site requirements, and should be very rigidly mounted, with adequate room for azimuth and elevation adjustment from the rear. The antenna polarization must be the same at both ends of the link, either *vertical* or *horizontal*.

In general, antenna mountings require a support pipe to which upper and lower support brackets are attached with U-bolts. The antenna and optional elevation and azimuth adjustment rods then are mounted onto the support brackets. The entire structure must be adequately grounded for lightning protection (see “Grounding” on page 24). The antenna system must always be installed according to the manufacturer's instructions.

Unless special test equipment is available, two operating radios are required to align the antennas. Alternatively, you can use a CW generator to transmit a signal toward the end being aligned.

The antenna is coarse-aligned using visual sighting and then fine-aligned using the receive signal level (RSL) voltage provided by the radio.

The RSL voltage reading still can be used to peak antennas even if the wireless units have not synchronized; however, you cannot measure far-end RSL from the near-end terminal until the units are synchronized.

STEP 6. ESTABLISH CONNECTIONS

This section discusses antenna connection, RF coaxial cable connection, IF transmission line connection, grounding, and power connections.

Helpful Hints—Lines and Connections

- Use proper transmission line.
- Proper termination is critical, especially at 5.8/5.3 GHz. Follow manufacturer’s instructions and use proper tools and connectors.
- Be careful with the bend radius and never kink the transmission line.
- Secure the transmission line to structures; be careful not to crush.
- A direct connection to the antenna feed is ideal (if required, you can use a flexible jumper at the antenna).
- Weatherproof all outdoor connections when completed with installation.
- When the RF Unit is placed indoors, the RF lightning arrestor is best located at the building egress point.
- When the RF Unit is placed outdoors, the IF lightning arrestor is best located at the building egress point. In addition, Proxim recommends that an additional lightning arrestor be placed at the RF input (from the antenna) and one at the junction between IF cable interface to the RFU

  NOTE: IF cable lightning arrestors must be specified to pass DC and rated to 1 GHz operation.
- IDU cable lightning arrestors must be specified to pass DC and rated to 1 GHz operation.
- All lightning arrestors and transmission line must be properly grounded.
- Do not use 90-degree adapters unless rated at operating frequency.
- Test power voltages and pinouts at the power connector before connecting power to IDU.

Connecting an Antenna

The radios are equipped with an N-type female connector on the RFU at the antenna port. You can use a short length jumper cable (such as 1/4-inch to 1/2-inch coax or pigtail of approximately 6 feet in length) fitted with two N-type male connectors to connect the RFU antenna port to the antenna (if the RFU is located near the antenna) or to the primary transmission line (if the RFU is mounted remotely from the antenna).

A low-loss 50-ohm cable is recommended for the antenna transmission line between the RFU and the antenna (such as Andrew LDF4-50 or Times LMR-600 1/2-inch coaxial cable, Andrew LDF4.5-50 or Times LMR-900 5/8-inch coaxial cable, or EW-52 waveguide).

The return loss presented by the transmission line at the RFU interface should be as high as possible (20 dB minimum recommended). The length of the antenna transmission line should be kept as short as possible to minimize losses.

To minimize feeder losses, use an elliptical waveguide (typical loss is 1.25 dB/100 ft. at 5.8/5.3 GHz) for implementations with longer transmission line lengths (such as >200 feet) or long paths (such as >20 miles). Depending upon path length and transmission line feeder length, ½-inch or $^5/_8$-inch coaxial cables are often sufficient. The lower the transmission loss the better, so if your installation can accommodate the larger cable ($^5/_8$-inch), this is highly desirable.

Antenna Cabling Guidelines for 5.8/5.3 GHz Units

- Coaxial cables of 7/8-inch or larger diameter can exhibit moding at 5.8/5.3 GHz and are never recommended. Also, some small diameter cable types, such as RG-8 or LMR-400, have high loss or poor VSWR at these frequencies. If small diameter cables are required, be certain to keep the lengths of these cables as short as possible and always properly terminate these cables.
- For waveguide transmission at 5.8/5.3 GHz, EW-52 waveguide is recommended. EW-63 also works, but may exhibit more loss.
- Do not use right angle N-type connectors with the radios operating at 5.8/5.3 GHz.
- Do not use low quality jumper cables with the radios.
- Always precisely follow the antenna manufacturer's recommended procedures and tools for termination.

Note: All cable and waveguides used should be UL-approved for the appropriate environment.

Connecting RF Coaxial Cables

Prior to installation, determine the specific antenna location and mounting. The transmission line should be kept as short as possible, so when line-of-sight placement of antennas allow flexibility, it is always desirable for the equipment to be located closer to the antenna. See "Planning for Antenna and RF Transmission Line Installation" on page 55 for further planning information.

If the RFU is mounted near the antenna, the RF transmission line can be pre-terminated at both ends and simply attached from the antenna feed to the RFU without any special consideration to securing the transmission line to the antenna structure (as the length is likely to be very short).

In this configuration, Proxim recommends you place an RF lightning suppression device specified for use at 5.8/5.3 GHz (such as Polyphaser LSX) between the RF transmission line and the RFU's RF port, as close as possible to the RFU. Always properly ground any lightning suppression device.

When the RFU is mounted near the antenna, generally follow the instructions in this section for the cable used to connect the RFU to the IDU. This cable is likely to be longer and also egresses the structure in which the IDU is located. It may require more care for installation, including grounding, lightning protection, and securing the cable.

Lightning suppression is required at the interconnection cable junction as close as possible to the RFU, as well as at the building egress point. For this cable, the lightning suppressors must be specified to pass DC and support the intermediate frequencies (approximately 800 MHz) and the digital signals carried by this cable. A NexTek PTC series Gas Tube surge protector (http://www.nexteklightning.com), rated at 90 Volts or greater, is an appropriate device for this application. These devices are available in various connector and mounting configurations, and provide the flexibility required for different installation configurations.

For example, a PTC-TNM-TNF-09S would be a unit with a TNC-Male connector on one end, and TNC-Female connector on the other end. A PTC-TNF-TNF-09S specifies the same part, but with TNC-Female connectors on both ends.

To prepare the RF transmission line or the RFU-to-IDU cable **(*experienced or skilled technician only*)**:

1. Cut a cable to the proper length (allowing some excess for service loops) that will connect the RFU to the building egress point. Terminate both ends with TNC-Male connectors.
2. Repeat this process for the cable that will connect to the lightning surge protector outside the building egress point and the equipment. Do not install the equipment end connector at this time, to facilitate pulling the cable through ducts, trays, or conduit (as required) between the egress point and the IDU location.
3. Install the building egress lightning surge protector between the two RFU/IDU cable ends outside of the building egress point, and ground the lightning surge protector to a proper broadband earth ground. The proper installation and grounding of this lightning/surge protector is critical, since it is the “firewall” protecting equipment and personnel inside the building from potentially lethal electrical storm power surges.
   - Pay close attention to the transmission line specifications for bend radius when installing.
   - Be careful not to kink, damage, or deform the transmission line in any way.
   - Support the transmission line in a tray on horizontal runs and by hangers on vertical runs. Space hangers according to the manufacturer instructions.
4. Ground the transmission line using the appropriate cable/waveguide grounding kits per the cable/waveguide manufacturer’s instructions. A minimum of three grounding points is recommended—at the antenna end of the cable/waveguide, at the base of the tower, and at the equipment building egress point. In addition, long transmission line runs should be grounded at least every 100 feet.
5. Install lightning protection devices, including proper grounding and termination to cables. There should always be a lightning protection device at the egress point for whatever cables egress the building or enclosure. For an all-indoor implementation, the in-line lightning protection device must be rated for the operating frequency of the radio (5.8/5.3 GHz).

   Lightning protection for the RFU-to-IDU connection portion of an outdoor implementation of the RFU must be rated to 800 MHz and must be non-blocking to DC. Proxim recommends placing lightning arrestors near the RFU and outside of the equipment building egress point for 2-piece systems. Lightning arrestors must be grounded to a proper broadband earth ground in order to be effective. This means use of a low-inductance ground strap or very short ground cable between the lightning protector and earth (not power company) ground.

6. After installation, terminate the RF transmission line with an N-type (or appropriate) male connector or low-loss adapter attached at the equipment end. For waveguide, this typically requires a CPR-to-N adapter.

   Be sure to use manufacturer-specified connectors and termination tools, and follow termination instructions precisely. Improper transmission line terminations can cause excess losses and reflections that can lead to many problems with the system.

7. Prior to operation, check the electrical integrity of the transmission line, including all connectors, with a simple DC check between the center conductor and outer conductor (this is not possible for waveguide, which should be swept to assure transmission performance).

   The transmission line ideally should be connected directly to the antenna at one end and to the radio antenna port at the other end; however, short pigtail jumper cables may be required in order to avoid sharp bends in the primary transmission line, or to limit stress on either connection.

Connecting IF Coaxial Cables

The radio can be installed with the RFU mounted indoors above the IDU in a 19-inch or 23-inch rack, or mounted outdoors onto the pole-mounted bracket (included).

- For indoor mounting, a short IF coaxial cable is included in the accessory kit to connect the IDU to the RFU.
- For indoor/outdoor mounting, a long IF coaxial cable is required to connect the IDU to the RFU outdoors. In such a case, the same cable installation, grounding, surge-protection (except using NexTek PTC series surge protectors and the appropriate cable type) as described above applies. In addition, a low-loss RF transmission line is required to run the RF signal from the RFU to the antenna (located outdoors atop a tower, monopole, rooftop pole, or cell site).

For indoor/outdoor mounting configurations, the connectors on both ends should be TNC (male) to TNC (male). Multiple cables can be used to accomplish IDU-to-egress and egress-to-RFU connections. **Be sure that a proper lightning protection device is installed at the building cable egress point.**

See “Planning For and Selecting IF Cable” on page 54 for cable recommendations.

Connecting Power

The radios do not have a power on/off switch. When you connect the DC power, the unit powers up and is operational in about one minute.

Note: When first powered up, the second LED from the left column lights up red, then the bottom one flashes red. If these conditions continue after about one minute, there is a problem powering up the radio and the unit should be returned.

There can be up to 200mW of RF power present at the RFU antenna port.

Before power is applied:

- Terminate the antenna port (either by connecting the RFU to an antenna or to an appropriate 50-ohm load, such as provided by a fixed RF attenuator).
- Connect the cable between the IDU and the RFU.

The IDU can be powered separately (with no cable or RFU present), but do not connect the RFU without removing power first; then connect the IDU-to-RFU cable and re-apply power.

WARNING!

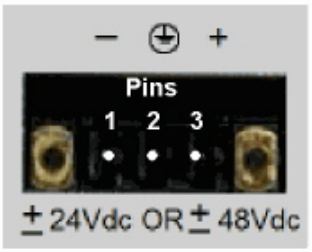
Connect all cables between the IDU and the RFU before applying power to the IDU— Do not apply DC power to the IDU if the RFU antenna connector is not terminated. Likewise, remove power from the IDU before removing any cables between the two units.

DC voltage is conducted on the IF coaxial cable; improper installation of the cable while power is applied could result in damage to the equipment. Be sure to read "Product Safety Instructions" in Chapter 2 before installing this product.

Power is connected using the terminal block connector contained in the accessory kit. The terminal connector is a 3-pin mating connector.

Use the pin information listed in following tables, along with the associated figures, to wire the terminal and connect the DC power supply properly. For DC power return connection, connect to the opposite voltage (either the -DC or the +DC Pin).

Be sure to connect the return to ground at the DC power plug and make sure that all equipment is grounded to proper station earth ground.



Negative DC Power Input Pin Assignment (-20 to -60 VDC)	
Pin Number	**Function**
1	Power (–DC)
2	Ground
3	Return (+DC)

Positive DC Power Input Pin Assignment (+20 to +60 VDC)	
Pin Number	**Function**
1	Return (–DC)
2	Ground
3	Power (+DC)

Note: Each radio terminal block must be fused externally with an 5-Amp maximum fuse. The DC power cable must be shorter than 3 meters (9.75 feet).

To wire the DC power, wire the power cable with an adequate current rating into the terminal block connector using the screw connections on the terminal block.

Suggested rating of external fuses and cables is 5 to 8 Amps (-120W to –240W) for 24V and 3 to 5 Amps (-144 W to –240 W) for 48V in order to accommodate inrush current at equipment power-up.

The radios consume less than 1.5 Amp at ± 48V, less than 3.0 Amp at + 24V under steady-state conditions.

- If using **negative power**, connect the negative voltage to pin **1**. Connect the return connection to pin **3** and use an optional jumper to pin **2** for ground reference.
- If using **positive power**, connect the positive voltage to pin **3**. Connect the return connection to pin **1** and use an optional jumper to pin **2** for ground reference.

The ground connection is available using pin **2**. ***Do not ground both sides of the power supply***.

Proxim recommends you leave the ground connection floating if the power supply also is floating. This configuration can help avoid ground loops and provide the best lightning protection; however, if the power source is referenced to ground, this configuration may not provide adequate grounding for lightning protection. This configuration is more susceptible to lightning damage no matter what grounding scheme for the radio power supply is chosen.

A grounding screw and nut is provided on the left front panel of the IDU. Be sure to use the local electrical code to determine wire size and proper connection to the grounding screw, and do not depend on rack mounting screws for a ground connection.

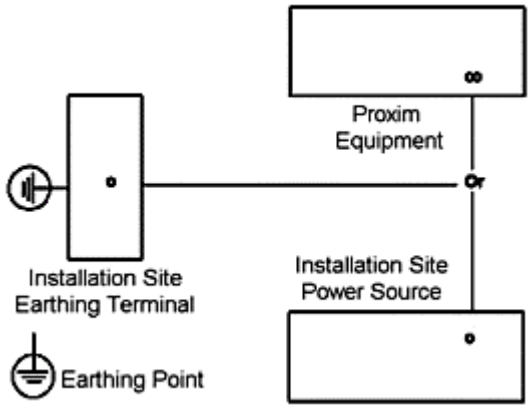
Note: Proper grounding, either through the chassis or the power supply, is important for protecting the unit against lightning. A grounding screw post is provided on the front panel.

Use a digital voltmeter (DVM) to verify the voltage and polarity of the plug after wiring the terminal block for power and before inserting the plug into the IDU.

Grounding

WARNING!

This equipment is intended to be grounded. If you are not using the power supply provided by Proxim Corporation, you must connect the grounding conductor of your power source to the grounding terminal located on the units; or, connect an grounding conductor between the unit's grounding terminals and your grounding point. For safe operation, always ensure that the units are grounded properly per the following figure.



Be sure to:

- Use a common station ground for all equipment
- Ground the radio to the rack
- Ground the tower or mast properly
- Ground the transmission line properly.

STEP 7. ALIGN THE ANTENNA

The larger the antenna, the more critical alignment becomes. For example, with a 2-foot dish at 5.8/5.3 GHz, the antenna can be moved ±3 degrees off the correct heading before the receive signal level drops by 3 dB. This compares with a 6-foot dish, which can be moved only ±1 degree for the same degradation.

- You must perform antenna alignment on one end of the link at a time, one plane at a time.
- Keep one antenna stationary at all times.
- Fine-align each end several times, until the planned RSL is reached.

In some cases, you may need to perform coarse alignment using a wide arc in both azimuth and elevation while reading the RSL to find the main beam of the opposite end antenna.

Note: The RSL voltage is slightly delayed, so make small incremental adjustments during the fine alignment phase and wait a few seconds for the RSL voltage to settle after each adjustment. When aligned to maximum RSL, ensure that all antenna mechanics are tightened without impacting the alignment.

Coarse Alignment

To coarse-align the antenna, set the antenna mount for flat elevation (no up-tilt or down-tilt) using a spirit level. Point the antenna at a heading marker obtained using a compass/GPS (magnetic corrected) back-bearing from an adjacent location (ideally, 100 feet or more away from the antenna).

If the path has substantial change to elevation from one end to the other, this may not be an advisable method for starting the alignment activities. In such cases, compare antenna elevations at each end of the link and set the initial elevation of the antenna to roughly match the anticipated up-tilt or down-tilt.

If you cannot set a heading marker sufficiently far away (for example when on a city building roof), obtain a rough azimuth setting by sighting along the antenna feed or based upon compass measurements made during the path planning stage.

Note: Use the instructions provided by the antenna manufacturer to verify that both antennas are on the same polarization; otherwise, the RSL will be approximately 25 to 30 dB below the calculated level.

Because maximizing the receive RF signal level at each end of the radio link is critical, most antennas also require fine alignment using an operating link.

Once the coarse alignment is completed at both ends, the link can be powered and some level of reliable communication established. The voltage at the radio test point can be measured with a DVM to determine the relative receive RF signal level.

Note: Be sure to read “Power Connections” on page 24 prior to powering up the radios.

Fine Alignment

When fine-aligning the antenna:

- Adjust the azimuth and then the elevation of the local antenna to maximize the RSL voltage.
- Align the far-end antenna in the same manner, using the RSL voltage of its local RFU.

Helpful Hints—Antenna Alignment

- Rough align antenna azimuth and elevation based upon path planning (using compass bearing or milestone sighting, telescopic sight, binoculars, and so on).
- Apply power to both ends of the radio system
- Use a Digital Volt Meter (DVM) to read the radio's RSL voltage provided on the RFU to peak antennas. Or, use the RSL reading from the IDU's front panel test point. (See "RSL / GND" in "Front Panel LED Descriptions" on page 75.)
- When aligning antennas, if the RFU is located indoors or distant from the antenna location, you may want to run wires or a cable from the RSL test point on the RFU to the antenna location so that the voltmeter reading or audio device is directly visible and audible to the technicians aligning the antenna. Alternatively:
  - The RSL value can be provided by a 'verbal relay' or by two-way radio (or similar communications device) from the radio location to antenna alignment personnel.
  - The RFU (and IDU, if necessary) can be taken to the antenna location temporarily for the purposes of antenna alignment. An additional short transmission line jumper may be required for this approach, along with TNC-to-N adaptors at each end of the primary transmission line. If this approach is used, the actual RSL when alignment is completed is higher than that planned (due to the shorter transmission line). Verify the desired RSL once the radio system is mounted as originally planned.
  - Coaxial couplers can be placed temporarily at each end of the primary transmission line so the RSL voltage is sent to the antenna location.
- A cellular telephone or two-way radio can be useful for coordinating alignment activities between both ends of the link. You can use an orderwire telephone for end-to-end voice communications once the units are synchronized. Synchronization usually can be accomplished by coarse alignment alone. After synchronization, you can use the orderwire phones to communicate between radio sites for antenna fine alignment.
- Make sure antenna polarization is the same at both ends.
  - Adjust alignment of one antenna at a time, one plane (azimuth vs. elevation) at a time.
  - Adjust each end multiple times until predicted RSL is achieved.

Checking RSL Against Predicted Results

There are two RSL voltages that can be read off the radio.

- The IDU front panel has an RSL Test Point for a voltmeter probe.
- The RFU also has a voltage test point at the BNC connector.

Both the IDU RSL voltage and the RFU RSL voltage readings are identical: They can range from 0.9 volts for –90 dBm to 0.05 volts for –5 dBm. The RSL voltage is -Volts RSL (mV)/10 or -10mV per dBm, so that the readings can range from 0.9 volts for –90 dBm to 0.1 volt for –10 dBm. This unique approach for measurement voltage makes it possible to read the RSL value directly off the DVM; for example: -60 dBm = 0.6V.

Keep in mind that a higher RSL results in a lower absolute voltage. Therefore, when you are 'peaking' an antenna, you actually are attempting to achieve the lowest voltage. For example, a desired RSL of –50 dBm is equivalent to 0.5 Volts RSL and, if you were reading 0.7 Volts of RSL (a higher voltage), this would be a lower (worse) RSL of –70dBm.

Because the maximum error-free receive signal level is –20 dBm, the receiver can produce errors above this level; however, this level will rarely, if ever, be exceeded in an actual system implementation. See "Calculating Received Signal Level and Link Budget" on page 52 to calculate the anticipated RSL. However, if cabling the system back-to-back with inadequate attenuation, permanent damage can occur. Also, extremely short paths can result in excess RSL.

During anomalous propagation conditions, the RSL can fade up but does not typically increase by more than 10 dB (except in unusual, very long paths, which may increase by 15 dB). This is not something that typically must be planned, but can cause error conditions if the normal (unfaded) RSL is close to the maximum error-free specification.

Antenna alignment should let RSL achieve the level calculated in the link budget. If the RSL is optimized but is approximately 20 dB below the calculated level, it is likely the antennas are aligned on a sidelobe of the antenna's radiated signal. In such case, you must adjust the antennas in a wide arc in both azimuth and elevation (at both sides) until the main lobe is located.

See also "Confirm Receive Signal Level (RSL) " on page 29.

STEP 8. ADJUST OUTPUT POWER

In certain cases, you may need to adjust the output power lower from the factory setting; for example, to:

- Meet any required EIRP (Effective Isotropic Radiated Power) limits
- Avoid exceeding the maximum far-end RSL of –20 dBm for the Tsunami.GX 90 and Tsunami.GX 32
- Meet in-bound RSL requirements for a hub site location

Note: In certain countries, Effective Isotropic Radiated Power (EIRP) limits dictate the maximum output power the radio can transmit, given transmission line loss and antenna gain. Consult with appropriate government agencies or Proxim Corporation if there is any question regarding maximum output power allowed.

Using the Web browser interface through the NMS1 or NMS2 port, you can adjust the output power from factory settings. Select the **Sys Cfg** tab and choose from +5 to +25 dBm for the Tsunami.GX 90 5.8 GHz and the Tsunami.GX 32 or from –7 to +13 for the Tsunami.GX 90 5.3 GHz in 1 dB steps, in the **Tx Power (dBm)** field.

Note: For precise measurement of transmitter power, a calibrated RF power meter is recommended. This power sensor can be connected directly to the output of the radio without exceeding the power rating. With some power meters, it may be necessary to place a calibrated in-line fixed attenuator between the radio antenna port and the power meter so as to not exceed the power meter's maximum input level. Thruline power meters do not operate at Proxim radio RF frequencies and are not recommended.

If adjusting the output power to meet an EIRP limit, you must calculate the overall RF system gains and losses, including feeder losses for the type of transmission line installed and the antenna gain.

Note: For the US and Canada, there is no EIRP limit for fixed point-to-point applications of this product.

You can determine the radio transmit power for EIRP-limited installations using the following equation:

Tx Power (dBm) = EIRP Limit (dBm) + Transmission System Losses (dB) - Antenna Gain (dB)

STEP 9. ESTABLISH A LINK BETWEEN THE RADIOS

Follow these steps to establish a link between the radios:

1) Connect the transmission line to the antenna and feed it to the RFU location.

Connect the opposite end of the transmission line to the N-type female connector located on the RFU through a lightning arrestor. If the RFU is mounted indoors or in a shelter, the lightning protection should be located at the cable egress point. If the RFU is mounted outdoors, it can be mounted at the RF input port of the RFU. The lightning arrestor must be properly grounded. The transmission line connection must be terminated into an antenna or a load before DC power is applied to the radio.

2) Connect the RFU to the IDU.

Connect the cable the runs from the RFU to the IDU. If the RFU is mounted outdoors, ensure that proper lightning protection is used at the shelter or building egress point as well as at the RFU connector. The lightning arrestor must be properly grounded. If the RFU is mounted indoors, use the supplied TNC jumper cable. No grounding or lightning arrestor is needed.

3) Confirm DC power connection.

With the DC power source active but not plugged into the radio, confirm with a voltmeter that the DC mating connector has the proper power connections as discussed in “Power Connections” on page 24.

- Verify the polarity and the absolute voltage on all pins.
- Verify ground connection for power (if applicable).
- Ensure that the RF Antenna port connection is properly terminated before applying power.
- Ensure that the IDU-to-RFU cable is connected.

4) Connect power to the radio.

When the radio is initially powered-on, some alarm conditions may be present. This is normal and alarms can be ignored at this time.

5) Ensure that the antennas at both ends are aligned.

Perform a general alignment of the antennas on both ends of the path using binoculars, compass, or other related tools. You must have the antennas aligned as accurately as possible before putting radio traffic over the link. This helps in getting the system running more rapidly. Assure that both antennas are set for the same polarization (vertical or horizontal at both ends).

6) Adjust RF power (if necessary).

Using the NMS port, verify the RF output power setting and, if necessary, adjust the output power of the local transmitter in accordance with the path analysis calculations.

In cases of no EIRP limits, the radio transmitter output power should be left at the factory setting, except for very short paths using very high gain antennas, where excessive power may not be advised (in which case power should be reduced), or in cases where lower RSL is desired into a hub site (multi-link) location.

Be sure the RF output port is terminated at all times when power is applied to the radio. Therefore, disconnect power to the unit before connecting a power meter; reapply power once connected.

Often, an RF power meter has a limit to the input power it can measure without damage. Proxim advises you place a calibrated fixed value RF attenuator (typically 20 dB or more) between the radio and the power meter to ensure proper operation and safety for the RF power meter. The value of this fixed attenuation then can be added to the value of the RF power meter reading to obtain the actual transmitter output power.

Other typical causes of inadequate RSL are:

- Path obstructions
- Excess loss in connectors/cables (poor terminations, improper bend radius, kinked, crushed, …)
- Poor quality or unaccounted for adapters and pigtail jumper cables
- Different antenna polarization at each end of the link
- Improper configuration of the radio's transmit power output adjustment
- Insufficient RF output power (faulty radio transmitter)
- Faulty antenna

7) Confirm Received Signal Level (RSL).

Connect a voltmeter to the RSL measurement port on the RF Unit. This voltage reading corresponds to the Received Signal Level (RSL) of the near-end radio. RSL is the amount of signal the near-end radio is receiving from the far-end radio. Because the antennas have not been finely aligned, the RSL value at this time will not be the desired value. However, you can verify that some communication is taking place between the two units.

Use the RSL voltage reading to align the antennas. Align one antenna at a time as discussed in "Align the Antenna" on page 25. Align both ends of the link before proceeding.

The RSL voltage output on the radio's front panel supplies a voltage over the usable range of the radio. (You can also use the RSL port on the RFU, which has both DC and Tone available.)

The RSL of both sides of the link can also be measured using the NMS port. See "Management with the Web Interface" on page 33 for details about connecting to the NMS port and viewing performance parameters.

If the RSL is not at the expected level, re-check the path clearance and transmission line, as these are the typical causes of insufficient RSL.

You can verify radio operations by connecting units back-to-back with attenuators (60-80 dB), as described in "Step 3. Test Radios Back-to-Back" on page 12. If the problem persists, see "6.0 Troubleshooting" on page 96.

The transmitter output power adjustment on the radio affects the RSL. Depending upon EIRP limits (if any), path distance, and antenna gain, you may need to adjust the output transmit power to the proper level before putting the units in service.

Helpful Hints—Checking RSL Against Predicted Results

- Is the RF Link LED red?
  - If so, keep aligning the antennas.
  - If not (or green), the radios are talking!
- Does the measured RSL at both ends closely match the predicted value?
  - If too strong, this is probably OK; the transmitter power may be higher than originally planned.
  - If not strong enough, keep aligning.
  - If still not strong enough, double-check the prediction and compare to the actual installation (verify antenna gains, lengths/type of transmission line, path length, and so on).
  - Are you sure you have line of sight?
  - Did you test the radios in advance?
  - You could have a bad cable, connector termination, or antenna
- Do you need to adjust the output power down?
  - Check path calculations and regulations.
  - Re-verify RSL after power is adjusted.

Several factors can contribute to low RSL:

- Incorrect antenna alignment (aligned on a side lobe and not on the main signal)
- Improper polarization orientation of antennas (horizontal versus vertical)
- Transmission line problems (loose connections, kinked or damaged cables, “loss-y” adapters, improper termination)
- Path obstructions (trees, buildings, hills, and so on)
- Improper path clearance (line-of-sight, earth curvature, Fresnel zone, diffraction, and partial obstruction)
- Weather (inversion layers, ducting, and multipath)
- Antenna feed (coaxial/connector) problem
- Highly reflective surfaces of the path terrain

8) Verify the channel plans.

Verify that the units follow the same channel plan, and that the opposite Tx and Rx frequencies complete a matched pair of radios (for example, A1 and A2 make up a matched pair). The RFU pair is made up of a “Hi” and “Low” pair of the same root model number. Also, if co-locating equipment for multiple paths, make sure that you do not deploy the same transmitter frequency as any of the receive frequencies at the same site.

9) Connect unit to telecommunications equipment to pass the Ethernet/T1/E1 traffic.

Connect to the Ethernet/T1/E1 circuits using properly shielded 8-pin modular (RJ-48C) connectors. All front panel LEDs should either be off or green. (You may need to set Data Input parameters on the HTTP **IntfCfg** page to make the Data Input LED green.) If any LEDs are red, see “Front Panel LED Definition” on page 75 or “Troubleshooting Alarms” on page 98 for more information.

STEP 10. ESTABLISH NEAR-END TO FAR-END COMMUNICATIONS USING ORDERWIRE (OPTIONAL)

To establish near-end to far-end communications using orderwire:

1. **Connect telephones to the near-end and far-end radios.**

   Using a standard RJ-11 telephone cable, connect a standard electronic telephone (a touch tone phone, complete with dialer, or DTMF phones) to the Orderwire connector on the radio front panel. This connector is wired identically to a standard two-wire telephone jack. For connector pin assignment, see "Connectors and Pin Assignments" on page 47.

   Note: If you are using a standard telephone (for orderwire function) not provided by Proxim with this product, ensure that the telephone has a ringing equivalency specification of 1.0 B and is a UL-Listed (ITE) device that has been evaluated to the Standard for the Safety of Information Technology Equipment, including Electrical Business Equipment.

2. **Call the far-end radio.**

   With a telephone connected to each radio on opposite ends of the link, either telephone can be used to dial-up the far-end location. The far-end radio internal ringer and the connected telephone ring, and if answered, two-way full-duplex voice communication is established.

If the radios are connected in a repeater configuration, you can establish orderwire services in the network by connecting the radios (by cabling their front-panel VF connectors). The orderwire operates on radios at each end of the repeater and at the repeater site. You can extend this function through several repeater sites. For hub connections of three or more radios, an external 4-wire VF bridge (600 is required to connect all devices for orderwire operations.

Dialing an * (asterisk/star key) on the orderwire telephone implements an "all call" feature that rings all connected radios. All telephones provide communication to all other telephones in the connected network. Even if a particular telephone does not ring, it can still be used to talk and listen to any ongoing orderwire activity if the orderwire is in use at other terminal locations.

Also, if a phone anywhere in the connected network has accidentally been left off-hook, the # [pound] key can be used to mute all off-hook phones until they are placed on and off hook again.

Chapter 3. Managing the Tsunami.GX

You can configure and manage the radios using any of the following methods:

Web Interface

Using a Netscape® or Windows® Internet Explorer browser, you can configure and manage the unit using a Web-based management interface. This management method includes all configuration parameters and monitoring information. The Web browser interface is the most versatile tool to use for the most complete set of information and access to configuration of the radio equipment. Of any of the tools to be used for configuration and troubleshooting, this tool is highly recommended. For more information, see “Management with the Web Interface” on page 33.

SNMP

Using an SNMP management program (such as HP OpenView or Castle Rock SNMPc), you can use MIB information to receive alarm traps, set configuration parameters, and get alarm and status information about the unit. This method provides the majority of configuration and monitoring tools available on the radio, and is a preferred method among those users already familiar with an installed SNMP Manager, or those who have a proprietary network element manager that uses SNMP protocol for communication. The MIB is available from Proxim Technical Services or the Proxim Internet site (http://www.proxim.com/support). For more information see “Management with SNMP” on page 44.

Telnet Command Line Interface (CLI) through IP

If a terminal is not available or you are a distance from the radio, you can use Telnet. See “Management with Telnet” on page 44.

Each radio’s IP address is used to identify it for the Web browser interface, SNMP interface, or Telnet session. For any extensive management, use the Web browser interface or the SNMP interface. The CLI is limited to initially configure the IP address, mask, gateway, and password.

Each radio communicates to its far end mate using a low-speed link, thereby creating a proprietary management channel for managing, configuring, and monitoring any link of radios. This communications channel is not accessible for use by end users; it is designated for use by the radios exclusively.

If it is desired to have in-band management, either the NMS1 or NM2 port needs to be connected to one of the Main Ethernet Data ports using an external switch. Radios are identified by IP addresses that are assigned by the end user. Default IP addresses are assigned at the factory for the radios.

MANAGING WITH THE WEB INTERFACE

Minimum Computer Requirements for NMS

The client PC should satisfy the following minimum requirements:

- CPU Processor speed greater than 1 GHz
- Web Browser: Internet Explorer, version later than 5.0; Netscape 7.0 and later
- 10/100 Ethernet Interface
- Windows® Operating System: Windows® 98 or later (including XP Home and Professional)

Accessing the Radio

Use Windows Internet Explorer® or Netscape® to access the radio by entering its IP address in the browser address bar. The radios are configured at the factory with the default IP address of 10.0.0.1. Once you have successfully logged in to the radio, you can change the IP address from the **Admin** tab of the Web interface.

You can configure your computer to this subnet by setting its address to 10.0.0.**x** (where **x** is from 2 to 254 and not already used in the network) or use the command line interface through Telnet to change the IP addresses of the radios.

Note: The PC connected to the near-end radio's NMS port must be on the same subnet as the near-end radio to communicate with each other.

Change both the near-end and the far-end radio to the desired IP addresses. You may need to change the subnet of your PC many times to accomplish this as you change from the default IP address to your desired address scheme. Always save the new IP address configurations of the radios.

After changing the IP addresses, you must reconfigure the IP address of your computer to again match the subnet of the radio (following your Operating System guidelines for changing IP addresses).

Providing a Contiguous Management Link

The second NMS port (NMS2) is switched with NMS1 on the front panel of the radio; it is used to daisy-chain a CAT5 cable between co-located radios to provide a contiguous management link between radios at a hub location.

Because the 10/100 Base-T ports are auto-MDI/MDI+X, the link can be established with either a straight CAT5 cable or a cross-over cable.

Factory Default Values:

Default IP Address (set at the factory).....10.0.0.1
Default Subnet Mask 255.0.0.0
Default Gateway 0.0.0.0

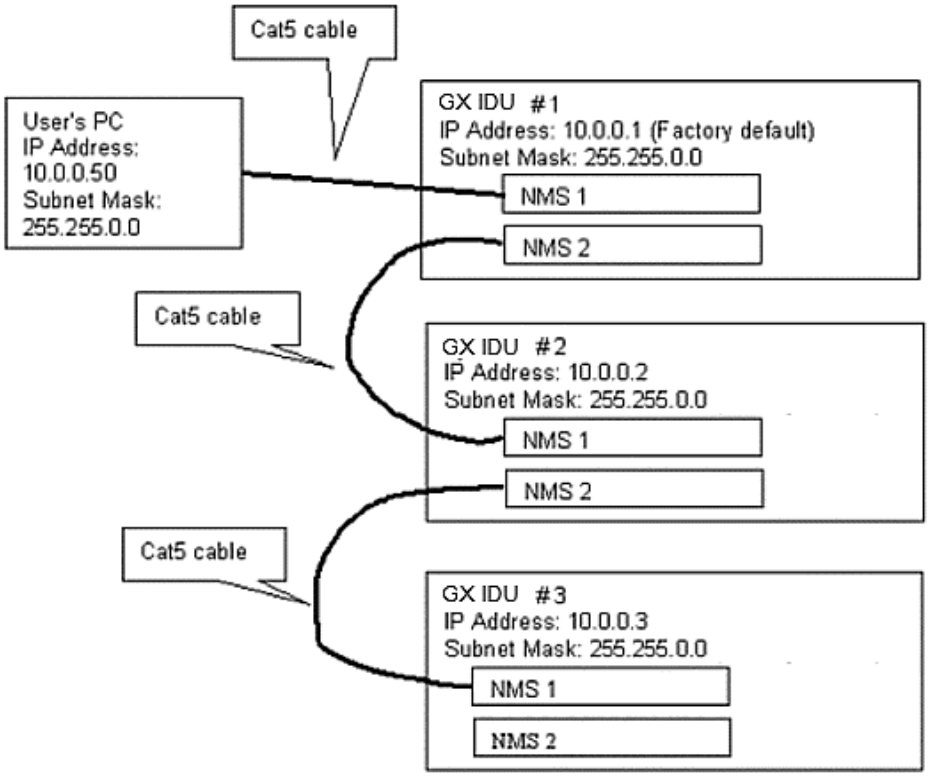


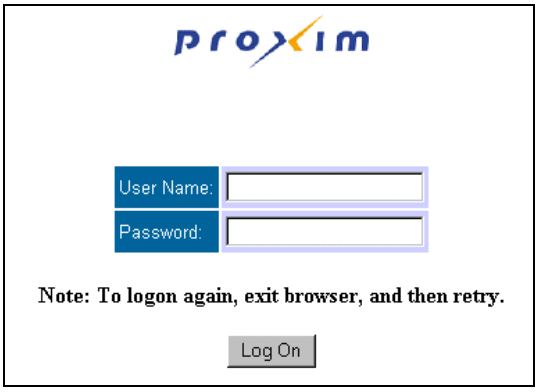
Figure 1. Daisy Chaining NMS Connections at a Hub Location

The next few pages describe how to access the Web Interface and the configuration and management available.

Initial Log-On

To access the Web Interface:

1. At your browser address field enter http://10.0.0.1 (or your previously set IP address) to open the **Logon** window.



2. Enter the following administrative logon username and default password (or your previously set password) in the corresponding fields on the logon page:

   Username: **managers**
   Password: **managers**

   The monitoring logon username and default password are:

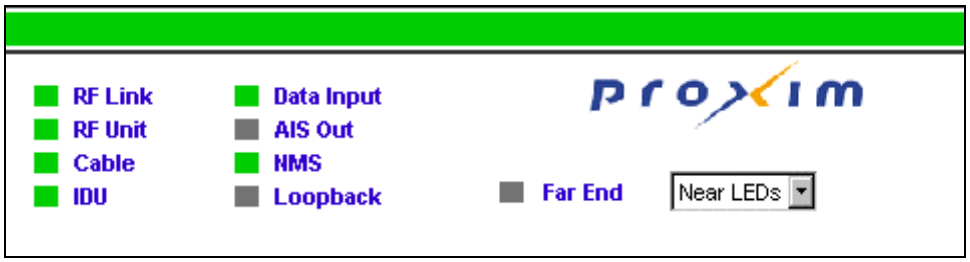
   Username: **operator**
   Password: **operator**

The radios ship from the factory with the default user name and password, as shown above. You should change the password to another value and practice proper security management for limiting access to the **Configuration** and **Control** menu tabs through the browser.

Note: If you forget the IP addresses or password, you can reset the radio to factory settings by powering the radio up while depressing the FAR END button for 10 seconds. The default IP address, subnet mask, gateway, and passwords are installed in the radio.

Web Interface Front Panel LEDs

The radio's front panel LEDs are displayed at the top of each window in the Web interface; they provide the same color and flashing alarm and status information as the actual LEDs on the front panel.



You can choose to view LED information for the near-end radio (the unit to which you are connected) or the far-end radio. The default option when you open a tab or refresh a page is to display the near-end LEDs. If the far-end radio is not available when you choose to view far-end LEDs, these LEDs flash red. See "Front Panel LED Descriptions" on page 75 for more information.

In addition, the large green bar at the very top of the display represents the summary LED (on the back of the IDU) that indicates the health of the radio by summarizing all the eight LEDs on the front panel:

- If all the LEDs are green or off, the bar is green
- If any LED is red, the bar turns red
- If any LED is yellow and none are red, the bar turns yellow

The bar also indicates the state of the Form C relays: Red indicates that the Major or "Out of Service" relay is energized; Yellow indicates that the Minor or "Summary" relay is energized. (A yellow AIS OUT LED will make the summary bar yellow, but will not energize the Minor Relay.) This feature also allows the user to view the summary status of multiple radios concurrently on a single computer display.

The rear panel LED is a single indicator that reflects the summary state of the radio, exactly copying the state of the status bar on the GUI. The LED is red when any alarm is active or front panel LED is red, yellow when any front panel LED is yellow, and green if all front panel LEDs are green or off.

Initial Configuration

The default settings of all Tsunami.GX radios are:

IP Address: 10.0.0.1
Subnet Mask: 255.0.0.0
Gateway Address: 0.0.0.0

The next three steps should be accomplished while both radios are on a test bench. Additional details follow.

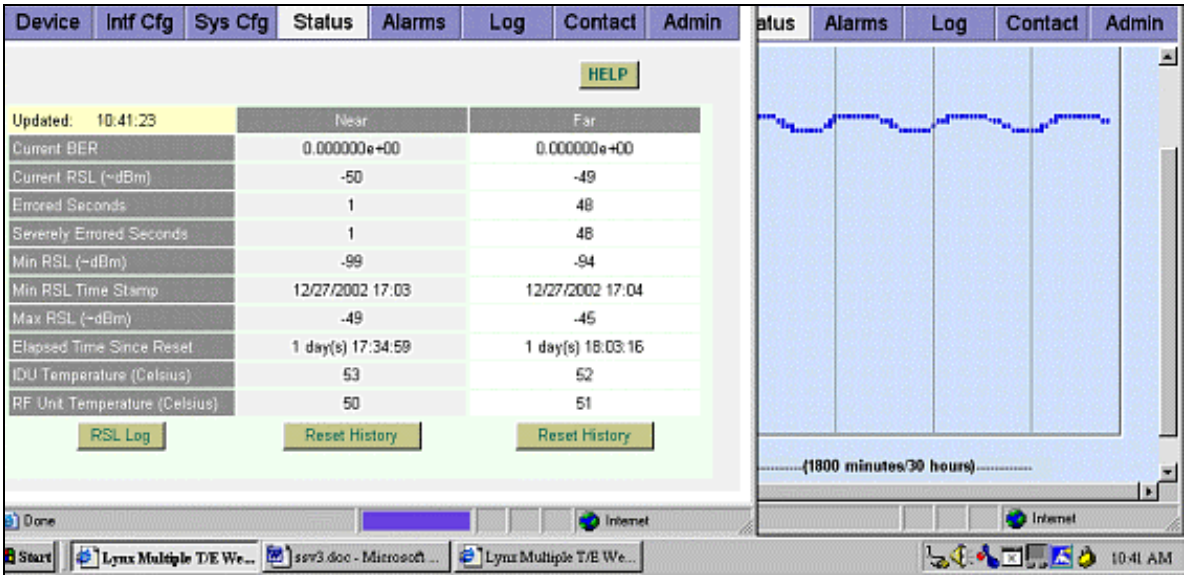
Step 1: Change the PCs IP address to the same subnet as 10.0.0.x. This allows you to address the local radio.

Step 2: Using the CLI, change the IP address, subnet mask, and default gateway of the two radios.

Step 3: Using the Web browser, review and configure any additional settings (such as changing wayside parameters) as necessary.

If it is desired to have in-band management, either the NMS1 or NMS2 port must be connected to one of the Main Ethernet Data ports using an external network device, such as a switch. Using in-band management lets you enable two browsers to be viewed on a PC at the same time.

The following is an example of two browsers enabled for two different radios.



The browser for each radio is opened using the IP address of that radio.

Helpful Configuration Hints

- You must set Tx Power to meet required EIRP limits or RSL requirements.
- You must set IP Address and Subnet Mask to conform to your network. You also must set the Default Gateway Address if your monitoring stations will be on a different IP subnet from the GX radio.
- If the device you are connecting to the Ethernet TX port is not set for Auto-Negotiation, you must set Ethernet Mode to the appropriate speed and duplex. (Never set Full Duplex when the device connected to is Auto or Half Duplex).
- If you are using E1 Wayside Channels, you must set Wayside/Channel Type to E1, and make sure the channels are enabled.
- If you will be using T1 waysides, you must set the appropriate Line Code and Line Buildout setting, and make sure the channels are enabled.
- If you are not using Wayside Channels, you will have greater Ethernet bandwidth if one or both wayside channels are disabled. (Be sure **Wayside/Channel Type** and **Channel Enable** settings on both ends of a link of radios are the same.)
- To aid in troubleshooting possible problems, Proxim recommends you set System Date and Time to provide correct timestamps for Log Messages.
- For greater security, Proxim recommends changing the Configuration Password. Also, use a unique Link Security Code for each link of radios.
- Unless you will be using both the Ethernet TX and Ethernet FX port, Proxim recommends changing the Ethernet Alarm to the one you will be using, either TX or FX.

Basic Tasks with the Web Interface

The following sections introduce you to the Web Interface and the tasks that can be accomplished with each window. For more in-depth information about the Web Interface windows, see “Web Interface Windows and Field Descriptions” on page 57.

Task Quick Reference

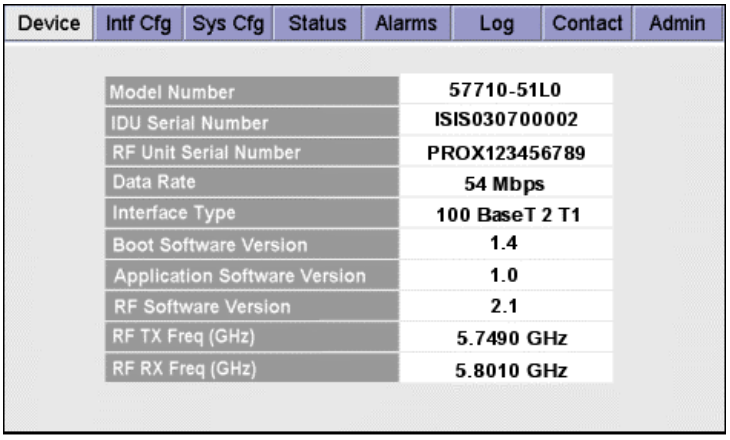
Monitor:

To view or monitor:	Click this tab:	To view or monitor:	Click this tab:
All or selected status alarms	LOG	RF receive frequency	DEVICE
Application software version	DEVICE	RF software version	DEVICE
BER (current)	STATUS	RF transmit frequency	DEVICE
Bit error alarm	ALARMS	RFU serial number	DEVICE
Boot software version	DEVICE	RSL reading of radio over time	STATUS/RSL button
Data rate	DEVICE	RSL (current)	STATUS
Elapsed time since reset	STATUS	RSL (max)	STATUS
Errored seconds	STATUS	RSL (min)	STATUS
External Input Alarm	ALARMS	RSL (min) timestamp	STATUS
External FX link alarm	ALARMS	Severely errored seconds	STATUS
External TX link alarm	ALARMS	Spectrum Analyzer	ADMIN
Fan summary alarm	ALARMS	Status alarms, all or selected	LOG
IDU serial number	DEVICE	T-1/E-1 AIS	ALARMS
IDU temperature	STATUS	T-1/E-1 Input	ALARMS
Interface type	DEVICE	Wayside configuration alarm	ALARMS
Major relay alarm	ALARMS	Minor relay alarm	ALARMS
Model number	DEVICE	Radio sync alarm	ALARMS

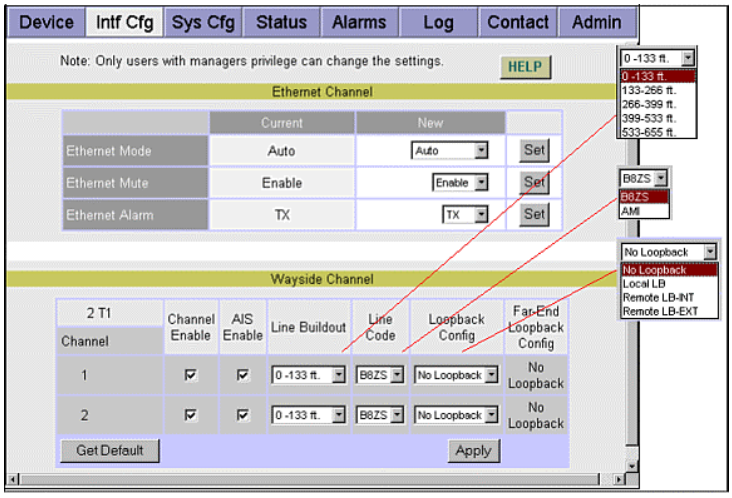
Configure:

To configure:	Click this tab:	To configure:	Click this tab:
Alarm external inputs	SYS CFG	Ethernet Mode	INTF CFG
Auxiliary port speed	SYS CFG	Ethernet Mute	INTF CFG
Date and time, system	ADMIN	IP address	ADMIN
Default gateway address	ADMIN	Link Security code	SYS CFG
Ethernet Alarm	INTF CFG	Orderwire address	SYS CFG
Signal Spreading (GX 32 only)	SYS CFG	TX/RX Frequency (GX 32 only)	SYS CFG
SNMP Community Strings	ADMIN	System passwords	ADMIN
Tx Power	SYS CFG	Wayside channel	INTF CFG
Wayside/Channel Type	SYS CFG		

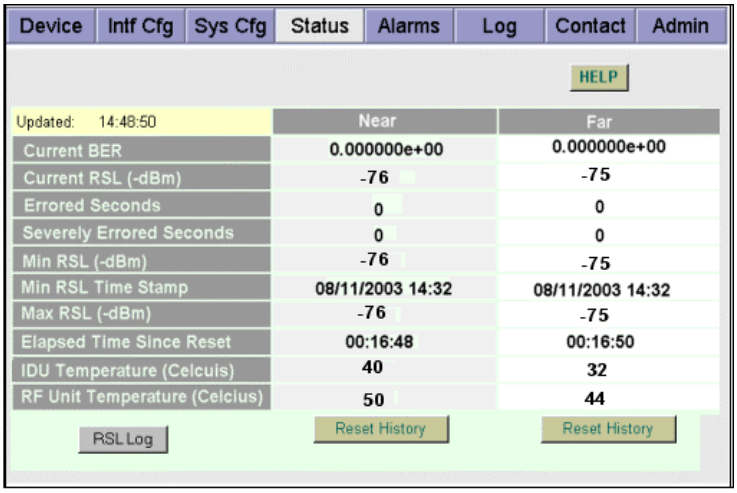
Viewing Radio Information

Use this tab:	To do this:	Window
Device Tab on page 57	***Access radio information***, such as model and serial numbers, data rate and frequency, interface type, and software version levels. **Note:** The Device window is the same for the Tsunami.GX 32 and 90 models, with the exception of the data rate field and the model and serial numbers. The fields in this window are not configurable.	

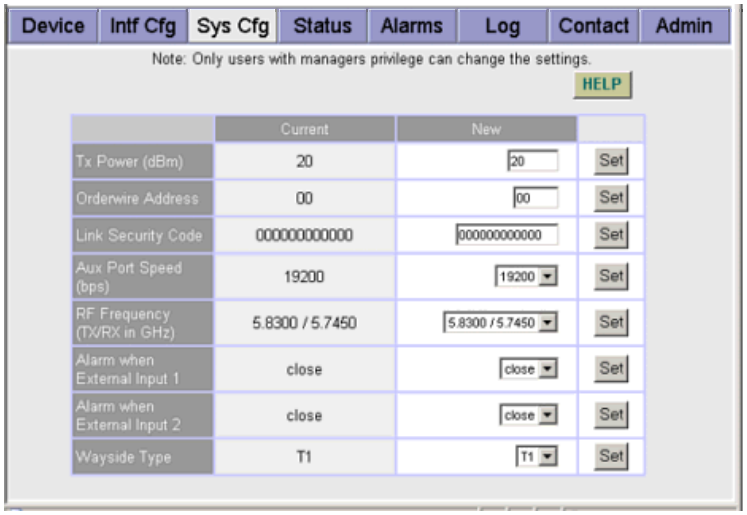
Modifying Ethernet / T1 / E1 Channel Interface Configurations

Intf Cfg Tab on page 58	***Modify the Ethernet, T1, or E1 channel interface configurations***, including Ethernet Mode, Mute, and Alarm, and Wayside channel line build-out, line code, and loopback configuration. There are two separate sections. Each Ethernet option is set separately, while the Wayside configuration lets you make your changes all at once.	

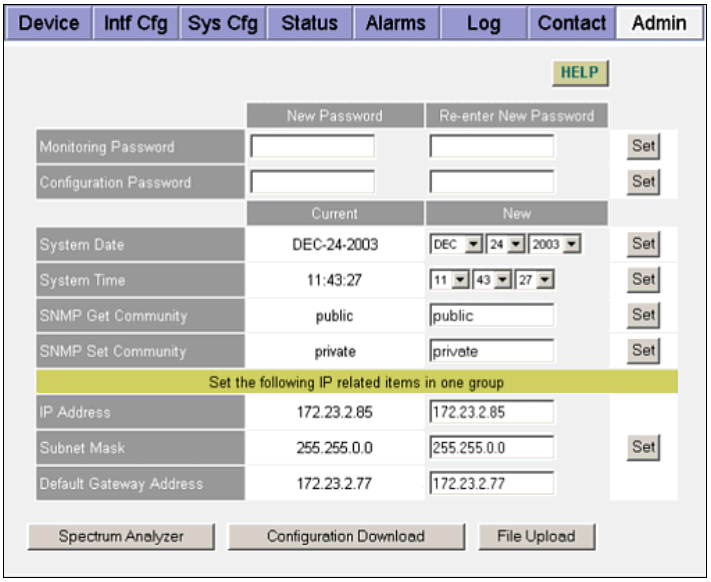
Viewing the Current Near and Far Status

Status Tab on page 62	***View the current Near and Far status for the selected unit***, including BER, errored seconds, RSL, elapsed time since reset, and temperature. You also can track the RSL reading of the radio over time by clicking the **RSL Log** button on the **Status** window. The fields on this window are not configurable. See "RSL Log" on page 63 for more information.	

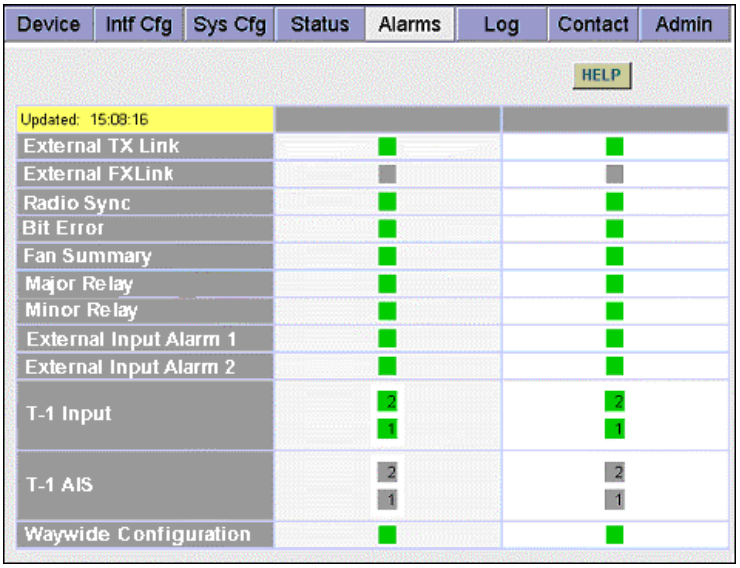
Configuring System Parameters

Sys Cfg Tab on page 59	***Configure Tx power, orderwire, security link ID, RF channel plan, aux port speed, RF frequency settings, variable TX/RX Frequency settings (GX32 only) Signal Spreading (GX 32 only), External Alarms, and Wayside/Channel Type***	

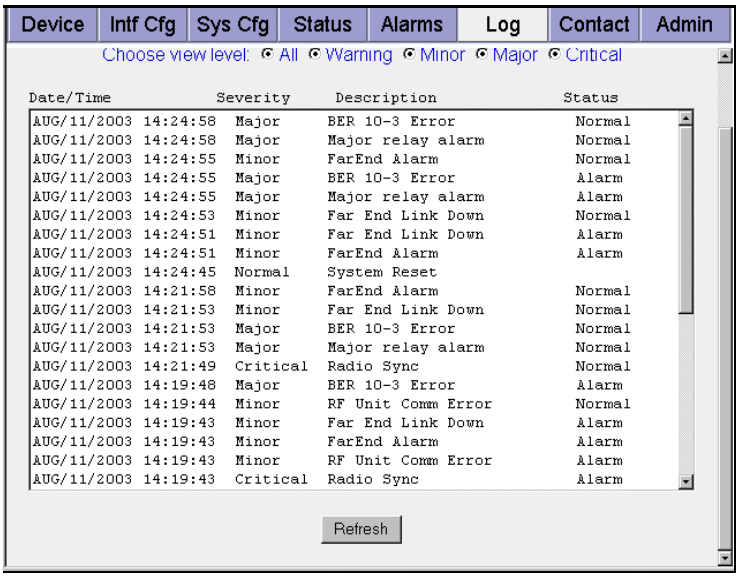
Changing Passwords, System Date and Time, SNMP Community Strings, and IP Address

Admin Tab on page 68	***Change the system passwords, system date and time, SNMP community strings, and radio IP address information***. You can also enable the built-in Spectrum Analyzer to check for transmission sources that the radio can receive and to determine whether these emitters could be a source of possible interference (click the **Spectrum Analyzer** button on the **Admin** window). You can do a Configuration Download to save all parameters to a file. You can do a File Upload of a configuration file or updated application software or FPGA firmware.	

Monitoring Link Alarms

Alarms Tab on page 64	***Monitor link status*** — both near-end and far-end link alarm status. The orientation of the wayside alarms matches the position of the connectors on the front panel.	

Viewing All or Selected Status and Alarms

Log Tab on page 66	***View all or selected status and alarms for the radio.*** You can view alarms of all levels or selected levels and greater.	

Viewing Proxim Support Information

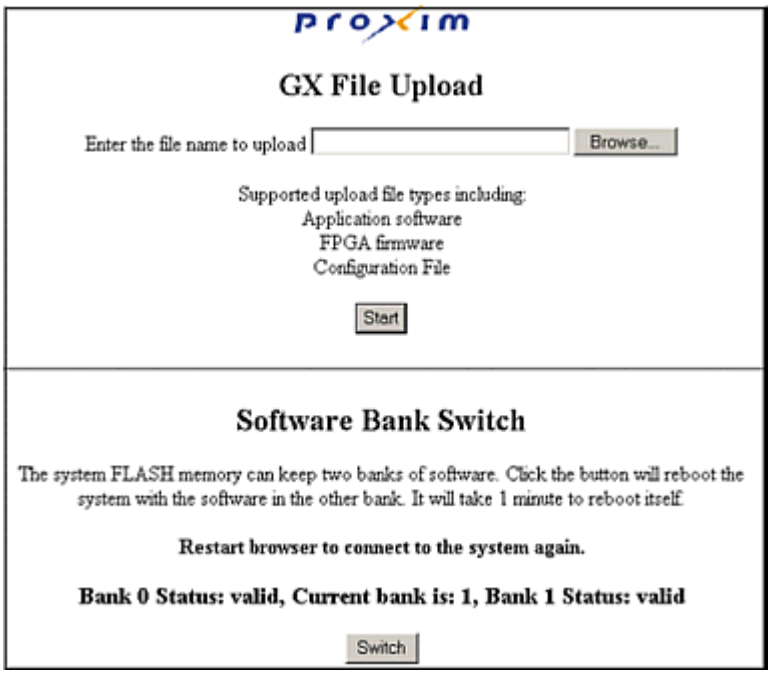
Contact Tab on page 68	***View Proxim Support information*** (see "Technical Support" on page 103)	

Uploading Software

You can upload the most recent version of the application software, FPGA firmware, or entire configuration. To upload a file:

1. Download the most recent software from http://www.proxim.com/support/.
2. Connect the PC with the new software to the radio terminal through the NMS.
3. At your browser's address field, enter **http://<IP address>/upload.htm**, or select **File Upload** from the **Admin** tab. (For factory default, use 10.0.0.1 for the IP address.)

4. If not already logged in, enter the default "managers" **username** and the appropriate **password**; the following Web page is displayed.



5. Enter the name and location of the file you want to upload, or click **Browse** and select the file location.
6. Click **Start**. For software or firmware, the file is uploaded to the unused Bank. Make note of the Current bank number for reference. (The radio has two banks of flash memory available: **Bank 0** and **Bank 1**. Only one bank is in use at a time. After uploading, the radio automatically switches to the bank holding the newly uploaded software.)

Once software upload is complete, the following message is displayed:

`File upload finished and system will reboot! Restart browser to logon again`.

For a configuration file, the following message is displayed:

`Configuration upload completed, system reboot…`

Also, the result of the configuration change will be displayed.

You will need to wait about one minute for the radio to restart. Close both browser windows and restart your browser. If uploading software or firmware, you may complete steps 1 through 3 to ensure the newly uploaded Bank is valid and is the current Bank in use. If changing the configuration and the IP address was changed, you may need to change the IP address of your monitoring computer.

To use the previous software version, you can manually switch between banks by clicking the **Switch** button; after switching between Banks, you must close and restart the browser after waiting for the radio to reboot. If a Bank is marked invalid, you cannot switch to that Bank and should upload the latest software to that bank. A Bank may become invalid if a software upload was interrupted.

MANAGING WITH SNMP

The radios support SNMP version 2C and earlier. All SNMP traffic, including traps, SET commands, and GET commands, are sent and received through the NMS . See “Planning NMS Configuration” on page 33 to configure the NMS network.

Requirements

- A copy of the Proxim MIB files are required to configure and manage the radios using SNMP. There is a generic MIB for all GX radios (g4_generic.mib) and a more interface-specific MIB file per the specific radio and its interfaces (for example, the file **if_e100.mib** and **if_t1e1.mib** are used for the Tsunami.GX radios).
- A workstation running an SNMP manager such as HP OpenView, Castle Rock SNMPc, or Ipswitch WhatsUp Gold.

Install the MIB in the SNMP Manager

Follow the instructions provided with the SNMP Management software to load and compile the generic MIB and the specific interface MIB for the radio onto the SNMP Network Manager. The MIBs contain all the traps and configuration variables for the radio SNMP agent. These MIBs are included in the CD that ships with the unit.

Network Connections

Use a ping utility to make sure your SNMP Manager can communicate with the radios. Configure the radio’s SNMP Community strings using the Web interface **Admin** page or through the CLI interface.

These radios support many of the RFC1213 functions, and the enterprise MIBs allow monitoring and configuring of boot, clock, trap, authentication, log, device, status, performance, and configuration information.

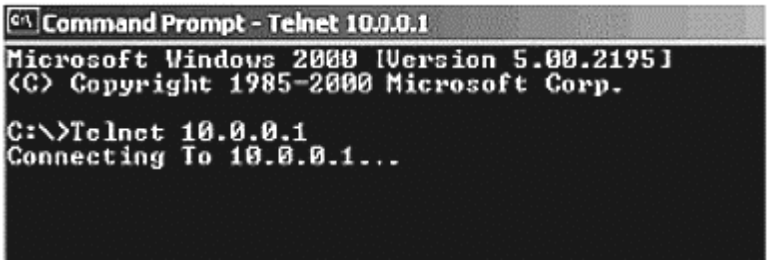
MANAGING WITH TELNET

You can use the command line interface (CLI) through Telnet to assign the radio new IP information, change the password, change SNMP community strings, and view some radio status information.

Starting a Session

To start a Telnet session through the NMS port:

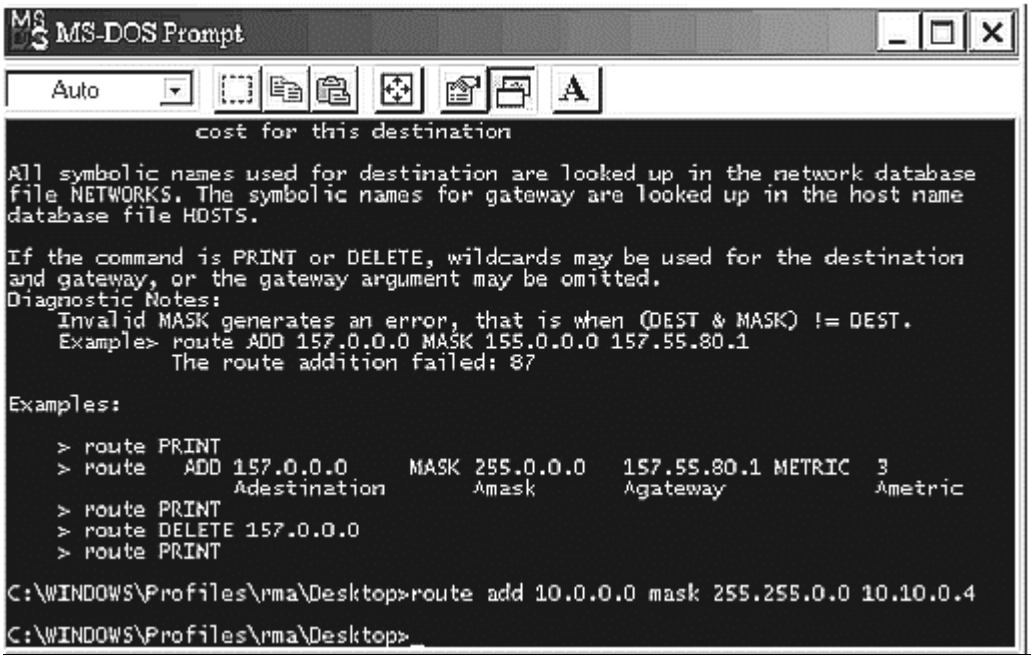
1. From Windows, open a Command Prompt, or MS-DOS Prompt (**Start ➔ Run…**).
2. Enter the following at the command line of the command prompt window:
   c:\>**Telnet *<IP address>***
3. Telnet issues a connection message;



4. When prompted, enter **managers** as the username and **managers** as the password (or your assigned password).

5. Enter **gxHelp** to view available commands, as shown in the following figure:

6. To end a Telnet session use the **logout** command. A config port session is unavailable until any telnet session has ended.



CLI Commands

These are the CLI commands you can use:

`gxHelp` ..... Shows system information and list of commands.
`getPerf` ..... Snapshot of the performance data.
`setIP("IpAdr")` ..... Sets IP address; example: setIP ("10.10.5.37")
`setMask ("Netmask")` ..... Sets subnet mask; example: setMask ("255.0.0.0")
`setGW ("Gateway")`..... Set to default gateway; example: setGW("10.10.5.10")
`setSetComStr ("ComStr")`..... Sets SNMP set community string
`setGetComStr ("ComStr")`..... Sets SNMP get community string
`SetPwd ("oldPwd", "newPwd")`.. Sets administrator's password

MAINTAINING THE RADIO

The radio does not require any regular maintenance. However, it is prudent to monitor the radio link at regular intervals to ensure that the link conditions are not changing. When visiting a radio site for maintenance, you should check the following items and record the results: RSL voltage, power setting (NMS), far-end RSL voltage, and alarm conditions.

Be sure to verify that the unit has adequate ventilation.

If any alarm conditions exist, record them. See “Troubleshooting Alarms” on page 98.

Proxim recommends you review the radio’s **Log** and **Status** pages to view whatever alarms and changes in performance have occurred since the last maintenance interval. Download the log or perform a ‘print screen’ with your computer to keep a record of the performance for your maintenance records.

Proxim also recommends that the antenna system be inspected annually. This inspection should include inspection of mounting hardware for tightness and corrosion, condition of the weatherseal on all RF connections, and integrity of ground connections on cable and surge suppressor.

Appendix A. Installation Planning

Prior to installing the radio system, be sure you have considered the following factors. In addition to selecting the installation site, you must:

Calculate:

- Predicted Path Availability
- Anticipated RSL and Fade Margin

Determine:

- Frequency Plan
- Required antenna size and type
- Required antenna mounting height to obtain proper path clearance and avoid creating a multi-path reflection problem
- Required transmission line types and lengths

You should also consider the following:

- Continuous power consumption needs
- Antenna installation
- Lightning protection and system grounding
- Radio hardware mounting
- Cable installation including egress

Also, before installing the system, a back-to-back test of the radio pair is recommended. Back-to-back testing is a simple way to verify that the radios are fully operational before they are installed. The process of installation adds several variables that can lead to system turn-up delays during troubleshooting (such as antenna alignment, cabling, and path dynamics). By pre-testing the radios, you reduce the chance of the radios being the cause of system turn-up problems, and you can focus on other factors, such as transmission line, antenna alignment, and path clearance. See “Test Radios Back-to-Back” on page 12.

SITE SELECTION

The radio site must have:

- Access to appropriate power and a proper earth ground for grounding all equipment
- Appropriate shelter/environment for mounting of indoor equipment
- Line-of-sight to the other radio location with adequate path clearance
- An appropriate structure for mounting the antenna
- Access to the telecommunications system you want to interconnect

Line-of-Sight and Path Clearance Guidelines

This product operates on frequencies that require clear RF line-of-sight because they are attenuated by trees and other obstructions. Factors to consider include allowance for earth curvature, tree growth, man-made obstructions, atmospheric refractivity, atmospheric ducting, and the path reflection point.

The proposed path design must provide clearance for 60% of the first Fresnel zone, and nothing more, in order to minimize the possibility of a creating a multi-path reflection outage problem. Clearing less than 60% of the 1st Fresnel zone will result in excess signal loss due to diffraction, in addition to the calculated free-space loss.

Excessive antenna height resulting in clearance of the 2nd and higher order Fresnel zones sets up the likelihood of multi-path reflection outages. The higher the number of the "cleared" Fresnel zones, the more likely that a system multi-path reflection outage will occur when atmospheric refractivity changes.

AVAILABILITY

Availability of the microwave path is a prediction of the percent of time that the link operates without producing an excessive bit error rate (BER) due to atmospheric fading only. The calculated availability number does not include outages caused by multipath reflections off of the terrain surface. With proper path clearance, and in the absence of direct interference, availability is affected by the following:

- Path length
- Fade margin
- Frequency
- Terrain (smooth, average, mountainous)
- Climate (dry, temperate, humid)

Depending upon the type of information carried over the link and the overall network design redundancy, you may want to design for a specific availability rate. For example, if the data or voice traffic carried by the radio is critical, the link can be designed for a very high availability rate (such as 99.999% or 5.3 minutes of predicted outage per year).

You can increase the fade margin to improve availability either by making the path shorter or by using higher gain antennas in conjunction with lower loss transmission line (using a higher quality transmission line, shortening the length, or both). Mounting the RFU near the antenna (thereby shortening the transmission line) is one means to assist in increasing fade margin.

FADE MARGIN

The fade margin is the difference between the actual received signal and the radio's threshold. Using the formula provided in the previous section, you can calculate the anticipated RSL. Compare this RSL to the specified threshold of the radio, and calculate the fade margin as the difference between the two signal levels.

Proxim Corporation recommends that you design your link to your desired availability standard, as discussed in "Calculating Availability" above. However, independent of the availability standard, the following guidelines are recommended for minimum fade:

- Greater than or equal to 15 dB for all paths, whenever possible, and always for path lengths greater than two miles (3.2 kilometers).
- No less than 10 dB for any path length (this is not recommended, but can provide adequate performance if the path length is very short—such as less than two miles (3.2 kilometers) over non-reflective terrain and in non-refractive atmospheric conditions).

USEFUL PATH CALCULATIONS

First Fresnel Distance Formula (USA)

The formula for calculating the first Fresnel distance is:

$$F = 72.2 \sqrt{\frac{d_1 \cdot d_2}{f \cdot D}}$$

where:

F = first Fresnel Zone radius (feet)

D = path length (miles)

f = frequency (GHz)

d_1 = distance from first antenna (miles)

d_2 = distance from second antenna (miles)

First Fresnel Distance Formula (international)

The formula for calculating the first Fresnel distance is:

$$F = 17.3 \sqrt{\frac{d_1 \cdot d_2}{f \cdot D}}$$

where:

F = first Fresnel Zone radius (meters)

D = path length (kilometers)

f = frequency (GHz)

d_1 = distance from first antenna (kilometers)

d_2 = distance from second antenna (kilometers)

Earth Curvature Formula (USA)

Clearance for terrain can be determined from accurate topographic maps (the height of trees and/or buildings needs to be considered). Alternatively, the path can be surveyed along the direct route.

Clearance for earth curvature can be calculated for various "K" factors using the formula:

$h = d_1 \times d_2 / 1.5 \times K$

K is the equivalent earth radius and under normal atmospheric conditions, K = 4/3 to give:

$h = d_1 \times d_2 / 2$

where:

h = change in vertical distance from a horizontal line (feet)

d = distance from first antenna (miles)

d = distance from second antenna (miles)

Earth Curvature Formula (international)

Clearance for terrain can be determined from accurate topographic maps (the height of trees and/or buildings must be considered). Alternatively, the path can be surveyed along the direct route.

Clearance for earth curvature can be calculated for various "K" factors using the formula:

$$h = d_1 \times d_2 / 12.75 \times K$$

K is the equivalent earth radius and under normal atmospheric conditions, K = 4/3 to give:

$$h = d_1 \times d_2 / 2$$

where:

h = change in vertical distance from a horizontal line (meters)
d = distance from first antenna (kilometers)
d = distance from second antenna (kilometers)

Path Loss Attenuation (USA)

The formula for calculating the path loss attenuation is:

$$Lp\ (dB) = 96.6 + 20 \log_{10} F + 20 \log_{10} D$$

where:

F is in GHz
D is in miles

Path Loss Attenuation (international)

The formula for calculating the path loss attenuation is:

$$Lp\ (dB) = 92.4 + 20 \log_{10} F + 20 \log_{10} D$$

where:

F is in GHz
D is in kilometers

Reflection Point (USA)

The formula for calculating the position of the reflection point on a path is

for K = 4/3 $h_1/d_1 - d_1/2 = h_2/d_2 - d_2/2$

for K = 2/3 $h_1/d_1 - d_1 = h_2/d_2 - d_1$

for K = ∞ $d_1 = D \bullet h_1/(h_1 - h_2.)$

where:

h is in feet
d and **D** are in miles

(The K factor allows for consideration of atmospheric conditions by allowing for the path of the beam, relative to the earth. K = 4/3 is normal for atmospheric conditions and K = infinity is for worst case flat-earth propagation conditions.)

Reflection Point (international)

The formula for calculating the position of the reflection point on a path is

for K = 4/3 $\mathbf{h_1/d_1 - d_1/17 = h_2/d_2 - d_2/17}$

for K = 2/3 $\mathbf{h_1/d_1 - d_1/8.5 = h_2/d_2 - d_1/8.5}$

for K = ∞ $\mathbf{d_1 = D \bullet h_1/(h_1 - h_2.)}$

where:

h is in meters
d and **D** are in kilometers

(The K factor allows for consideration of atmospheric conditions by allowing for the path of the beam, relative to the earth. K = 4/3 is normal for atmospheric conditions and K = infinity is for worst case flat-earth propagation conditions.)

Fading Outages and Availability (USA)

The formula for calculating the unavailability, U, of a path (due to multipath fading) is:

$$\mathbf{U = a \times b \times 2.5 \times 10^{-6} \times f \times D^3 \times 10^{-F/10}}$$

where:

a = climate (0.1 to 0.5)
b = terrain (0.25 to 4)
f = frequency, GHz
D = path length, miles
F = fade margin, dB

The formula for calculating the availability, A, of a path is:

$$\mathbf{A = (1 - U)\ 100\%}$$

where:

U = unavailability

Received Signal Level and Link Budget

Use the following formula to estimate the received signal level (RSL):

RSL (dBm) = P_{out} - L_1+ G_1 + G_2 - L_2 - L_p

where:

P_{out} is the transmitter output power (in dBm)

L_1 is the total loss of all transmission elements between the antenna and the RF Unit on one side of the link (in dB)

- **G_1** is the gain of the antenna on one side of the link (in dB)
- **G_2** is the gain of the antenna on the opposite side of the link (in dB)
- **L_2** is the total loss of all transmission elements between the antenna and the RF Unit on the opposite side of the link (in dB)

L_p is the Path loss, defined by either:

Lp (dB) = 96.6 + 20 $\log_{10}$F + 20 $\log_{10}$D (D=distance in miles)

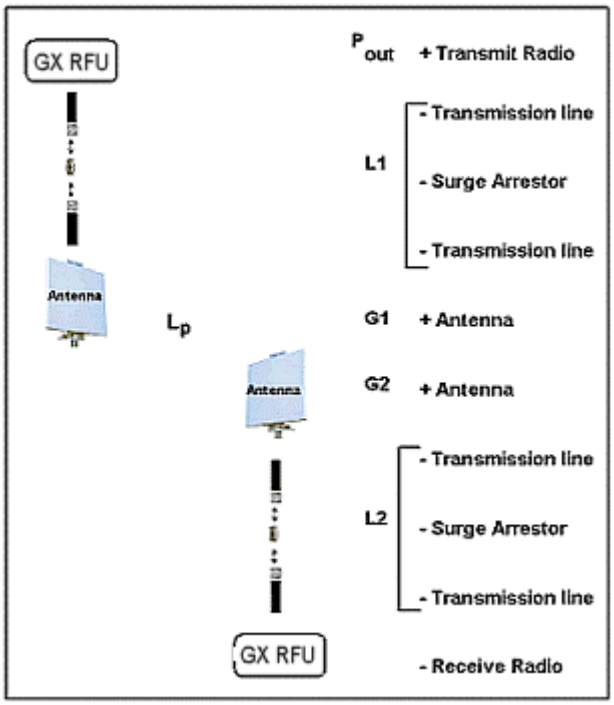
or:

Lp (dB) = 92.4 + 20 $\log_{10}$F + 20 $\log_{10}$D (D=distance in kilometers)

where:

F is the Frequency of the radio system in GHz (5.8/5.3 in the case of this model)

The results of this link budget calculation are very important for verifying proper installation and can significantly help identify problems during installation and troubleshooting. If you have calculated the expected RSL, you can verify that it has been achieved during installation and use the actual results compared to expected results for troubleshooting, if necessary.



In the USA and Canada, this model radio can be installed with any gain directional antennas, as there is no Effective Isotropic Radiated Power (EIRP) limit for the application of these systems for fixed point-to-point applications. In other countries, EIRP limits may apply.

In the case of EIRP limits, use the lesser of either (P_{out} - L_1+ G_1) or the EIRP limit within the previous equation. You should check this equation in both directions to assure legal application.

An EIRP limit is the maximum RF energy that can be transmitted, as measured at the transmitting antenna, and is usually determined by government regulations.

EQUIPMENT CO-LOCATION

When configuring radios in a hub or repeater configuration, perform careful engineering of the radio frequency plans and antenna locations to minimize potential interference between the nearby radios.

As a rule of thumb, do not place opposite frequency plan radios (such as A1 and A2) at the same site. Using alternate channels (such as A1 and A2) is highly unlikely to be successful (and therefore not recommended) due to the high level of transmitter-to-receiver isolation required from the antenna system.

In most cases, you should use the same frequency plan (such as A1 and A1) or, in some cases, a different frequency plan from the same side of the band (such as A1 and B1, when more than one channel plan is available).

With careful engineering, you can easily place more than one radio of the same frequency channel plan at the same site. When designing these configurations, antenna size, antenna polarization, and antenna location are critical.

Antenna polarization always should be oriented such that adjacent links are oppositely polarized relative to one another (that is, vertically and horizontally). This provides additional discrimination of the received signals coming into the hub site. If you must place an odd number of links at the same location, ensure that the largest angle is bounded by the two links of like polarization. Further interference analysis may be required to ensure these adjacent links will provide adequate separation.

Changing polarization on the antenna system to the orientation that provides the maximum rejection to the interference is also an extremely effective measure.

The radio must have access to a supply of appropriate power, either DC or AC (if the AC adapter option has been ordered). The unit can be powered from a DC battery system, or from a solar or generator power plant, usually with battery reserves. Typically, either a $\pm$ 24 or $\pm$ 48 volt supply is used.

For DC, be sure the cable is of sufficient gauge to carry the necessary current and is less than three meters (9.75 feet) in length. A minimum gauge of **14** is recommended.

Before you install the radio, plan for the unit's continuous power consumption needs. You also should plan for backup power for critical communication circuits. Backup power lets the radios and associated equipment operate continuously when primary power is interrupted.

The radio channel plans are shown in the *Specifications* document for your radio.

PLANNING FOR AND SELECTING IF CABLE

The radio can be installed with the RFU mounted indoors above the IDU in a 19-inch (or 23-inch) rack, or mounted outdoors onto the pole-mounted bracket (sold separately).

For indoor mounting, a short IF coaxial cable is included in the IDU accessory kit to connect the IDU to the RFU; the cable is TNC (male) to TNC (male), about 12 inches in length. A low-loss RF transmission line is required to run the RF signal from the RFU to the antenna (located outdoors atop a tower, monopole, rooftop pole, or cell site. The choices for RF transmission line are discussed in the next section.

For outdoor RFU mounting, a long IF coaxial cable is required to connect the IDU to the RFU outdoors. The recommended cables are listed in the following table. The IF cable shall not exceed 1000 feet (300 meters) when LMR-600 is used. Select UV-resistant sheathing on the cable.

IF Transmission Line		
Type	$^{1}/_{4}$-inch coaxial	$^{3}/_{8}$-inch coaxial
Manufacturer	Times Microwave	Times Microwave
Model	LMR-240	LMR-400
Connectors (needed to connect to RFU and IDU)	TC-240-TM “TNC”	TC-400-TM “TNC”
Loss* per 100 ft. at 748 MHz IF (up stream)	7.6 dB	3.9 dB
Loss* per 100 ft. at 140 MHz IF (down stream)	3.0 dB	1.5 dB
DC Resistance* per 100 ft. (center conductor plus shield)	0.709 ohms	0.304 ohms
Recommendation for length of cable	For cable lengths less than 330 ft or 100 meters	For cable lengths up to 600 ft. or 200 meters
Radio maximum IF loss: <24 dB at 748 MHz (upstream), <10 dB at 140 MHz (downstream)		
Radio maximum DC resistance (center plus shield): < 3.5 ohms		

*Source: Times Microwave Systems Communications Coax Selection Guide

Equivalent or lower-loss cable can be used in place of the two cables listed in this table. Be sure to use cable rated for outdoor use (UV-resistant sheathing).

Note: Always apply waterproof butyl tape after the cable has been installed onto the RFU outdoors.

The connectors on both ends should be TNC (male) to TNC (male). Multiple cables can be used to accomplish IDU-to-egress and egress-to-RFU connections, including lightning protection devices. All device losses and resistances (including connectors) must be added and maintained within the limits listed above.

PLANNING FOR ANTENNA AND RF TRANSMISSION LINE INSTALLATION

In general, the larger the antenna used with the radio, the better the link performs. Larger antennas have narrower beamwidth and higher gain, which yield better link performance (higher fade margin, better availability) and improve immunity to interference (due to the narrower beamwidths). This is especially important for multi-link installations (hub sites) and for locations with potential interference sources nearby.

However, larger antennas are more costly to purchase and install than smaller antennas and, in some cases, require special installation equipment and more robust mounting structures (due to increased weight and wind loading). You should consider all of these factors when selecting an antenna.

Prior to installation, determine the specific antenna location and mounting. The transmission line should be kept as short as possible, so when line-of-sight placement of antennas allow flexibility, it is always desirable for the equipment to be located closer to the antenna.

This advanced planning, combined with the decision about where the RFU is to be mounted, yields the transmission line requirements.

Note: In areas where transmitted output power restrictions apply, the use of larger antennas benefits narrow beamwidths and receive gain. However, you could be required to reduce output power to meet regulations. Only directional antennas should be used with these radios; typically flat-panel or solid-parabolic antennas. As a general guideline, Proxim Corporation recommends a maximum 3 dB beamwidth of 10 degrees for directional systems.

The following tables list various transmission lines, and then antenna types, performance, and manufacturers.

Within the USA and Canada, antennas other than those illustrated in these tables can be used with this radio, but must be of the same type (flat panel or solid parabolic), dimensions, and gain as those listed in the table. Antennas with gain less than 23.5 dBi are not approved for use within the USA or Canada. Consult governmental regulations or Proxim Corporation for applications outside of the USA or Canada.

For further information regarding antenna installation and adjustment, see “Installing and Adjusting the Antenna” on page 18.

RF Transmission Line (Antenna to RFU)				
Type	**Manufacturer**	**Model**	**Loss***	**Notes**
½-inch foam coaxial	Andrew	LDF 4-50	6.1 dB	Add –0.25 dB per connector
5/8-inch foam coaxial	Andrew	LDF 4.5-50	4.7 dB	Add –0.25 dB per connector
Waveguide	Andrew	EW-52	1.2 dB	Does not include transitions
½-inch foam coaxial	Times Microwave	LMR-600	7.3 dB	Add –0.25 dB per connector
5/8-inch foam coaxial	Times Microwave	LMR-900	4.9 dB	Add –0.25 dB per connector
* per 100 ft. @ 5.8/5.3 GHz RF Frequency				

Antenna Manufacturer Information			
Antenna Type	**Manufacturer**	**Model Number**	**Mid-Band Gain (dBi)**
1-foot flat panel	Tripoint Global Andrew RFS	DFPD1-52 FPA5250D12-N MA0528-23AN	23.5 23.6 23.0
2-foot flat panel	Tripoint Global Andrew RFS	DFPD2-52 FPA5250D24-N MA0528-28AN	28.0 28.2 28.0
2-foot parabolic	Tripoint Global Tripoint Global Radio Waves Andrew RFS	QF2-52 HQF2-52 SP2-5.2 P2F-52 SPF2-52A	28.5 28.1 28.3 29.4 27.9
3-foot parabolic	Radio Waves Andrew RFS	SP3-5.2 P3F-52 SPF3-52A	31.4 33.4 31,4
4-foot parabolic	Tripoint Global Tripoint Global Andrew Radio Waves RFS RFS	QF4-52 HQF4-52 P4F-52 SP4-52 SPF4-52A SDF4-52A	34.2 33.9 34.9 34.6 33.9 33.9
6-foot parabolic	Tripoint Global Tripoint Global Radio Waves Andrew RFS RFS	QF6-52 HQF6-5 SP6-5.2 P6F-52 SPF6-52A SDF6-52A	37.5 37.2 37.7 37.6 37.4 37.4
8-foot parabolic	Tripoint Global Tripoint Global	SSP8-52A HSSP8-52	39.8 39.6

The formula for determining maximum output power setting for 5.725-5.850 GHz Radio Transmitters (@EIRP=54.5 dBm) is:

Max Tx (dBm) is the lesser of 24.5 dBm and 54.5 - G + FL

where:

G = Antenna Gain

Tx = the output power measured at the antenna input

FL = feeder loss including loss of connectors

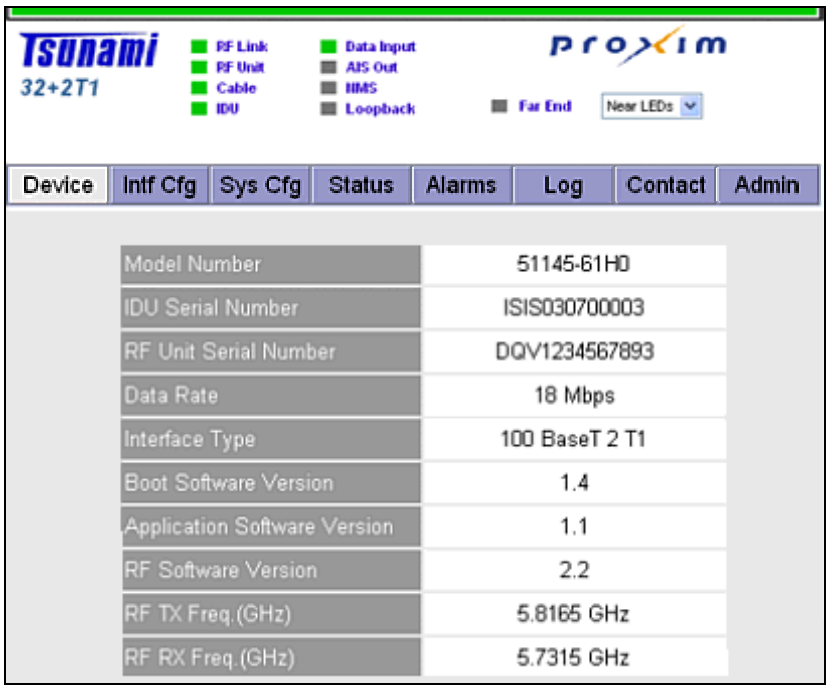
Note: EIRP shall never exceed 54.5 dBm. This is for the compliance to the CFR 47 Part 1.1310 for RF exposure.

Appendix B. Web Interface Windows and Field Descriptions

DEVICE TAB—ACCESSING RADIO INFORMATION

You can access radio information by clicking the **Device** tab. The Device tab is illustrated in the following figures, which provide information about a Tsunami.GX with wayside T1. A description of each field follows the figures.

Note: The Device window is the same for the Tsunami.GX 32 and 90 models, with the exception of the data rate field and the model and serial numbers. The Tsunami.GX 32 is pictured in this example.



Device Window Field Descriptions	
Model Number	The model number of the radio being managed.
IDU Serial Number	The IDU serial number of this system.
RF Unit Serial Number	The RF Unit serial number of the system being managed.
*Data Rate**	The aggregate wireless link data rate in Mbps for each direction. The value in this field differs for the separate models of the Tsunami.GX.
Interface Type	Type of interface (for example, 100 Base-T plus two wayside T1s).
Boot Software Version	Version number of the current boot software in the IDU.
Application Software Version	Version number of the application software for this radio in the IDU.
RF Software Version	Version number of the RF software of the system being managed.
RF TX Freq (GHz)	RF transmission frequency in GHz (center frequency).
RF RX Freq (GHz)	RF receive frequency in GHz (center frequency).

*This data rate includes Ethernet, T1/E1, orderwire, aux data, NMS, and overhead channels.

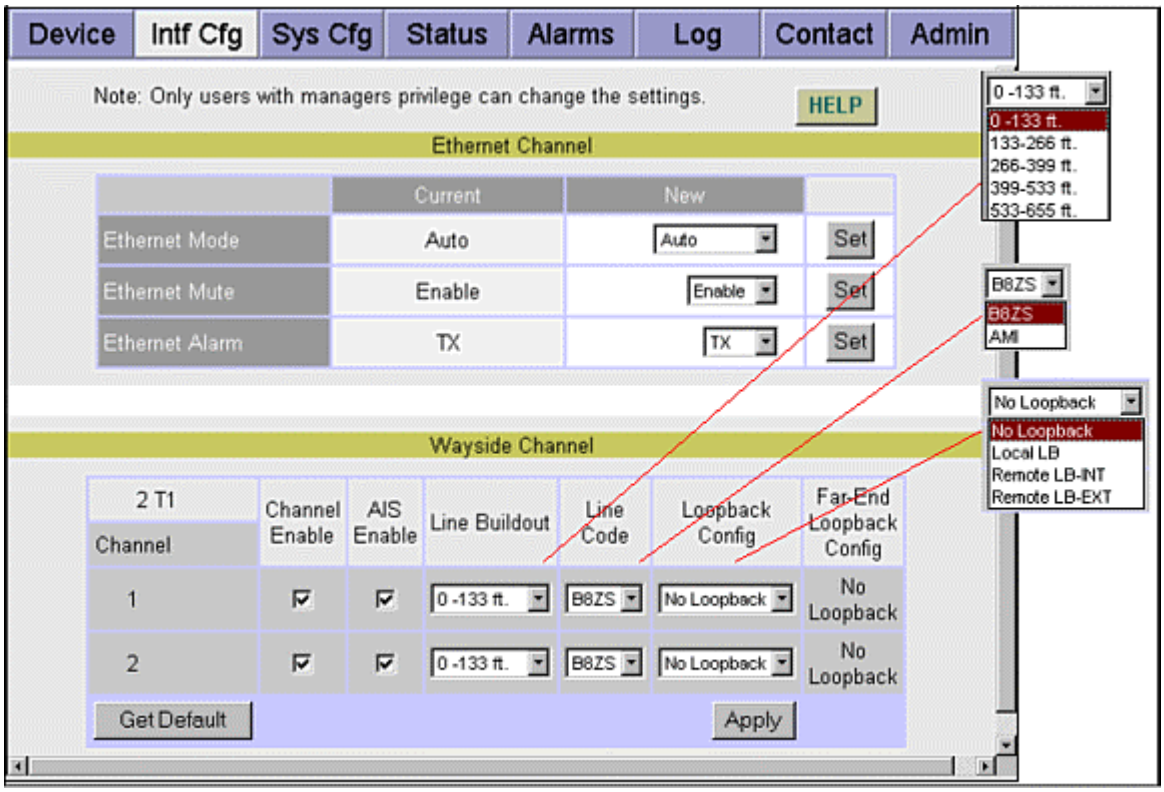
INTERFACE CONFIGURATION TAB—MODIFYING ETHERNET AND WAYSIDE INTERFACE CONFIGURATIONS

To modify the Ethernet, T1, or E1 channel interface configurations, click the **Intf Cfg** tab. An example of the **Intf Cfg** page is shown in the following figure. A description of each column in the **Intf Cfg** page follows the figures.

There are two separate sections. Each Ethernet option is set separately, while the Wayside configuration lets you make your changes all at once. Click the **Apply** button to implement and save your wayside changes. The **Get Defaults** button lets you see the default wayside settings. Click **Apply** to save the default settings.

After entering any wayside configuration changes, click on the **Apply** button. The **Default** button installs the default settings for all entries but does not apply them until the **Apply** button is clicked. Any changes outside the range of acceptable values is identified for the user (with a "Failed to change configuration(s)" message) and the changes fail to apply.

Note: The **Wayside Channel Enable** must be set the same on both radios of a hop for Ethernet and Wayside channels to pass data.



Intf Cfg Window Field Descriptions	
ETHERNET CHANNEL	
Ethernet Mode **Note:** Actual data throughput may be less than the speed setting of the 100 BaseT Ethernet interface and is dependent upon the specific Tsunami.GX model	This variable controls the Ethernet mode. By setting this variable, you select an Ethernet mode operation and the speed setting for the 100 Base-T Ethernet interface. This setting must match the setting on the opposite equipment. The default value for this field is **auto**. **auto** indicates the Ethernet main channel is operating in auto negotiation mode. **full-100MB** indicates the Ethernet main channel is operating at 100 megabits per second with full duplex mode. **half-100MB** indicates the Ethernet main channel is operating at 100 megabits per second with half duplex mode. **full-10MB** indicates the Ethernet main channel is operating at 10 megabits per second with full duplex mode. **half-10MB** indicates the Ethernet main channel is operating at 10 megabits per second with half duplex mode.
Ethernet Mute	Setting this variable controls the Ethernet mute function for the 100 Base-T Ethernet interface. **enabled** causes the Ethernet main channel to be shut down when an RF link down is detected at the near end or the far end. **disabled** causes the Ethernet main channel to remain running regardless of the RF link status.
Ethernet Alarm	This field lets you select the Data Input alarm function for the Ethernet main channel and the optical channel for the 100 Base-T Ethernet interface. **both** selects both the TX and FX channel link status to be reported. **txOnly** selects the main channel link status to be reported. **fxOnly** selects the optical channel link status to be reported. **none** selects neither the main nor optical channel link status to be reported. The default value for this field is **both**.
Wayside Channel	
Channel	Identifies the T1/E1 interface number of the Proxim radio. The interface numbers start at 1 and increase sequentially to the maximum wayside interfaces supported by this radio.
Channel Enable	Indicates whether the channel is enabled.
AIS Enable	Indicates whether AIS is enabled. If the channel is disabled, then this also should be disabled.
Line Buildout	T1 interface line length setting for each channel. A drop-down menu provides selections from zero to 655 feet.
Line Code	AMI/B8ZS line code setting for each T1 interface.
Loopback Config	Activates or deactivates one of three loopback modes at the wayside input port. Only one loopback can be running from one port on each side of the link at a time. Setting a loopback while another loopback is running stops the previously running loopback and starts the recently set loopback. **Local LB:** Local radio line interface is in loopback to the line connector (does not test the wireless link). Data that enters the connector is looped back at the local connector. **Remote LB-int:** The far end or remote radio is set to loopback data so that the received signal is sent back to the originating local radio from the far-end radio's interface port. The radio uses an internally generated signal and external signals are ignored. This tests the entire wireless link for the selected input. **Remote LB-ext:** Similar to Remote LB-int, but an external signal is required locally. The externally injected signal passes through the entire radio link, is looped at the far end's interface port and is sent back across the link, returning to the input connector. Any channel set to loopback takes that channel out of service. The loopback LED on the front panel blinks yellow.
Far End Loopback Config	Displays the status of loopbacks initiated at the far end radio.

SYSTEM CONFIGURATION TAB—CONFIGURING TX POWER, SECURITY LINK ID, AND TX CHANNEL PLAN

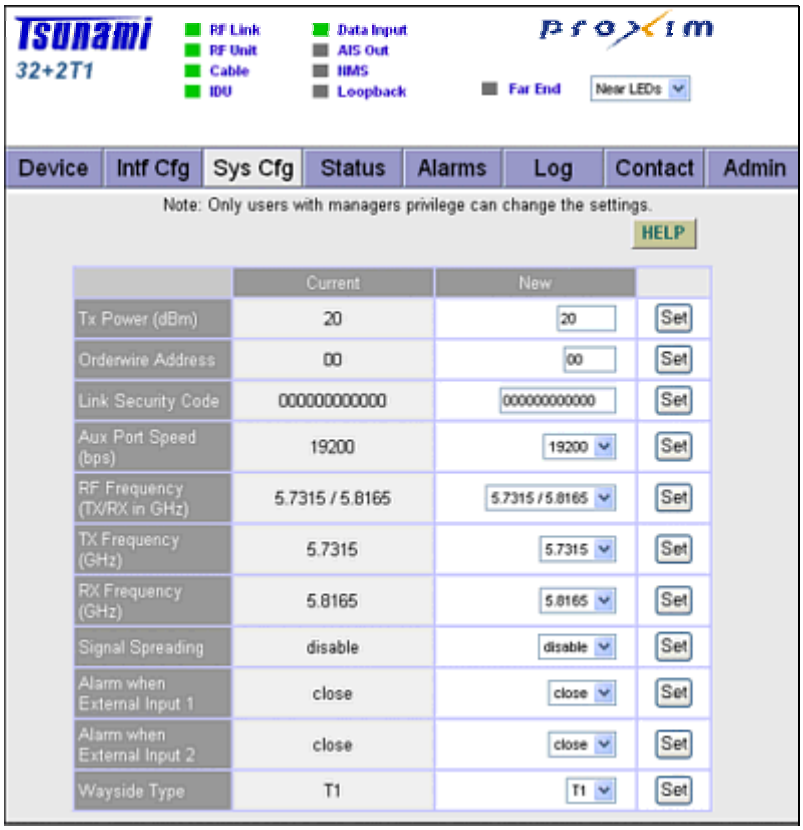
Select the **Sys Cfg** tab to configure transmitter power, orderwire, security, aux port speed, and RF frequency settings. Make one change at a time and click **Set**. The following figure depicts the Tsunami.GX 32 **Sys Cfg** window content. Note that the **Signal Spreading**, **TX Frequency**, and **RF Frequency** fields are available only with the Tsunami.GX 32.

For GX 32, you can select either 13.5 Mbps modulation (2 channels) or 18 Mbps modulation (3 channels) using the **Signal Spreading** parameter. Radios are pre-set with the 18 Mbps modulation (3-channel) option enabled.

Once you select a modulation, you can use either the **pre-configured non-overlapping channel plans** (the **RF Frequency** parameter) or the **variable channel plan option** (the **TX Frequency** and **RX Frequency** parameters)**.** The variable channel plan option lets you change the center frequencies of the transmit and receive channels independently (in 0.5 MHz increments) subject to constraints of RF diplexer and FCC rules.

Variable channel selection better allows you to find non-interfering channels, thereby leveraging all the capabilities of the GX platform, including the spectrum analyzer.

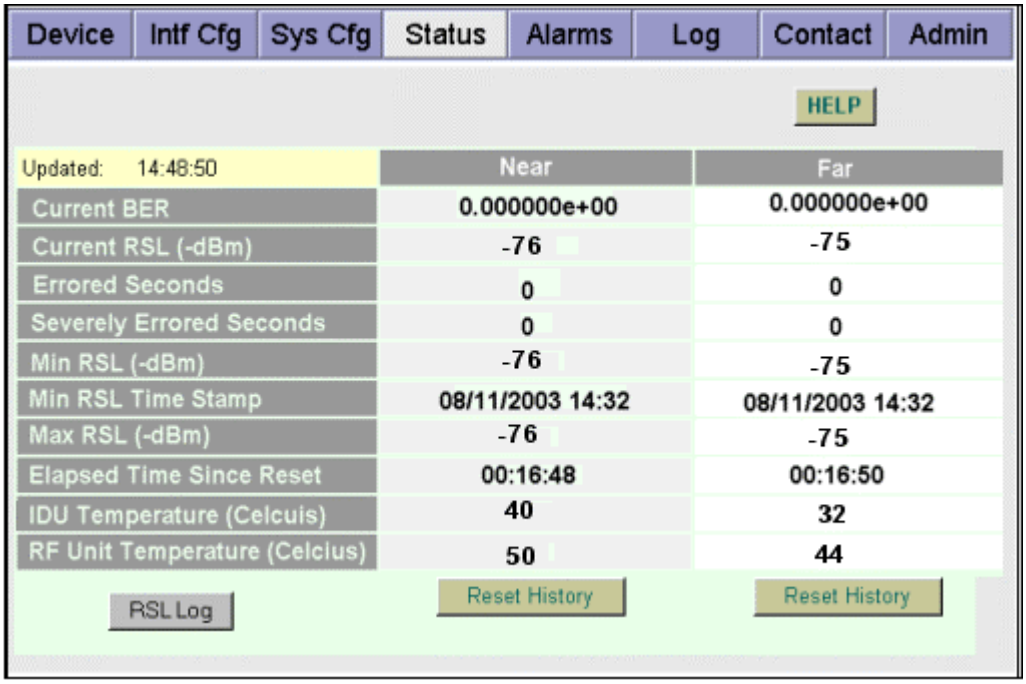
See the field descriptions following the figure for more information.



Sys Cfg Window Field Descriptions	
Tx Power (dBm)	Power setting range in dBm. Choose from +5 to +25 dBm for the Tsunami.GX 90 5.8 GHz or 32 or from –7 to +13 fro the Tsunami.GX 90 5.3 GHz in 1 dB steps.
Orderwire Address	The Orderwire telephone address. Choose any 2-digit number from 00 to 99.
Link Security Code	Security code set by the user; choose 12 characters using an alphanumeric combination of **0** to **9** and **a** to **f** (hexadecimal). This code must match the far end radio to establish the wireless link. Changing the code initiates a 60-second timer for the radio to check and verify the code; the RF link LED will flash red for 60 seconds after the LINK ID is matched. Provides 12^{16} possible codes (281 trillion). **Note**: All user data traffic is invalid until the link security code is matched and the LED stops flashing.
Aux Port Speed (bps)	Speed of the auxiliary port in bits per second, in the range of 2.4 kbps to 19.2 kbps. Must match far end radio.
TX Frequency (TX/RX in GHz) (GX 32 only)	All available variable transmit frequencies in GHz. This option is not shown when only the default channel frequency is available. You can select the transmit frequency in this field. Depending upon the model of the radio, the available choices are listed on the pull down menu. See *Technical Specifications* on page 72 for information specific to the individual radio models.
RX Frequency (in GHz)(GX 32, 20 only)	All available variable receive frequencies in GHz. This option is not shown when only the default channel frequency is available. You can select the receive frequency in this field. Depending upon the model of the radio, the available choices are listed on the pull down menu. See *Technical Specifications* on page 72 for information specific to the individual radio models.
Signal Spreading (GX 32 only)	The Tsunami.GX 32 can be configured to use 2 channels (with ISM signal spreading enabled) or 3 channels (with signal spreading disabled). With signal spreading enabled, the signal is spread to a wider bandwidth for transmission to improve interference rejection and range.
External Input Alarm 1 / 2	The external alarm inputs can be set to cause an alarm under an open or closed condition between the appropriate pins on the front panel interface. These fields let you set the state that is to activate the alarm for external input alarms 1 and 2. **Closed** is when the input is connected to GND. **Open** is when the input is not connected to GND.
Wayside/Channel Type	This selects whether the Wayside channels will be T1 or E1. After making a change, the radio will do a warm reset, and traffic will be interrupted for a few seconds.

STATUS TAB—VIEWING CURRENT STATUS

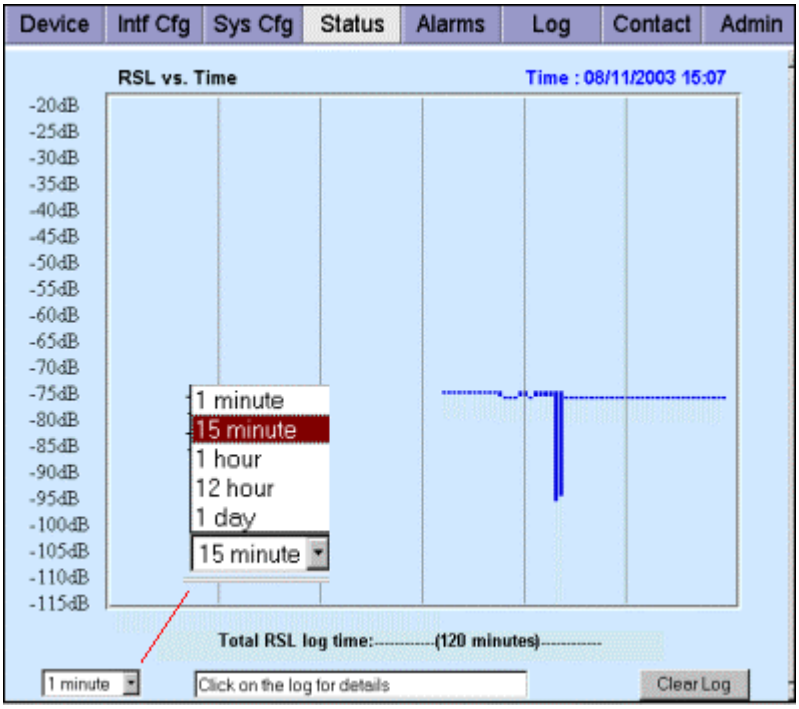
To view the current **Near** and **Far** status for the selected unit, click the **Status** tab. You can click the Near or Far **Reset History** buttons to clear all data for the corresponding radio, which is useful for resetting the time stamp, such as after installation. A description of each row follows the figure.



Status Window Field Descriptions	
Current BER	Current estimated received bit error rate (near side measures BER from the far end toward the near end).
Current RSL (~dBm)	Current estimated received signal level in dBm.
Errored Seconds	Number of seconds that incurred at least one bit error since the last reset.
Severely Errored Seconds	Number of seconds that incurred bit errors in excess of BER=10e-3 since the last reset.
Min RSL (~dBm)	Minimum estimated received signal level (in dBm) measured since the last reset.
Min RSL Time Stamp	The last time at which the minimum estimated RSL value was measured.
Max RSL (~dBm)	Maximum estimated received signal level (in dBm) measured since the last reset.
Elapsed Time Since Reset	The amount of time since the last system or history reset.
IDU Temperature (Celsius)	The current internal temperature of the IDU in Celsius.
RF Unit Temperature (Celsius)	The current internal temperature of the RF Unit in Celsius.

Viewing the RSL Log

A window such as the following is displayed when you click the **RSL Log** button from the Status window; this is a RSL log page at 1-minute intervals.



This feature is useful for tracking the RSL reading of the radio over time to view any degradation of performance, and to correlate any alarms recorded in the Alarm log. You can determine the frequency at which entries are displayed from the drop-down box at the bottom left of the window. To clear all log entries and start over, click on **Clear Log**.

The display consists of the latest 120 sample points, with the latest sample point at the far right and the earliest sample point moving to the left edge. Sample points older than the latest 120 samples drop off the left edge of the screen.

Each sample point displays the min and max values from the measurement interval as a vertical bar. This ensures that no extreme values are missed even if the same periods are very long.

The date, time, max RSL, and min RSL are displayed at the bottom of the page by clicking on the vertical bar on the graph. This function is only supported by Netscape 7.x and Internet Explorer 5.5 and later.

For each sample setting, the total time displayed varies but always consists of only the latest 120 sample points. For example, when **1 minute** is selected as the setting in the drop-down box at the bottom left side of the window, the window shows the last 120 minutes or 2 hours.

For periods of troubleshooting, the recommended setting is 15 minutes, which shows the last 30 hours, providing more than a full day's RSL readings to review.

Sample Rate	Total Time recorded	Application
1 minute	120 minutes or 2 hours	Highest resolution
15 minutes	30 hours	Best for 1 day
1 hour	120 hours	Best to view a workweek or long weekend
12 hours	60 days or 2 months	
1 day	120 days, 4 months, or forever	

ALARMS TAB—MONITORING LINK STATUS

Click the **Alarms** tab to monitor both near-end and far-end link alarm status. Field descriptions follow the figures. Note that the orientation of the alarms matches the position of the connectors on the front panel.

These alarms contain some more specific detail than the Front Panel display, and are helpful in determining possible problems. **Ethernet TX Link** and **Ethernet FX Link**, along with the input of each wayside channel, affect the Front Panel Data Input Alarm. How these alarms are displayed is a combination of the **Ethernet Alarm** and **Channel Enable** settings on the **Intf Cfg** page, and whether there is a valid link at the corresponding connector.

For the **Ethernet TX Link** and **Ethernet FX Link**, there are four states listed from lowest to highest Data Input Alarm priority:

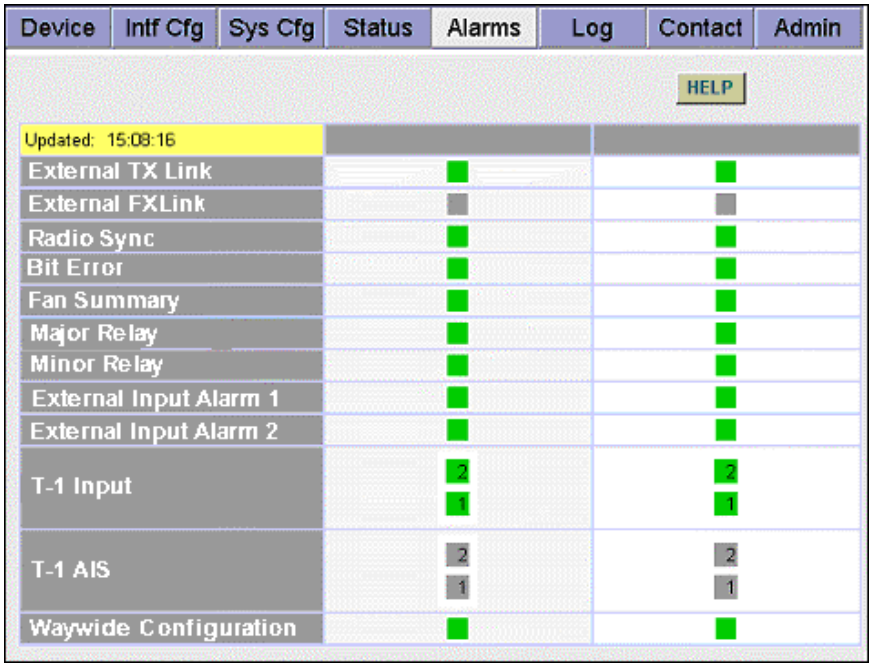
- A **gray** state shows that the input alarm is disabled for this connector and the link is down. This may show that it was decided to not monitor this connector because it will not be used.
- A **green** state shows that the input alarm is enabled for this connector and the link is up. It was decided to monitor this link, and this connection is functioning properly.
- A **yellow** state shows that the input alarm is disabled for this connector and the link is up. This may show that it was decided to not monitor this connector, but now due to any reason it is being used. Consider changing the Ethernet Alarm configuration on the **Intf Cfg** page.
- A **red** state shows that the input alarm is enabled for this connector and the link is down. This shows that it was decided to monitor this link, and a cable connection is not present or invalid.

If determining the **Ethernet TX Link Status** or **FX Link Status** when the RF Link is red, **Ethernet Mute** must be disabled on the **Intf Cfg** page.

For the **Wayside Input** there are three states listed from lowest to highest Data Input Alarm priority:

- A **gray** state shows that this channel is disabled and whether a link is present or not is not displayed. This shows that this channel will not be used, giving more bandwidth to the Ethernet.
- A **green** state shows that this channel is enabled and the link is up.
- A **red** state shows that this channel is enabled and the link is down.

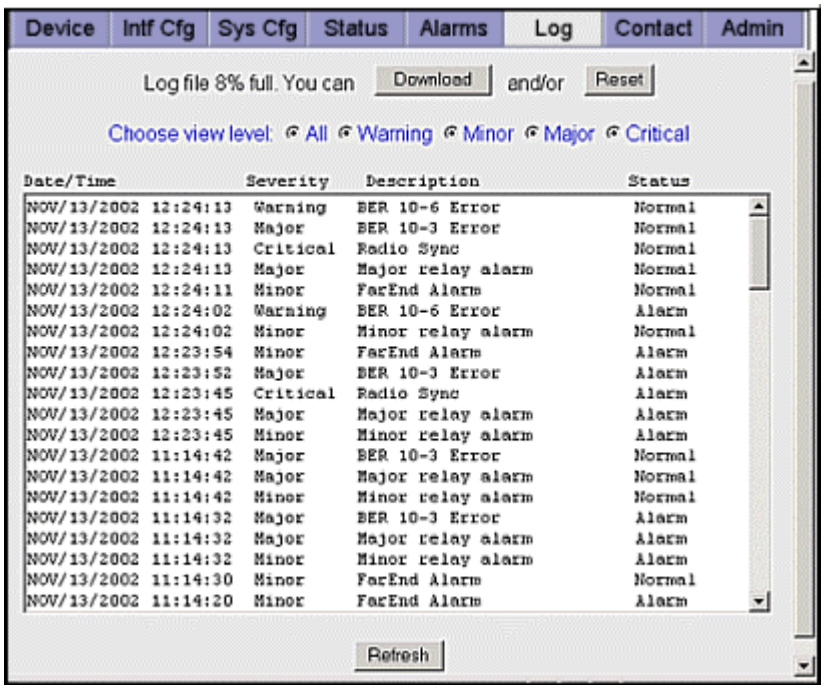
More field descriptions follow the figure.



Alarm Indicators				
	If Grey:	**If Green:**	**If Yellow:**	**If Red:**
External TX Link	Ethernet Alarm None or FX; TX link is down	Ethernet Alarm Both or TX; TX link is up	Ethernet Alarm None or FX; TX link is up	Ethernet Alarm Both or TX; TX link is down
External FX Link	Ethernet Alarm None or TX; FX link is down	Ethernet Alarm Both or FX; FX link is up	Ethernet Alarm None or TX; FX link is up	Ethernet Alarm Both or FX; FX link is down
Radio Sync	N/A	Radio link is synchronized.	N/A	Radio link is NOT established.
Bit Error	N/A	Error-free operation.	Bit Error Rate is between 10e-6 and 10e-3	Bit Error Rate is worse than 10e-3.
Fan Summary	N/A	Fans are operating correctly.	One or two fans are malfunctioning.	Two or three fans are malfunctioning.
Major Relay	N/A	No Major Alarm present	N/A	Major Alarm exists
Minor Relay	N/A	No Minor Alarm present	Minor Alarm exists	N/A
External Input Alarm 1	N/A	No External Alarm present	N/A	External Alarm exists
External Input Alarm 2	N/A	No External Alarm present	N/A	External Alarm exists
T1/E1 Input	Channel is disabled	Channel is enabled and input is present	N/A	Channel is enabled and input is not present
T1/E1 AIS	NOT injecting all 1s.	N/A	Injecting all 1s in data stream.	N/A
Wayside Configuration	When the wayside configuration on the far end is unknown	When the wayside configuration on each side matches	N/A	When the wayside configuration on each side does not match

LOG TAB—VIEWING STATUS AND ALARMS

You can view all or selected status and alarms for the radio when you click the **Log** tab. You can choose to view alarms of all levels or selected levels and greater. To update the information, click **Refresh** at the bottom of the page. Click **Reset** to clear the log.



Log Window Field Descriptions	
Date/Time	The date and time the status/alarm was reported.
Severity	The severity of the alarm.
Description	A description of the status/alarm.
Status	The alarm status (Normal or Alarm).

Only the most recent alarm log messages are displayed on this page. Download the log to view all log entries up to the last 20,000. You can download the log information to a location on your station's local directory by clicking the **Download** button and following the instructions displayed.

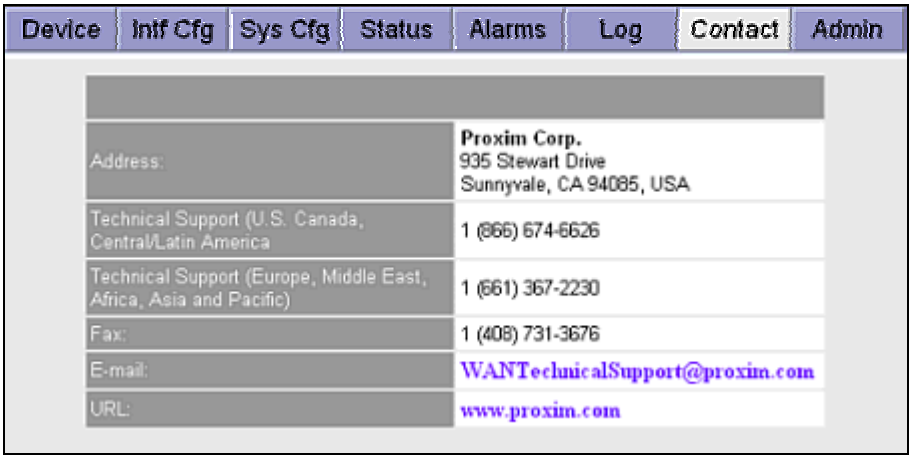
Select **Open in New Window** for a quick view of the downloaded file. Size the window to align the columns for better viewing.

The following table lists the possible alarms that are logged on this page. **Spectrum Analyzer on/off**, **System Reset**, **RF Unit Reset,** and **Log Reset** do not have a transition status. All others log the transition into alarm and out of alarm.

Severity	Message	Description for Alarm Status
CRITICAL	Radio Sync	The radio is not communicating to the far end.
MAJOR	Major relay alarm	The major relay is in alarm (a MAJOR alarm condition exists).
MAJOR	Link ID mismatch	The link security IDs do not match within the last minute.
MAJOR	BER 10-3 Error	The wireless link BER has exceeded 10^{-3}.
MAJOR	RF Unit Synth Error	The RF UNIT Synthesizer has failed.
MAJOR	RF Unit Cable	The RF Unit Cable has been shorted for more than 5 seconds within the last minute.
MAJOR	RF Unit Over Temp	RF Unit temperature has exceeded the maximum operating level.
MAJOR	RF Unit Low Power	The power supplied to the RF Unit is too low.
MAJOR	SysBoard Over Temp	IDU temperature has exceeded the maximum operating level
MAJOR	Ethernet TX Link Down	The TX port does not detect a link.
MAJOR	Ethernet FX Link Down	The FX (fiber) port does not detect a link.
MAJOR	Loopback Error	The internal loopback has measured at least one error.
MAJOR	T1/E1 Port X Input (X is between 1 and the maximum ports on the radio)	Port X has the Input Alarm enabled with no data present.
MAJOR	IDU IF Synthesizer alarm	The IDU IF Synthesizer has failed.
MINOR	Minor relay alarm	The minor relay is in alarm (a MINOR alarm condition exists).
MINOR	RF Unit Comm Error	The RF UNIT has lost communication with the IDU.
MINOR	SysBoard Fan Error	Two or Three IDU Fans have failed.
MINOR	FarEnd Alarm	There is a major alarm on the far end radio.
MINOR	Far End Link Down	The wireless link telemetry is down.
WARNING	BER 10-6 Error	The wireless link BER has exceeded 10^{-6}.
WARNING	SysBoard Fan Warning	The IDU Fan Warning status has changed.
WARNING	SysBoard Temp Warning	The IDU temperature has gone over the warning level.
WARNING	External Input Alarm 1	The External Contact Relay 1 is in the alarm state.
WARNING	External Input Alarm 2	The External Contact Relay 2 is in the alarm state.
NORMAL	System Reset	The radio has reset.
NORMAL	Log Reset	The log was reset from the web interface or SNMP.
NORMAL	Spectrum Analyzer on	The Spectrum Analyzer function has been started.
NORMAL	Spectrum Analyzer off	The Spectrum Analyzer function has been stopped.
NORMAL	RF Unit Reset	The RF Unit has reset.

CONTACT TAB—VIEWING SUPPORT INFORMATION

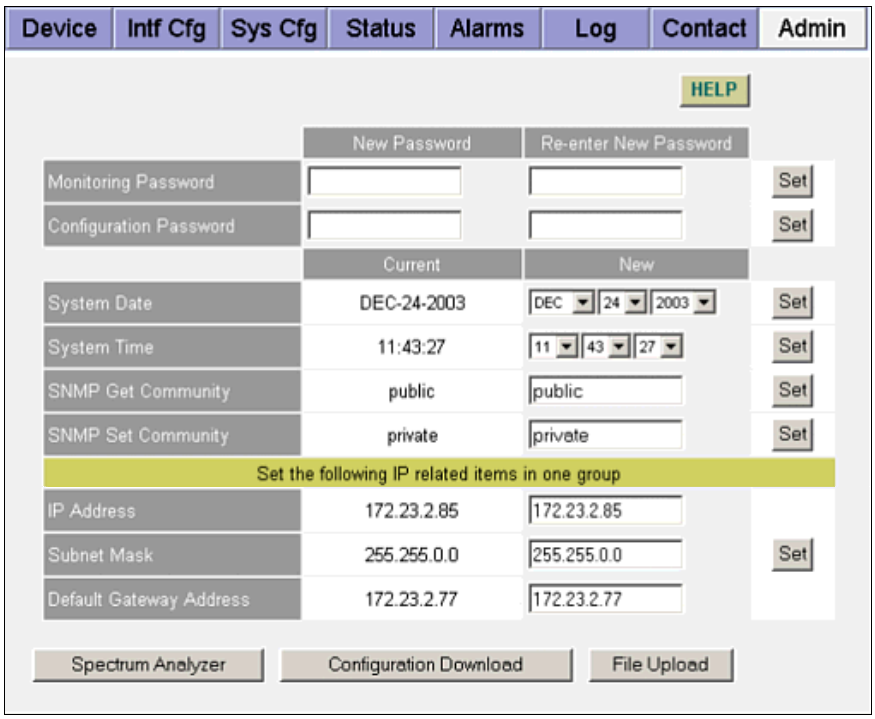
Click the **Contact** tab to view Proxim Support information (see “Support” on page 103). If you are connected to the Internet, you can click on the URL or on the Proxim logo to open Proxim’s Internet site, and you can click on the e-mail address to open an e-mail window addressed to Proxim Technical Support.



ADMINISTRATION TAB—CHANGING SYSTEM PASSWORDS, DATE, AND TIME

Click the **Admin** tab to change the system passwords, system date and time, SNMP community strings, and radio IP address information. Click the **Set** button once you configure each field, except for the three IP-related fields. For these, you can change all three, then press the single **Set** button next to them. Changing the IP settings causes the system to restart. You must close the browser and logon again with the new IP address. From this page, you also gain access to the **Spectrum Analyzer**, **Configuration Download**, **and File Upload** pages**.**

Change the default password (managers) for subsequent entry into the NMS browser. Click on **Set** after changing the password by entering it two times. If you forget the password, you must reset the IP address and passwords by holding in the FAR END button on the front of the radio while powering it up.



Admin Window Field Descriptions	
Monitoring Password	Enter the monitoring password (8 to 15 characters). This is the password for "operator" on the log-in page. To change the password, you must re-enter the password two times. The default is "operator."
Configuration Password	Enter the configuration password (8 to 15 characters). This is the password for "managers" on the log-in page. Access at this level is required to change settings on the **System Configuration** and **Interface Configuration** menus and make changes to the **Administration** page**.** To change the password, you must enter the password two times**.** The default is "managers."
System Date	Set the system date from the drop-down boxes.
System Time	Set the system time from the drop-down boxes.
SNMP Get Community	Enter the desired Get community string for the radio's SNMP network management agent. The default is "public".
SNMP Set Community	Enter the desired Set community string for the radio's SNMP network management agent. The default is "private".
IP Address	Enter a new IP address for the network management system. The default is 10.0.0.1
Subnet Mask	Enter a new subnet mask for the network management system. The default is 255.0.0.0
Default Gateway Address	Enter a new Gateway address for the network management system. The default is 0.0.0.0

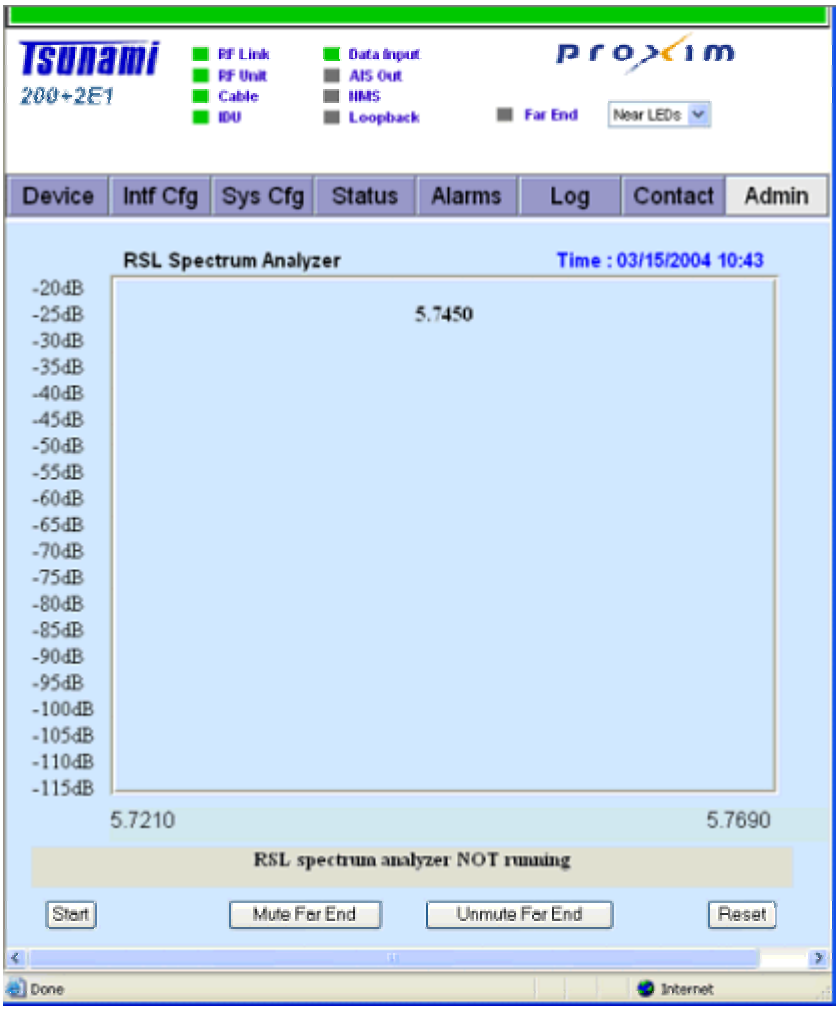
Checking Rx Sources with the Spectrum Analyzer

To enable the built-in Spectrum Analyzer, select the **Admin** tab and scroll to the bottom of the window.

This spectrum analyzer is a useful feature for checking for received signal sources that the radio is capable of receiving, and for determining whether these emitters could be a source of possible interference.

Click the **Spectrum Analyzer** button to display the spectrum Analyzer window. The frequency band displayed is what the RF unit is capable of receiving–the low-band half of the 5.8 GHz ISM band (or 5.3 GHz UNII band), or the upper half of the 5.8 GHz ISM band (or 5.3GHz UNII band), depending upon which version of the RFU is connected to the near-end radio. The lower half of the 5.8 GHz ISM band is illustrated in the following figure, as indicated by the frequency labels at the top center of the window.

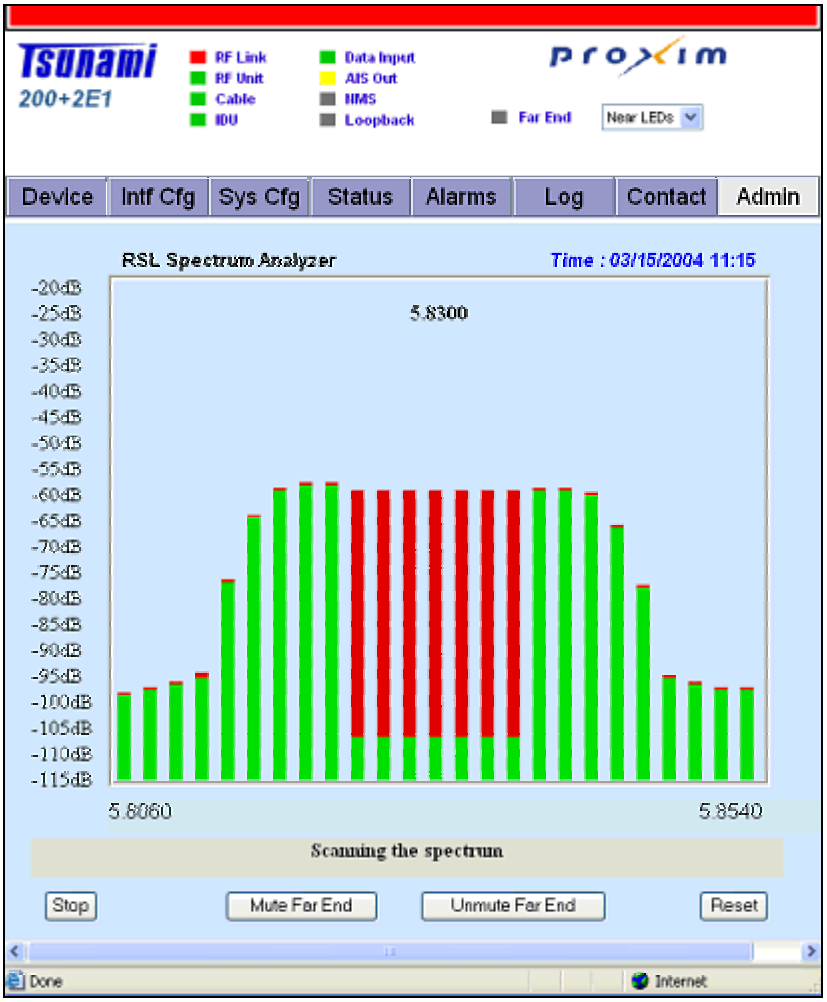
The current status of the Spectrum Analyzer is indicated on the bottom. When this menu is first turned on the analyzer is not running. To start the analyzer, click on the **Start** button.



The Spectrum Analyzer interrupts traffic on the near end because it is analyzing the spectrum. The far-end radio is still receiving from the near-end transmitter. Click **Start** to run the Spectrum Analyzer; it completes a scan within a few minutes and continues to display the data as it is processed.

On some radios, there are two additional buttons. **Mute Far End TX** tells the far end radio to stop transmitting. This function is useful for checking for interference from other sources. **Unmute Far End TX** tells the far end radio to begin transmitting again. These functions are successful only if the radio link is function, or was functional prior to running the Spectrum Analyzer. These functions may be used whether or not the Spectrum Analyzer is running.

A window such as the following is displayed. Note that the unit is in RED alarm.



There are 25 bars across the screen, representing 25 measured points spaced 2 MHZ apart from the left of the display (in this example, 5.721 GHz) to the right of the display (5.769 GHz). The height of the red bar indicates the highest level of the received signal at that frequency (the “max hold” or “highest read level”). The height of the green bar is the lowest level of the received signal at that frequency (the “current” level reading on the spectrum analyzer).

In this example, the far end transmitter of an RF unit was switched on, and the transmit emission mask is displayed. Normally, the far-end transmitter should be muted using the **Mute Far End TX** button or powered off so that any signals received by the spectrum analyzer can be viewed as potential interferers. The analyzer will continue to scan across the band from lower frequency (left side of the display) to higher frequency (right side of the display) until stopped by the operator.

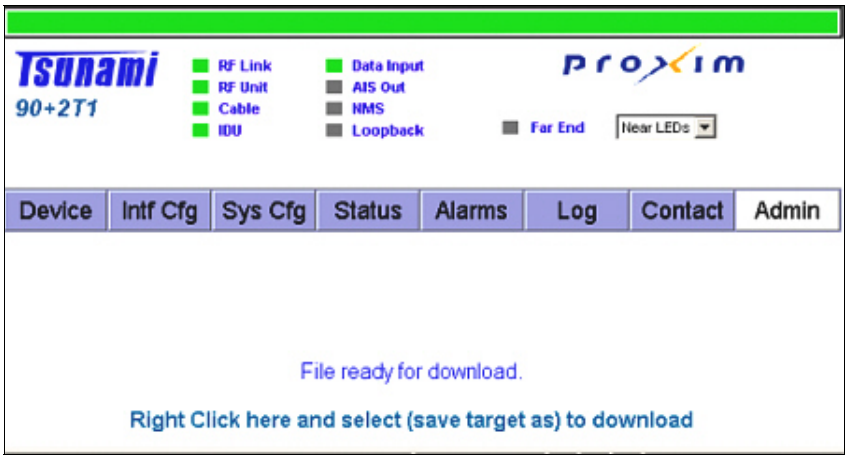
WARNING! Starting the Spectrum Analyzer is a service-disrupting activity.

In this example, the far end transmitter was muted about a third of the way through a scan; this is indicated by the start of the red bars. The height of the received signal dropped to the noise floor of the receiver, and then rose again when the transmitter was turned on again.

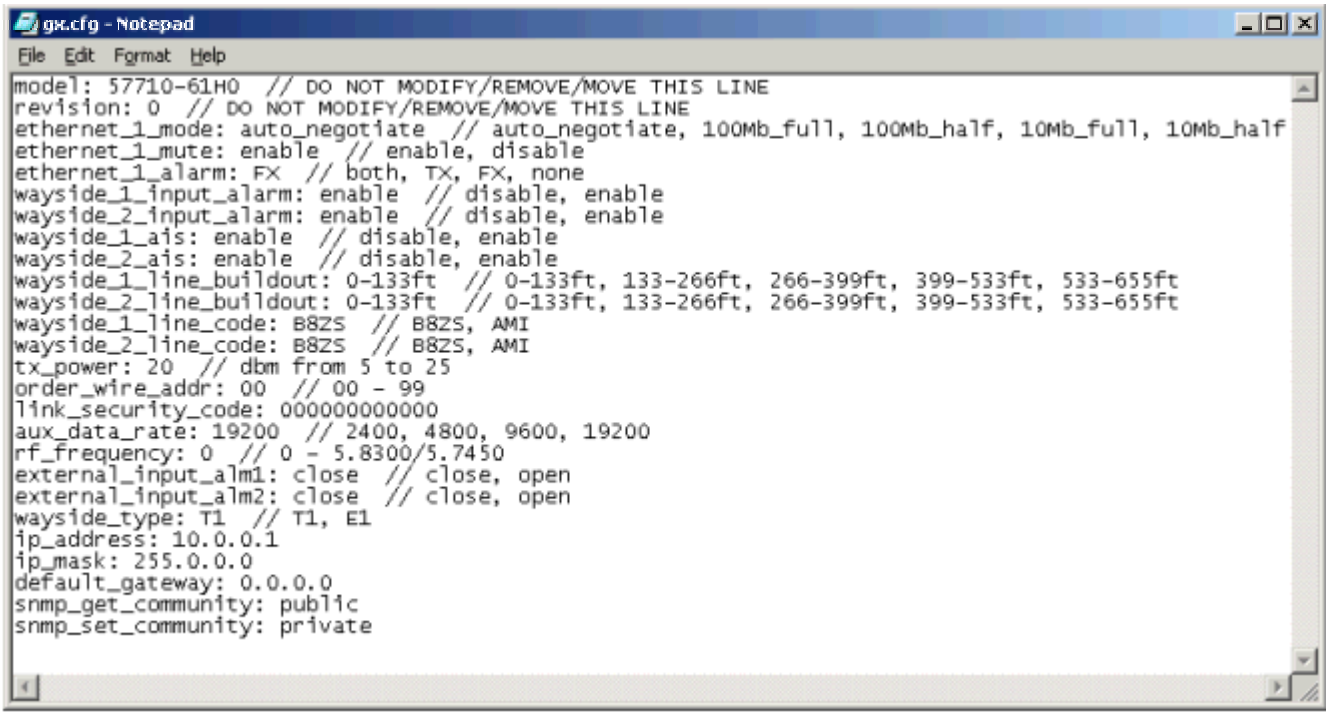
The Spectrum Analyzer runs until you click on **Stop.** If you leave the web page, the Spectrum Analyzer self-terminates after 10 minutes. To turn off the Spectrum Analyzer, click on **Stop**. Stopping the analyzer also clears the display. You also can begin a new graph by clicking **Reset**.

Using Configuration Download

The Configuration Download button at the bottom of the Admin page opens the Configuration Download page. This page allows downloading the current configuration of the radio for multiple GX radio configurations. This will save time when several GX radios require configuration.



On this page, simply right-click on “Right Click here and select (save target as) to download” and select **Save Target As…** from the menu. From the next dialog box, select a name and location for the file. The file is a text file and can be opened using any text editor.



This sample configuration file above is for a Tsunami.GX 90, Model 57710-61H0. The radio is in default mode. The model and revision at the beginning of the configuration file must match the GX radio model. Following those two lines, any or all of the above configurations are possible. If the configuration value is fixed, a list of possible values are listed after “//”. If invalid values are found in the file, they are ignored, and only valid values are accepted. Do not alter anything in the file except for the actual parameter to set, as the file may become unusable. The three IP parameters may be left out, or should be different for each radio in a specific IP network. To upload a file, see “Uploading Software” on page 42.

Appendix C. Tsunami.GX Front Panel and Connections

MODELS

This information in this appendix applies to the following Tsunami.GX models.

Model Number	Item Number	Ports	Frequency	Compliance
301-57750-51L0 301-57750-51H0	67255 67254	10/100 Base-TX, 100 Base-FX, plus 2 T1/E1 ports (90 Mbps)	5.3 GHz	UNII
301-57710-61L0 301-57710-61H0	67255 67254	10/100 Base-TX, 100 Base-FX, plus 2 T1/E1 ports (90 Mbps)	5.8 GHz	ISM
301-51145-61L0 301-51145-61H0	64765 64766	10/100 Base-TX, 100 Base-FX, plus 2 T1/E1 ports (32 Mbps)	5.8 GHz	ISM

BASIC SPECIFICATIONS

All Tsunami.GX models

Primary Interface Connectors..... 10/100 Base-TX RJ-45 female; Fiber SC Multimode
Wayside T1 Line Code/Channel..... AMI/B8ZS
Wayside T1 Line Buildout/Channel ..... 0–655 ft., selectable, for wayside

Tsunami.GX 90 5.8

Frequency Plans..... 1
Typical Output Power ..... ≥ 23.5 dBm
Aggregate* Capacity (Each Direction).... 54 Mbps

Tsunami.GX 90 5.3

Frequency Plans..... 1
Typical Output Power ..... ≥ 13 dBm
Aggregate* Capacity (Each Direction).... 54 Mbps

Tsunami.GX 32

Frequency Plans..... 2 or 3 non-overlapping; or 45/55 TX/RX Variable selections
Typical Output Power ..... ≥ 23.5 dBm
Aggregate* Capacity (Each Direction).... 18 Mbps

CHANNEL PLANS

	Tsunami.GX 32 3-channel*	Tsunami.GX 32 2-channel*	Tsunami.GX 90 5.8 GHz	Tsunami.GX 90 5.3 GHz
Frequency Channels (Tx) MHz	A1: 5731.5 B1: 5745.0 C1: 5758.5 A2: 5816.5 B2: 5830.0 C2: 5843.5	A1: 5734.0 B1: 5756.0 A2: 5819.0 B2: 5841.0	A1: 5745 A2: 5830	A1: 5274 A2: 5326

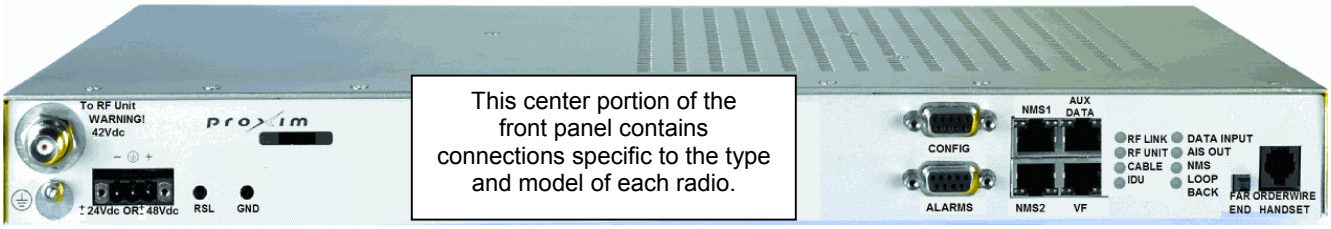
*Variable Channel Plans in .5 MHz increments available

TSUNAMI.GX FRONT PANEL

The IDU front panel can be thought of as having three distinct parts.

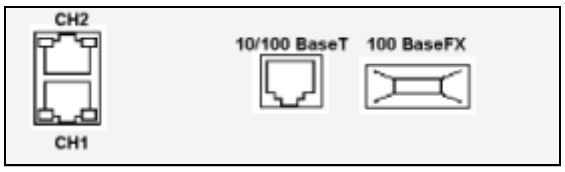
- The left portion of the IDU contains the connection for the RF Unit, the DC power connection, and the RSL and GND test points.
- The middle portion of the IDU contains connectors specific to the Tsunami.GX model.
- The right portion contains LEDs, CONFIG, ALARMS, and ORDERWIRE connections, and a FAR END push button switch.

The following figure illustrates the left and right portions of the IDU front panel, which are the same for all Tsunami.GX models.



10/100 Base-T and 100 Base-FX Ethernet Connections

The Tsunami Bridges use **10/100 Base-TX** RJ-48 modular port connectors and **100 Base-FX** SC connectors for the Fast Ethernet interface. They carry the signals in and out of the radio.



FRONT PANEL COMMON CONNECTORS, INDICATORS AND CONTROLS

To RFU

This is an RF TNC female connector. This connector is used to connect the IDU to the RFU. The center conductor contains DC voltage as well as IF and telemetry signals.

WARNING!

The voltage on this connector is ~+ 42 VDC. Be careful not to short this conductor pin to the body of the connector when installing the cable to the unit if DC power has been turned on or applied.

Do not under any circumstances connect RF test equipment to this connector as the test equipment will be damaged instantly by this DC voltage.

± 24 VDC OR ±48 VDC

The power receptacle recommendation for positive or negative DC power is 24 or 48. However, it accepts any voltage between 20 and 63 Volts. Optionally, you can use an AC-to-DC power adapter. For additional information, see “Power Connections” on page 24.

RSL / GND

These are the radio’s two front panel test points. Connecting a voltmeter across the GND and RSL front panel test points, the voltage reading corresponds to the Received Signal Level (RSL) of the near-end radio. For example, a value of .65V corresponds to –65 dBm (-10mV per dBm). Pressing and holding the FAR END button while measuring the voltage at these test points displays the RSL of the far-end radio.

CONFIG

This is a serial interface port (RS-232) to the radio using a Female DB-9 connector. This port provides connection to a computer or terminal using a standard null-modem cable for retrieving diagnostic information, and allows IP and SNMP Community String configuration for the radio. The settings for this port are 9600 bps, 8 data bits, No Parity, 1 Stop Bit, and No Flow Control. The terminal emulation is VT100. See "Connectors and Pin Assignments" on page 47 for CONFIG port connector information.

ALARMS

This connector provides alarms for external alarm collection systems using a female DB-9 connector. There are two Form C relays that can be connected to other transmission equipment for monitoring alarm status locally or remotely. One alarm represents Major alarms (usually alarm conditions) and the other Minor alarms (usually warning conditions). Major Alarms correspond to red LEDs on the front panel. Minor alarms correspond to yellow LEDs on the front panel (AIS Out does not affect the Minor Relay Alarm). See "Front Panel LED Descriptions" below for specific LED descriptions.

There are two external input alarms, independent of the relay outputs, available from the SysCfg page, you can set whether an open or closed condition produces an alarm.

See the table of alarms in "Log Tab: Viewing Status and Alarms" on page 66 .

See "Connectors and Pin Assignments" on page 47 for ALARM port connector information.

NMS1 and NMS2

There are two Ethernet 10/100 Base-TX connections (both switched) for access to the Network Management System (NMS) using SNMP, HTTP, or Telnet. Both of these connections auto-negotiate speed and duplex, and auto-sense MDI or MDI-X connections. On GX radios, the two 10/100BT ports are identical, and can be used to daisy chain the NMS connections between units at a hub location or to connect to other local Ethernet devices. See "Providing a Contiguous Management Link" on page 33.

AUX DATA

This is a serial interface port (RS-232) using an RJ-45 connector, supporting speeds from 2400 to 19200 baud (set through the NMS). This allows auxiliary serial data connection from one end of the wireless link to the other, completely separate and independent of the main bearer channel. It can be used for separate data connections for serial devices. See "Connectors and Pin Assignments" on page 47 for AUX DATA port connector information. Note that the aux data rate must be configured using the Web interface before use.

VF (Voice Frequency)

This RJ-45 connector is used to link two radios at a repeater site for Orderwire operation or to connect to an external Orderwire system. This allows Orderwire calls to and from any point in the network that is connected. The circuit is a 4-wire audio (2xTX and 2xRX) configuration. All phones off-hook hear and participate in the call (behave as a 'party line'). The NMS provides Orderwire addressing capability for individual radio terminal signaling. See "Connectors and Pin Assignments" on page 47 for VF port connector information.

FAR END

When the LED on this button is red, alarms exist on the far-end radio. Press and hold the button to view those alarms on this radio's front panel. If the far-end radio is not available, such as when the link is down, all LEDs flash red.

Note: Pressing and holding this button while powering on the radio resets the IP address settings and passwords to default values.

ORDERWIRE Port

This connection is used to access the electronic orderwire function (a facility for telephone style service from one radio to another). A standard analog telephone (with an electronic ringer) plugs into this RJ-11 connector. You can dial the orderwire address of the far-end radio (or any radio in the network) to cause that radio and any connected orderwire phone to ring; however, communications is automatically established when both telephones are lifted off hook.

This communication does not interrupt or interfere with the other radio communications. The radio link must be operational to use this facility. The orderwire feature can be very useful for installation, maintenance, and troubleshooting.

Note: All radios connected to the same orderwire network should have unique address settings (telephone numbers) to facilitate proper signaling.

Front Panel LED Descriptions

Front Panel LEDs		
LED	**Color**	**Description**
RF Link	Green Yellow Red Flashing Red	BER<10^-6 Bit errors occurring (when 10^-6 ≤ BER ≤ 10^-3) Excessive bit errors or radio link failure (BER ≥ 10^-3 or sync loss) Link Security ID mismatch within the last minute
RF Unit	Green Red	RF UNIT OK RF UNIT alarm (Over-temp (>95°C), IDU to RFU communication failure, DC power loss, or RFU detected hardware failure.)
Cable	Green Red	Cable between system board and RF UNIT is OK Cable short longer than 5 seconds detected in the last minute
IDU	Green Yellow Red	IDU OK IDU warning (warning condition in IDU (over-temp or a fan failed) IDU alarm (all fans failed or over-temp (>65°C)
DATA INPUT (listed by priority)	Red Yellow Green Off	Input Alarm enabled; data not present on at least one enabled channel Input Alarm disabled; data present on at least one channel Input Alarm enabled; data present on all enabled channels Input Alarm disabled; data not present on any channels
AIS OUT	Off Yellow	Not injecting AIS (Alarm Indication Signal, or all ones) in data stream Injecting AIS in data stream
NMS	Green Off	Tx or Rx NMS data present on the interface No NMS interface connection detected or no data present
LOOPBACK	Flashing Yellow Solid Yellow Off	At least one data channel in loopback Internal loopback is on and has detected at least one error No loopbacks on any channels

Rear Panel LED

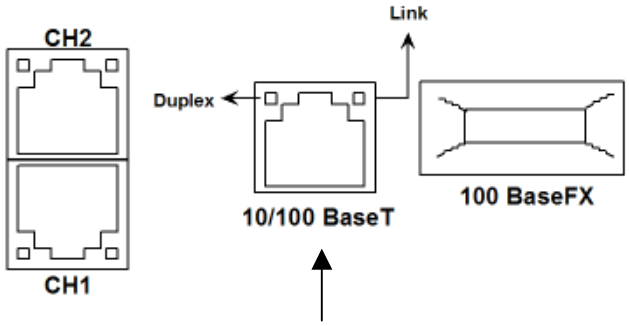
The rear panel of the IDU has a single LED that reflects the summary state of the radio, exactly copying the status bar on the Web browser interface (see “Front Panel LEDs” on page 75). The LED is red when any alarm is active or the front panel LED is red, yellow when any front panel LED is yellow and none are red, and green if all front panel LEDs are green or off.

Appendix D. Connectors and Pin Assignments

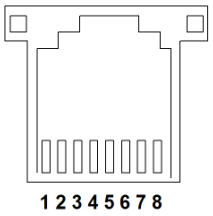
This section describes the radio port connectors and pin assignments for the IDU (Indoor Unit) and RFU (Radio Frequency Unit).

IDU ETHERNET 10/100 BASE-TX PORT CONNECTOR

The front panel 10/100 Base-TX Port connector supports 10/100 Base-TX Ethernet serial data using one 8-pin modular jack connector. This port allows Ethernet data to be passed across the hop.



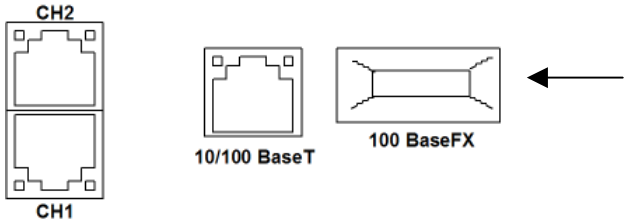
Shown below is the wiring for this plug per USOC 568B. The right LED on this connector will illuminate to indicate that the Ethernet connection is on, and the left LED indicates green for full duplex and off for half duplex (this LED will flash green to indicate collisions in half duplex mode).



10/100 Base-TX Port Connector Pin Assignment Description		
Pin	**Description**	**Signal Direction**
1	TX Data Out +	Output
2	TX Data Out -	Output
3	TX Data In +	Input
4	* (connected to cross-talk suppression circuits)	
5	*	
6	TX Data In -	Input
7	*	
8	*	

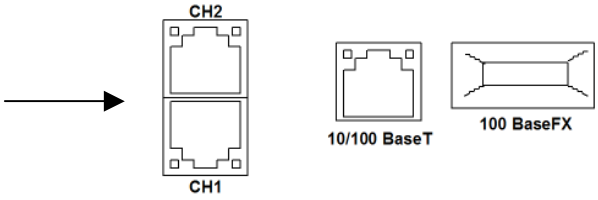
IDU ETHERNET FX PORT CONNECTOR

The front panel 100 Base-FX Port connector supports 100 Base-FX Ethernet serial data using one SC fiber jack multimode connector. This port allows Ethernet data to be passed across the link, and is fixed at 100 Mbps Full Duplex.

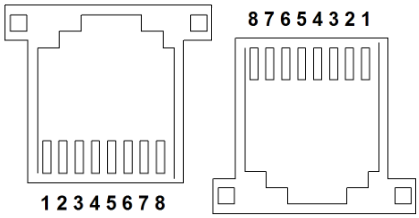


IDU WAYSIDE TRAFFIC T1/E1 CONNECTORS

The main traffic ports for T1 or E1 connections appear on the front panel as multiple 8-pin modular jack connectors wired per RJ-48C. The following figures show the actual format and layout of the T1/E1 connectors, an illustration of the traffic port pin assignment, and a table listing the pin assignment descriptions.



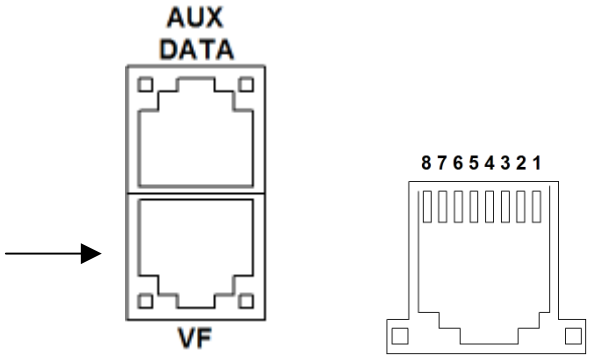
Each connector has a green LED on the right side of the connector that illuminates when a T1 or E1 signal is received at that port. The left LED is not used. The upper row has the connector tab in the up position, whereas the lower row has the connector tab on the bottom position.



T1/E1 Plug Connector Pin Assignment Description					
Pin	**Description**	**Signal**	**Pin**	**Description**	**Signal**
1	T1/E1 OUT-tip: Line transmit out (tip)	Output	5	T1/E1 IN-ring: Line receive in (ring)	Input
2	T1/E1 OUT-ring: Line transmit out (ring)	Output	6	GND: Chassis Ground	
3	GND: Chassis Ground		7	NC: No Connection	
4	T1/E1 IN-tip: Line receive in (tip)	Input	8	NC: No Connection	

IDU VF PORT

The front panel VF (Voice Frequency) port supports standard audio interfaces (600 Ohm balanced, 0 dBm maximum level) on an 8- pin modular jack as shown below. This port can be connected to an external orderwire unit, and is bridged to the Orderwire RJ-11 connector. The green LEDs on the VF port have no function. The front view is illustrated.

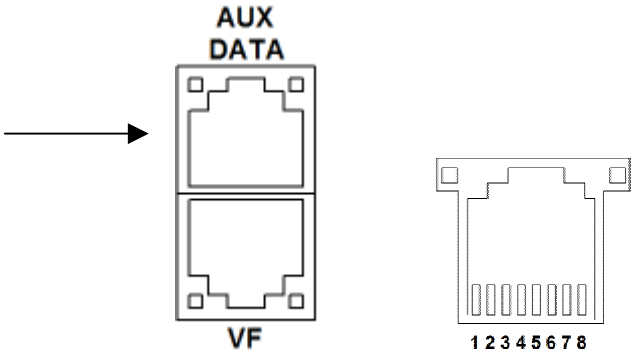


VF Plug Connector Pin Assignment Description		
Pin	**Description**	**Signal Direction**
1	NC: No Connection	
2	VF OUT-tip: Audio Output (tip)	Output
3	VF OUT-ring: Audio Output (ring)	Output
4	NC: No Connection	
5	NC: No Connection	
6	VF IN-ring: Audio Input (ring)	Input
7	VF IN-tip: Audio Input (tip)	Input
8	NC: No Connection	

IDU AUX DATA PORT CONNECTOR (DCE PORT)

The front panel Aux (Auxiliary) Data Port supports EIA-561 (electrical wiring standard) serial data on an 8-pin modular jack as shown below. The data rate is user selectable to 2400, 4800, 9600, or 19,200 bps. The asynchronous data is configured for 1 start bit, 8 data bits, no parity, and 1 stop bit. The green LEDs on the Aux Data port have no function. The front view is illustrated.

Note: Pins 2 and 7 are not used on the AUX DATA port of the radio. The user may connect a digital signal to these pins; however, operation of this data port is not affected.



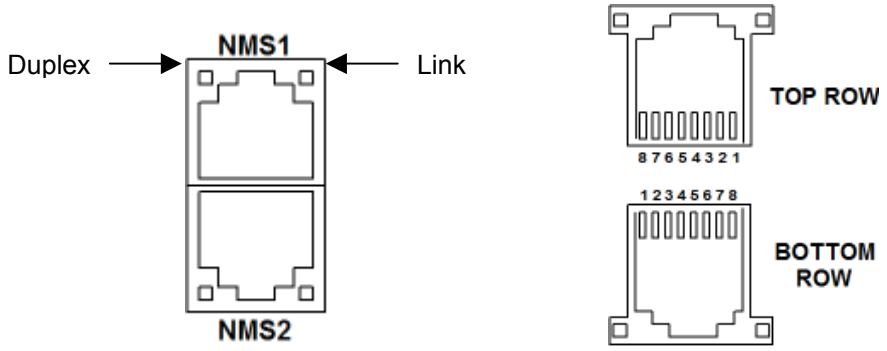
Aux Data Plug Connector Pin Assignment Description		
Pin	**Description**	**Signal Direction**
1	NC: No Connection	
2	+3.3 V (Data Set Ready)	
3	+3.3 V (DTE)	
4	Common Signal/Chassis Ground	Gnd
5	Aux Data Out	Output
6	Aux Data In	Input
7	+3.3 V (Clear To Send)	
8	+3.3 V (RTS)	

IDU NMS PORT CONNECTORS

The two front panel NMS (Network Management System) Port connectors (NMS1 and NMS2) support 10/100BaseT Ethernet serial data using two 8-pin modular jack connectors. Shown below is the wiring for each connector per USOC 568B. Two jacks permit bridging to other Ethernet devices without the need for an additional Ethernet hub or switch.

- The right LED (Link) on each connector illuminates to indicate that the NMS connection is on.
- The left LED (Duplex) indicates green for full duplex and off for half duplex (the LED flashes green to indicate collisions in half duplex mode).

The front view is illustrated. These ports auto-sense MDI or MDI-X. The Pin Assignments below show both MDI and MDI-X.



NMS Plug Connector Pin Assignment Description		
Pin	**Description** (MDI, *MDI-X*)	**Signal Direction** (MDI, *MDI-X*)
1	NMS Data Out +, *NMS Data In +*	Output, *Input*
2	NMS Data Out -, *NMS Data In -*	Output, *Input*
3	NMS Data In +, *NMS Data Out +*	Input, *Output*
4	* (connected to cross-talk suppression circuits)	
5	*	
6	NMS Data In -, *NMS Data Out -*	Input, *Output*
7	*	
8	*	

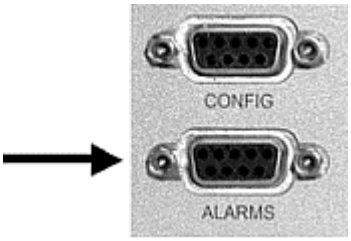
IDU ALARM PORT CONNECTOR

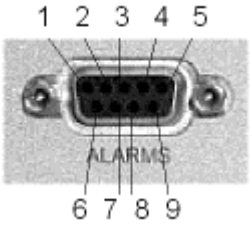
External alarm outputs are provided using the 9-pin, D-type (DB-9) ALARM female connector. Two Form C alarm relays capable of switching 30 VDC at 1A are provided. Both relays are energized in the normal state and de-energized in the alarm state. The two relay alarms are:

- The Major alarm is activated by any red alarm. This is also indicated by the “bar” alarm indicator on the GUI.
- The Minor alarm is activated by any yellow alarm except AIS OUT.

Two external relay inputs are available and can be set on the **SysCfg** page. By default, shorting the alarm pin to ground (close condition) causes the external alarm to display on the web page or in SNMP. This can be changed on the **SysCfg** page to make the open condition cause the alarm.

Note: All alarms are active for a minimum of one second, or as long as the alarm condition persists, which ever is longer duration.

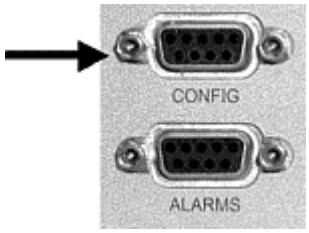


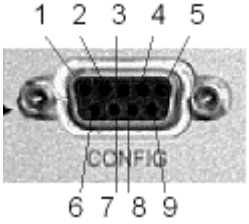


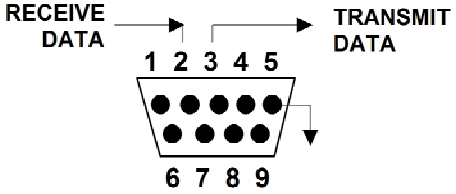
Alarm Plug Connector Pin Assignment Description – Front View	
Pin	**Description**
1	NO, Minor Alarm, Form C: normally open connection. Closed when in alarm.
2	NC, Minor Alarm, Form C: normally closed connection. Open when in alarm
3	COMMON CHASSIS/SIGNAL GROUND.
4	NO, Major Alarm, Form C: normally open connection. Closed when in alarm.
5	NC, Major Alarm, Form C: normally closed connection. Open when in alarm.
6	Common, Minor Alarm, Form C: common connection on the minor alarm relay.
7	External Input Alarm 1 (used with NMS alarm and SNMP only)
8	External Input Alarm 2 (used with NMS alarm and SNMP only)
9	Common, Major Alarm, Form C: common connection for the major alarm relay.

IDU CONFIGURATION PORT CONNECTOR (DTE PORT)

Configuration (CONFIG) port connections to modems, computers, or terminals, as well as auxiliary data connections, are made using a 9-pin, D-type, female connector, compliant to EIA-574 wiring. The CONFIG port is configured as a DTE (Data Terminal Equipment) so a null modem cable (pin 2 is connected to pin 3) is required when connecting to a DTE such as a standard PC Serial COM port.



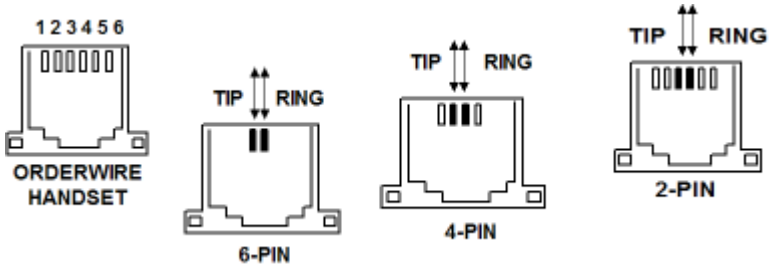




Configuration Plug Connector Pin Assignment Description – Front View		
Pin	**Description**	**Signal Direction**
1	+3.3V (Data Carrier Detect)	Unused
2	Serial Data Input (Receive Data)	Input
3	Serial Data Output (Transmit Data)	Output
4	+3.3V (Data Terminal Ready)	Unused
5	Common Signal/Chassis Ground	GND
6	+3.3V (Data Set Ready)	Unused
7	+3.3V (Request To Send)	Unused
8	+3.3V (Clear To Send)	Unused
9	NC: No Connection (Ring Indicator)	Unused

IDU ORDERWIRE PORT CONNECTOR

The IDU front panel Orderwire telephone port supports connection to standard electronic ringer telephones on a 6-pin RJ-11 modular jack as shown below. The center two pins (pins 3 and 4) are used for the Tip and Ring. Telephones with RJ-11 modular plugs can be 6-, 4-, or 2-pin modular plugs. The center two pins are used on the phone regardless of the number of pins on the modular plug



Note: If you are using a standard telephone (for orderwire function) not provided by Proxim with this product, ensure that the telephone has a ringing equivalency specification of 1.0 Baud and is a UL-Listed (ITE) device that has been evaluated to the Standard for the Safety of Information Technology Equipment, including Electrical Business Equipment.

IDU/RFU CABLE CONNECTOR AND PIN ASSIGNMENT

The IDU (Indoor Unit) is connected to the RF Unit using a 50-Ohm coaxial cable terminated with male TNC (Threaded Neill Concelman) connectors on each end. The female TNC connector provides termination for this coaxial cable on both the IDU front panel and RFU enclosures. The single coaxial cable carries power, telemetry, receive IF signals, and transmit IF signals between the IDU and the RFU.

TNC Port Connector Pin Assignment Description	
Pin	**Description**
Center	+ 42 VDC, 125 kHz Telemetry, 140 MHz Receiver IF, 748 MHz Transmitter IF
Outer	Common Signal/Chassis Ground

RSL AND GND CONNECTORS ON IDU

The RSL (Received Signal Level) and GND (Ground) front panel test points are both single connection female test points that permit insertion of a 0.062" test probe pin from a VOM (Volt Ohm Meter). The test point is located on the IDU just below the "Proxim" logo and the radio type on the unit.

RSL and GND Connector Pin Assignment Description		
Pin	**Description**	**Signal Direction**
RSL	Received Signal Level (voltage), where Voltage = -10mV per RSL (dBm) Example: +0.5 volts indicates a -50 dBm received signal level. Range from 0.9 to 0.1 Volts	Output
GND	Common Signal/Chassis Ground	

RFU/ANTENNA CONNECTOR AND PIN ASSIGNMENT

The RFU (RF Unit) is connected to the antenna using a 50 Ohm coaxial cable terminated with male Type N (Neill) connectors on each end. The female Type N connector provides termination for this coaxial cable on the RFU enclosure and antenna assembly. The following figure illustrates the RFU Antenna port Type N connector.

Female

Male

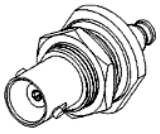
TNC Port Connector Pin Assignment Description	
Pin	**Description**
Center	Transmitter and Receiver RF
Outer	Common Signal/Chassis Ground

RFU RSL/TONE AND PIN ASSIGNMENT

The RFU (RF Unit) is provided with a BNC (Bayonet Neill Concelman) connector that provides a dual function for assisting in antenna installation and alignment:

- Provide a high impedance drive DC voltage level corresponding with the RSL (Received Signal Strength). A standard DVM (Digital Volt Meter) is used for this purpose.
- Provide a low impedance drive AC voltage tone that indicates the RSL. This tone is monitored using a 40 Ohm headset. A higher pitch tone indicates a stronger signal.

The following figure illustrates the BNC connector.



Female Panel

Male to DVM or Headphone

BNC Port Connector Pin Assignment Description	
Pin	**Description**
Center	DVM mode: Lower voltages for higher strength signals: Received Signal Level: RSL (dBm) = -10mV per RSL Earphone mode: Higher pitch tones for higher strength signals: BNC Audio: Tone Frequency (Hz) = 460800/(-2 * RSL (dBm) +76) Examples: -70 dBm: 2133 Hz, -50 dBm: 2618 Hz, -30 dBm: 3388 Hz Examples: -70 dBm; 0.7 V -50 dBm; 0.5 V -30 dBm: 0.3 V
Outer	Common Signal/Chassis Ground

Appendix E. Spares and Accessories

The following optional spares and accessories are available for purchase for your Tsunami.GX radio.

Item #	Model #	Product Description	Contents
68661	301-52053-H	GX RF UNIT SPARE 5.3 GHz UNII HIGH	A single GX RFU 5.8 GHz ISM high with no accessories
68662	301-52053-L	GX RF UNIT SPARE 5.3 GHz UNII LOW	A single GX RFU 5.8 GHz ISM low with no accessories
67265	301-52000-H	GX RF UNIT SPARE 5.8 GHz ISM HIGH	A single GX RFU 5.8 GHz ISM high with no accessories
67264	301-52000-L	GX RF UNIT SPARE 5.8 GHz ISM LOW	A single GX RFU 5.8 GHz ISM low with no accessories
67272	301-57710-61	GX 90 IDU SPARE TSUNAMI.GX 90 +2T1/2E1	A single Tsunami.GX 90 IDU with no accessories
67706	301-51145-61	GX 32 IDU SPARE TSUNAMI.GX 32 +2T1/2E1	A single Tsunami.GX 32 IDU with no accessories
67263	ACC-GX-3	GX IDU INSTALLATION KIT SPARE	Screws, brackets, and cable for rack installing (19” or 23”) a GX IDU
67262	ACC-GX-4	GX RF UNIT INDOOR INSTALLATION KIT SPARE	Screws, brackets, and cable for rack installing (19” or 23”) an RF unit
61688	ACC-GX-RF-2	GX RF UNIT OUTDOOR MOUNTING KIT	1 mounting bracket, screws, clamps, cable for RFU outdoor mounting.
62427	201-31075-1	AC POWER ADAPTER, 100/200 VAC, WITH CORD	1 AC-to-DC 110/220 VAC Power Adapter with DC cable
67446	ACC-GX5	GX BNC-TO-STD STEREO HEADPHONE CABLE	1 cable that converts BNC to a standard 6.3 mm stereo headphone jack for audio antenna alignment

Appendix F. Tsunami.GX Specifications

TSUNAMI.GX 90 (5.8 GHz) SPECIFICATIONS

PRODUCT INFO	
Model Numbers	301-57710-61L0, 301-57710-61H0
Item Numbers	67255. 67254
Digital Capacity (Each Direction)	54 Mbps
Usable Ethernet Capacity (no waysides enabled)	48 Mbps each direction (96 Mbps aggregate)
Usable Ethernet Capacity (both T1 waysides enabled)	45 Mbps each direction (90 Mbps aggregate)
Usable Ethernet Capacity (both E1 waysides enabled)	44 Mbps each direction (88 Mbps aggregate)
Frequency Band	5.8 GHz ISM
Max. packet size including CRC	1536 bytes
Frequency Channels (Tx)	A1: 5745 MHz A2: 5830 MHz
T/R Spacing	85 MHz
FCC ID	HZB-S58-GX1
FCC Rules	Part 15.247 ISM
Industry Canada	1856A-U5358GX1
SYSTEM AND TRANSCEIVER SPECS	
Frequency Range	5.725 – 5.850 GHz (ISM)
Transmit Frequency Stability	± 10 ppm from -30º to +55º C
FEC	Reed Solomon decoding
Modulation type	QPSK
System Gain	>103.5 dB (105 dB typical)
Aggregate Data Rate	54 Mbps each direction
Transmit Output Power	+23.5 dBm minimum
RF Transmit Power Range	20 dB
Rx Threshold at 10-6 BER	< -80 dBm
Maximum Receive Level	-20 dBm error free, 0 dBm without damage

TSUNAMI.GX 90 (5.3 GHz) SPECIFICATIONS

PRODUCT INFO	
Model Numbers	301-57710-61L0, 301-57710-61H0
Item Numbers	67255. 67254
Frequency Band	5.3 GHz UNII
Frequency Channels (Tx)	A1: 5274 MHz A2: 5326 MHz
T/R Spacing	52 MHz
FCC ID	HZB-US5358-GX1
FCC Rules	Part 15.407 UNII
Industry Canada	IC RSS210
SYSTEM AND TRANSCEIVER SPECS	
Frequency Range	5.250 – 5.350 GHz (ISM)
Transmit Frequency Stability	± 10 ppm from -30º to +55º C
FEC	Reed Solomon decoding
Modulation type	QPSK
System Gain	>93 dB
Aggregate Data Rate	54 Mbps each direction
Transmit Output Power	+13 dBm minimum
RF Transmit Power Range	20 dB
Rx Threshold at 10-6 BER	< -80 dBm
Maximum Receive Level	-20 dBm error free, 0 dBm without damage

TSUNAMI.GX 32 +2T1 (5.8 GHZ) SPECIFICATIONS

	Tsunami.GX 32 3-Channel	Tsunami.GX 32 2-Channel
PRODUCT INFORMATION		
Model Numbers	301-51145-61L0 301-51145-61H0	
Item Numbers	64765, 64766	
Frequency Range	5.725 – 5.850 GHz (ISM)	
Digital Capacity	18 Mbps	13.5 Mbps
Usable Ethernet Capacity (no waysides enabled)	16 Mbps each direction (32 Mbps aggregate)	12 Mbps each direction (24 Mbps aggregate)
Usable Ethernet Capacity (both T1 waysides enabled)	13 Mbps each direction (26 Mbps aggregate)	9 Mbps each direction (18 Mbps aggregate)
Usable Ethernet Capacity (both E1 waysides enabled)	12 Mbps each direction (24 Mbps aggregate)	8 Mbps each direction (16 Mbps aggregate)
Frequency Channels (Tx)	A1: 5731.5 A2: 5816.5 B1: 5745.0 B2: 5830.0 C1: 5758.5 C2: 5843.5	A1: 5734.0 A2: 5819.0 B1: 5756.0 B2: 5841.0
Selectable frequency channels, 0.5 MHz steps (Tx in MHz)	Low 5731.5 – 5758.5 High 5816.5 – 5843.5	Low 5734 – 5756 High 5819 – 5841
Pre-configured non-overlapping channels	3-Channel, ISM Un-spread	2-channel, ISM Spread
TX Channel Bandwidth	9 MHz @ 6 dB	13.5 MHz @ 6 dB
C/I Carrier to Interference	<11 dB	<7 dB
T/R Spacing (minimum spacing req'd between TX and RX channels)	58 MHz	63 MHz
FCC ID	HZB-S58-GX1	
FCC Rules	Part 15.247 ISM	
Industry Canada	1856A-U5358GX1	
SYSTEM AND TRANSCEIVER SPECS		
Modulation type	QPSK	
System Gain	>108.5 dB	>109.5 dB
Aggregate Data Rate	18 Mbps each direction	13.5 Mbps each direction
Rx Threshold at 10-6 BER	< -85 dBm	< -86 dBm
Transmit Output Power	+23.5 dBm minimum	
RF Transmit Power Range	20 dB minimum	
Transmit Frequency Stability	± 10 ppm from -30º to +55º C	
Maximum Receive Level	-10 dBm error free, 0 dBm without damage	
FEC	Reed Solomon decoding	

DIGITAL INTERFACE SPECIFICATIONS

DIGITAL INTERFACE	
Primary Ethernet Interface Line	
Interface	10/100 BaseTX and 100BaseFX
Connectors	1 x RJ-48C, 1 x SC fiber multimode
Regulatory Compliance	IEEE 802.3d
Maximum Packet Size	1518 bytes + CRC
100 Base-FX Ethernet port	In band SC, multimode fiber 100Mbps, full duplex 1300 nm
10/100 Base-TX Ethernet port	In band RJ-45 modular jack Software selectable or auto-negotiate speed and duplex
Wayside T1 Line	
Interface	DSX-1 (T1)
Line Rate	2 x 1.544 Mbps
Connector(s)	RJ-48C modular jack
Connector Quantity	2 x T1, connectorized, selectable
Line Code	AMI or B8ZS, selectable
Line Buildout	0 to 655 feet, selectable
Blue Code	AIS (Alarm Indication Signal)
Regulatory Compliance	ANSI-2987-T1; CCITT G.823
Wayside E1 Line	
Interface	CEPT-1 (E1)
Line Rate	2 x 2.048 Mbps
Connector(s)	RJ-45 modular jack
Connector Quantity	2 x E1, connectorized, selectable
Line Code	N/A
Line Buildout	N/A
Blue Code	AIS (Alarm Indication Signal)
Regulatory Compliance	ITU-T G.703, G.823, GR-499-CORE

OTHER TSUNAMI.GX SPECIFICATIONS

General System Parameters			
Product Configuration	1+0 IDU + RF Unit (RFU with outdoor option)		
Intermediate Frequency	745 – 750 MHz, 140 MHz (+/- 2 MHz)		
Digital Interface	10/100BaseTx		
Error Floor	10^{-11}		
GX Store and Forward Latency Ethernet Latency (64 byte frame) Ethernet Latency (1518 byte frame)	T32: <220 usec <1440 usec	T90: <150 usec <800 usec	
Wayside Latency (msec)	<500 usec, <150 msec (does not include over-the-air latency)		
Error Correction	FEC, Reed-Solomon Decoding		
Security	12-character hexadecimal Link ID code (12^{16}, 281 trillion combinations)		
Digital Interface (on IDU)			
Orderwire (for DTMF Phone)			
Connector	2-wire, 4-pin mod jack RJ-11		
REN	1.0 B		
DTMF Tones	Within ± 1.5% of nominal frequency (+0 to 6 dB)		
Ringing Voltage	48 VDC, typical		
Address	00 to 99		
VF (Orderwire Bridge)			
Connector	RJ-45 jack (4-wire); bridged to Orderwire RJ-11		
Input Level	0 dBm		
Output Level	0 dBm		
Impedance	600 ohm balanced		
Configuration Port			
Connector	DB-9 DCE (female, 9 pin D sub)		
Protocol	RS-232 (8 bit data, No Parity, 1 Stop Bit)		
Data Rate	9.6 kbps		
Auxiliary Data Port			
Connector	RJ-45 DCE (modular jack, unkeyed)		
Protocol	RS-232 (8 bit Data, No Parity, 1 Stop Bit)		
Data Rate	2.4 kbps, 4.8 kbps, 9.6 kbps, 19.2 kbps, selectable		
Alarms Port			
Connector	DB-9 (female, 9 pin D sub)		
Form C Relay (NO, NC)	Summary Alarm, Out-of-Service Alarm		
External Input Alarms (2)	Software selectable for alarm on open or close condition		
Network Management System			
Connector	RJ-45 (modular jack, unkeyed) 2 each		
NMS 1	10/100 Base-Tx		
NMS 2	10/100 Base-Tx		

Interface (RF Unit)	
Antenna Port	
Connector	Type-N female
Impedance	50 ohms
Signal	See Unit Specifications for frequency channels
IF Port	
Connector	TNC female
Impedance	50 ohms
Signal	Uplink: 745/750 MHz; Downlink: 140 MHz; +48 VDC; Telemetry: 125 KHz; Power: +42 VDC
Output RSL	
Connector	BNC female, cap and chain
Output Level	0.5 to 0.95 = > –5 dBm to –95 dBm 500 Hz to 3 kHz for earphone jack
Audio Tone	RSL and RSL earphone connectors are combined onto single connector
Fault and Configuration Management	
Type	Integral SNMP Agent Integral Web Server Serial Craft Terminal CLI Telnet, via 10/100BT
10/100 Base-TX Ethernet port (NMS1)	Out of band RJ-45 modular jack auto-negotiate speed and duplex
10/100 Base-TX Ethernet port (NMS 2)	Out of band RJ-45 modular jack auto-negotiate speed and duplex
Configuration port	VT-100 Craft Terminal port; Config port: DB9 female
SNMP	SNMP v2C, MIB II, Proxim Enterprise MIB
SNMP Manager Compatibility	HPOpenView, SNMPc, or equivalent
Fault Management	Alarm traps sent to up to 5 Managers; via MIB variables
Web Browser Compatibility	Any IE version above 5.0 (5.0, 5.5, 6.0) Netscape 7.x in both Windows and Linux
User Access Security	Two level password protection
Performance Management	ES, SES, BER, LOS; near and far end
Alarm Log	Up to 20,000 entries, downloadable
Software Updates	Download Upload via Internet Web Browser over Ethernet or via TFTP over Ethernet
Configuration Management	Near end only, via IP address
Advanced features	Spectrum Analyzer – 10 channels RSL vs.Time charting

Temperature and Environment	
Operating Temperature, RF Unit	-30° to +55° C
Operating Temperature, IDU	0° to +50° C
Humidity, IDU	95% max, non-condensing
Humidity, RFU	100%, all weather
Altitude	15,000 ft., maximum
Wind (RF unit)	Up to 115 miles per hour
MTBF	IDU > 100,000 hours RFU > 100,000 hours
Power Requirements	
VDC nominal input voltage (IDU)	±48 VDC or ±24 VDC
IDU DC Input Voltage Range (IDU)	-20 to –60 VDC or +20 to +60 VDC
Power Consumption Per Terminal	< 70 watts
Power Consumption	IDU: < 30 watts; RFU: <40 watts
AC Adapter (external) for IDU	240 watts; 50/60 Hz, 110/220 VAC; UL rated
DC Power Connector (IDU)	3-pin barrier strip type, plug-in
Connector (RF Unit)	Uses coax cable for delivery
RFU voltage level	+42 volts DC
Power delivery to RFU	DC voltage over coax cable
Mechanical	
IDU Size (w x h x d) and Weight	17.2 x 1.75 x 11 inch (1RU) < 7 lbs
RF Unit Size (w x h x d) and Weight	14 x 1.75 x 11 inch (1RU) < 13 lbs
Mounting	IDU: EIA rack mount 19-inch rack mount; 23-inch extenders in kit RF Unit: EIA rack mount 19-inch rack mount; Pole-mounted, 1.5 to 3 inch diameter pole using mounting plate
Cooling	IDU: 3 each DC fans RF Unit: Heatsink
Cable Specifications	
IDU to RFU Cable	
Cable type	LMR-240 or equivalent for cable lengths <330 feet (or 100 meters) LMR-400 or equivalent for cable lengths up to 600 feet (or 200 meters) LMR-600 or equivalent for cable lengths up to 1000 feet (or 300 meters)
Cable connector	N male
Impedance	50 Ohm
IDU Controls	
Far End Pushbutton	Yes – red LED
Ethernet TX Connector LEDs	
10/100 Base-TX Right Left	Link: Green = Link On; Off = Link Off Duplex: Green = Full; Flashing = Half w/collisions; Off = Half Duplex

NMS Connector LEDs	
10/100 Base-TX NMS 1 Right (Link) Left (Duplex)	 Link: Green = Link On; *Flashing = Traffic; Off = Link Off; Flashing = Traffic Duplex: Green = Full; Flashing = Half w/collisions; Off = Half Duplex
10/100 Base-TX NMS 2 Right (Link) Left (Duplex)	 Link: Green = Link On; *Flashing = Traffic; Off = Link Off ; Flashing = Traffic Duplex: Green = Full; Flashing = Half w/collisions; Off = Half Duplex

*Link LED will flash on some models.

Appendix G. Troubleshooting

This chapter provides information about:

- Changing Frequency Plans
- Counteracting and Evaluating Interference
- Troubleshooting data stream errors and interference
- Troubleshooting alarms
- Measuring radio function
- Troubleshooting radio management tools
- Repair policy

CHANGING FREQUENCY PLANS

The radio frequency selections are listed in “Channel Plans” on page 73. The near-end radio and the far-end radio must correspond, for example, A1 and A2. All **1** frequency plans can be selected, when available, from the radio model with the low-side RF unit, or the “ –xxL0” model. All **2** frequency plans can be selected, when available, from the radio models with the high-side RF unit (the “–xxH0” model).

The frequency plans are configured in the **Sys Cfg** tab of the Web Interface.

COUNTERACTING AND EVALUATING INTERFERENCE

The recommended interference countermeasures available are:

- Short paths
- Narrow beam antennas (high gain)
- Frequency channel selection and orientation
- Antenna Polarization
- Transmit Power
- Equipment/Antenna Location
- Use of a Spectrum Analyzer to evaluate potential interference

Short Paths

The single most effective countermeasure against interference is to maintain a “short path” length. This can be achieved by dividing long paths into multiple small paths by cascading hops. Intermediate repeaters can be formed using back-to-back terminals and transmit output power reduced, if required.

By definition, “short path” is defined as a path where fades are extremely rare and signal levels vary by no more than ±3 dB during fades. This distance varies with the RF frequency. Typically a “short path” is defined as any path length shorter than 5 miles at 5.8/5.3 GHz.

Narrow Beam Antennas (High Gain)

This is the next most effective countermeasure. Narrow-beam antennas ensure that the transmitted power is sent in a single direction; this minimizes the possibility of causing interference inadvertently to other users. Narrow beam antennas also reject off-azimuth signals being received from potential sources of interference and have high gain, which boosts desired receive levels and improves the carrier-to-interference signal level.

When selecting narrow beam antennas, it is helpful to know that larger antennas generally out-perform smaller antennas. Another important antenna specification is the front-to-back ratio, which ensures rejection of unwanted signals from azimuth angles behind the antenna. High performance antennas with improved sidelobe attenuation are also available.

Frequency Selection

You often can overcome interference by exchanging frequencies of both ends of the radio link (for example, change your A1 terminal to an A2 and change the other end from an A2 to an A1). For the GX series, this requires swapping of the RF Unit from end to end. Also, changing channel plans (for example, from A to B) can be very effective, provided multiple channel plans are available.

See “Channel Plans” on page 73 for frequency selections. The near-end radio and the far-end radio must be corresponding (such as A1 / A2).

Antenna Polarization

Cross-polarized antennas can provide approximately 20 to 30 dB discrimination of unwanted signals. The actual discrimination depends upon the antenna design and any rotation of polarization along the path (for example, due to reflections). Substantial discrimination only exists between two orthogonal polarizations:

- Vertical versus horizontal
- Left-hand circular versus right-hand circular

There is only 3 dB discrimination between circular and linear (vertical or horizontal) polarization.

If changing polarization to minimize interference, the antenna polarization must be changed at both ends of the link.

Transmit Power

The maximum level into the receiver is -20 dBm. Errors can occur in the receive data stream above this level. You should reduce transmit output power on very short paths to avoid overload.

Equipment/Antenna Location

Interference is occasionally caused by the radio equipment or the antenna being too close to another similar transmitter. Moving the radio equipment, the antennas, or the interfering equipment can reduce or eliminate interference.

Interference countermeasures rely to some extent on the measurement of the received interference level and frequency. Before turning up a new link, use a spectrum analyzer (either built-in or external) to monitor the spectrum at each end to check for possible interfering signals. For more details, see the section that follows.

Use of a Spectrum Analyzer to Evaluate Potential Interference

Connecting to the antenna and using “peak hold” on a spectrum analyzer, the spectrum across the receive frequency range of the radio can be swept and any signals being received at levels above the radio's specified threshold identified.

If potential interfering signals are found, you can change the frequency plan to avoid a receive channel that may contain significant interference (see “Changing Frequency Plans on page 96. For example, you can reduce interference by moving or swapping terminals. Signals outside the receiver frequency range can be generally ignored: they almost always do not cause interference.

When using an external spectrum analyzer for determining the presence of interference, use very narrow resolution bandwidth settings to detect signals down to the unit’s threshold (approximately -80 dBm, depending upon the type of radio). Use a directional antenna in combination with the spectrum analyzer and determine not only the frequency, but also the primary direction and the dominant polarization of interference sources. Once the frequency, direction, and dominant polarization of interference is known, proper planning for your radio system’s channel plan, polarization, and antenna placement can be optimized.

TROUBLESHOOTING ALARMS

Use these troubleshooting guidelines when you receive:

- Data Stream Errors
- RF Link Alarms
- RF Unit, Cable, IDU Alarms
- Far End Alarms

Data Stream Errors

When the radio is in service, errors in the user data may occur. This is usually known to the operator either by faulty data indications of downstream equipment or by external bit error rate testing. It is possible that no alarms appear on the front panel during normal operations, even when there are errors present in the data stream.

Some errors do not result in an alarm (such as bipolar violations, improperly terminated connections, or certain incorrect settings), but are exhibited on downstream data processing equipment or during a BER test.

In other cases, there may be data errors due to atmospheric conditions (fading), interference, or other reasons, but not at a high enough error level to be indicated with the BER alarm LED. In the case of these types of errors, the following information can be helpful to troubleshoot the radio link.

Indications

- During external BER test, test equipment indicates errors
- Downstream equipment (multiplexer, channel bank, codec, router, and so on) indicates errors

Possible Causes

- Path fading due to atmospheric conditions
- Poor transmission line connections
- Antenna problems, misalignment or path clearance
- Received signal level (RSL) is too strong
- Far-end radio transmitter circuitry is faulty
- Near-end radio receiver circuitry is faulty
- Interference

Recommended Actions

- Check and Verify data interface wiring
- Follow the troubleshooting instructions described in “IDU Fail Alarms.”

RF Link Alarms

This LED indicates that the demodulator function is not synchronizing with the intended received signal.

Possible Causes

- Severe path fading due to atmospheric conditions, usually accompanied by a low RSL voltage reading
- Poor transmission line connections, usually, but not always, accompanied by low RSL voltage reading
- Antenna problems, misalignment, or path clearance, usually accompanied by low RSL voltage reading
- Improper radio settings (such as frequency channel)
- Received signal level (RSL) is too strong
- Interference
- Far-end radio transmitter circuitry is faulty
- Near-end radio receiver circuitry is faulty
- Link security ID mismatch between the radios (flashing)

Recommended Actions

Check the following at each end of the link:

- Verify that radios are opposite channel plans on each end (for example, one is A1 and other is A2).
- Verify that all connections between radios and antennas are secure and all devices between radios and antennas are rated for the radio frequency band (5.8/5.3 GHz). View **RF Link** alarm while flexing transmission lines near all connectors to test for poor connector terminations.

Measure RSL by placing a voltmeter across RSL and GND test points and:

- Comparing this to the RSL that was expected using path calculations (see “Calculating RSL and Link Budget” on page 52) and the RSL that was achieved during installation (if RSL was once sufficient).
- Pressing and holding the DISPLAY FAR END button and measuring the far-end RSL (while continuing to hold the button).
- Comparing this RSL to the expected RSL from the link budget calculations.

Excessive Loss

If RSL from both ends of the radio are approximately the same as each other, but lower than anticipated for this installation, then the likely cause of the BER alarm is excessive losses between the radios. Excessive loss problems could include the transmission line at either end, all adapters, connectors, the antennas, the antenna alignment, as well as the path itself (any obstructions or clearance problems).

Verify antenna alignment, line-of-sight, and path clearance; if this does not improve RSL, check all devices between the radios and their antennas at both ends. Make sure all transmission lines, connectors, and any other devices are properly rated for operation at the radio's frequency (5.8/5.3 GHz).

Power Adjustment

If only one end has low RSL, this could be caused by low transmit output power from the opposite end radio. Verify that the transmitter output power of the radio opposite to the low RSL receiver has been set in accordance to path calculations or EIRP restrictions (where applicable).

WARNING! Power adjustment must be performed by professional installation personnel only.

Tx Power can be viewed or adjusted from the **Sys Cfg** web page.

If an RF power meter is available, you can connect it to the RF output of the RF Unit for precision measurement. This test also verifies that the radio transmitter is working properly. This is highly recommended if RSL is low in only one direction. If one terminal has high RSL, this could be caused by interference.

Short Path or Interference

To verify the possible presence of interference, remove DC power to the unit opposite the one that is reading high RSL or experiencing errors. Once power is removed, measure RSL on the remaining radio. If RSL voltage is lower than its threshold, it is unlikely that an interfering signal is present. If an RSL measurement is made above threshold, then the presence of interference is likely.

If interference is suspected, the most effective potential remedy is to swap frequency channels on both sides of the link. (see “Changing Frequency Plans” on page 96). Swap RF Units at both ends of the link so they are the opposite of their original installation. After both ends are moved, reconnect the radios and determine whether the BER alarm is still active. If so, you can select other frequency channels or try other interference counter-measures, as discussed in “Counteracting and Evaluating Interference” on page 96.

Possible Radio Failure

If all path related and data input problems have been pursued and the BER alarm is still active, the problem could be related to a radio failure. Although radio failure typically is indicated by more severe alarm conditions, it is possible that one of the radios may be out of specification, and this could be the cause of the BER alarm. A back-to-back test verifies proper radio operation. See “Test Radios Back-to-Back” on page 12 for more information. A threshold test on both radios, along with a test to verify proper RF output power, would be beneficial.

Perform a back-to-back test before returning any radio terminal to the factory for repair. A back-to-back test verifies radio operation.

If the radios pass their back-to-back testing successfully, the problem is likely with the path, with the connections between the radio and the antenna, or interference. Before you reinstall the radios, be sure to set the output power to the appropriate level for the installation.

RF Unit, Cable, and IDU Alarms

These LEDs indicate a known problem with the radio hardware.

Possible Causes

- RF Unit hardware failure, such as amplifier or pre-amp circuits
- IF cable shorted
- IDU hardware failure

Recommended Actions

1. Remove power from the unit.
2. Check to make sure power supply voltages are within specification.
3. Reapply power to the unit, even if the voltages were within specification.
4. Verify that RF UNIT cable is assembled and connected correctly
    - If the alarm clears, place the radio back into service.
    - If the alarm does not clear, perform a back-to-back test to verify radio operation.
    - If the alarm is still active in a back-to-back test, return the unit in alarm to the factory for repair.

Far End Alarms

This LED indicates that there is an alarm condition present on the far-end radio. When the DISPLAY FAR END button is pressed (and held), the status LEDs indicates the alarm conditions of the far-end radio.

Possible Causes

One or more alarm conditions exist on the far-end radio.

Recommended Actions

Press and hold the DISPLAY FAR END button and observe the LED status. Follow the troubleshooting instructions provided in “RF Link Alarms” and “Radio Fail Alarms.”

TROUBLESHOOTING THE WEB INTERFACE MANAGEMENT TOOL

Problem

- Slow Web Interface
- Unable to logon to the Web Interface

Solution

- Check the Ethernet duplex settings of the PC or switch connected to it. Set the PC or switch to auto-negotiate, or half duplex if auto-negotiate is not available. The NMS ports on the radio are auto-sensing for speed and duplex.
- Check that the IP address of the PC is in the same subnet as the locally connected radio, that is, 10.0.0.0.
- Check the CAT5 cable by using an Ethernet cable tester or using the same cable with another known good device.

REPAIR POLICY

The radio terminal includes comprehensive alarm indicators designed to diagnose potential faults. Should a fault occur, it often can be resolved by operator adjustment. If a fault occurs that cannot be resolved by operator adjustment and that has been confirmed by back-to-back testing, the equipment should be returned to Proxim for repair.

The GX radios are complex systems not designed for user repair. Do not remove the cover or open any part of the terminal. Contact WANTechnicalSupport@proxim.com for assistance in determining possible problems and troubleshooting.

Contact the factory in advance of returning the product. You will be assigned a Return Material Authorization (RMA) number that authorizes your return. Units sent to the factory without an RMA number may delay the repair process. Be sure to include the following information:

- RMA number
- Description of the problem
- Your name and telephone number
- Return shipping address
- Urgency of repair

See the published Warranty policy for repair policy details.

Radios should be packaged in their original packing boxes for shipment. Whenever possible, Proxim Corporation can provide an empty box shipment to facilitate proper packaging. Regardless, proper and adequate packaging must be used for shipments to protect the units from damage. Proxim Corporation cannot be held responsible for any repairs due to inadequately packed materials.

Damage caused by improper packing can result in higher repair costs and delays. See “Warranty” for explicit product warranty information.

Proxim Corporation provides 24-hour telephone technical support with purchased service plans. We do, however, encourage you to troubleshoot your radio and link according to the troubleshooting methods provided in this document.

Technical Support

If you are having a problem using a Tsunami.GX product and cannot resolve it with the information in “Troubleshooting” on page 96, gather the following information and contact Proxim Technical Support:

- What kind of network are you using?
- What were you doing when the error occurred?
- What error message did you see?
- Can you reproduce the problem?

Be sure to:

- Note the serial number of the product before installation. Keep this information in a safe place. The serial number is required to obtain support and can be found only on the back of the unit.
- Obtain an RMA number before sending any equipment to Proxim for repair.

Access Knowledgebase:	**WANsupport@proxim.com** Ask your wireless WAN question and get an express response:
E-mail Technical Support:	**WANtechnicalsupport@proxim.com**
Web Technical Support:	**http://www.proxim.com/support**
Call Technical Support:	Toll Free **+1-866-674-6626** or **+1-408-542-5390** Hours: 6:00 a.m. to 5:00 p.m. M-F Pacific Time

ENHANCED WARRANTY PACKAGES

Proxim’s ServPak program delivers premium support services that complement your Tsunami.GX standard warranty. Available services include, warranty extension, 24x7x365 technical phone support and priority response, and next day priority hardware replacement. For more information, contact Proxim or your Proxim authorized reseller.

Warranty

1. **PROXIM CORPORATION TWO-YEAR LIMITED EQUIPMENT WARRANTY**

1.1 For the applicable Warranty Period (as defined in Paragraph 1.2 below) Proxim warrants that the hardware manufactured by Proxim and initially purchased or leased from one of Proxim's authorized resellers or distributors by the original end-user ("you") for your personal use and not for resale (the "Equipment") (a) substantially conforms to the specifications contained in the most recent version of the manual for the model of the Equipment purchased or leased by you (the "Equipment Specifications") and (b) is free from defects in materials and workmanship. This Limited Warranty only applies to the Equipment and its preloaded firmware. This Limited Warranty does not apply to any software (or its associated documentation), whether preloaded with the Equipment, installed subsequently or otherwise ("Software"), nor does it apply to any firmware revision that is not originally preloaded on the Equipment at the time the Equipment is purchased or leased. The Software is licensed to you pursuant to the software license agreement that accompanied the Software and is subject to the terms, including the limited warranty and limitation of liability, contained in that license agreement. Proxim has no obligation to repair or replace Software under this Limited Warranty.

1.2 This Limited Warranty shall start on the date that the Equipment is first shipped to you (the "Shipping Date") and shall end two (2) years after the Shipping Date ("Warranty Period").

1.3 Nothing in this Limited Warranty affects any statutory rights of consumers that cannot be waived or limited by contract.

2. **LIMITED WARRANTY EXCLUSIONS AND LIMITATIONS.**

2.1 The Limited Warranty covers customary and intended usage only.

2.2 Proxim does not warrant, and is not responsible for damage, defects or failures caused by any of the following:

(a) Any part of the Equipment having been modified, adapted, repaired, or improperly installed, operated, maintained, stored, transported or relocated by any person other than Proxim personnel or a Proxim authorized service agent;

(b) External causes, including electrical stress or lightning, interference caused by other radios or other sources, unsuitable physical or operating environment and use in conjunction with incompatible equipment or accessories;

(c) Cosmetic damage, including all damage to the surface of the Equipment;

(d) Acts of God, fires, floods, wars, terrorist acts, sabotage, civil unrest, labor disputes or similar events, actions or hazards; and

(e) Accidents, negligence, neglect, mishandling, abuse or misuse, other than by Proxim personnel or a Proxim authorized service agent.

2.3 The Limited Warranty does not apply to the following parts of the Equipment, which are not manufactured by Proxim, but which may be otherwise covered by an original manufacturer's warranty:

(a) antenna systems, including coaxial cable, waveguide, connectors, flex sections, mounts, and other parts of the antenna system and installation materials;

(b) rack mounted equipment, which is not manufactured by Proxim but which may be assembled, wired and tested at Proxim's factory or supplied as part of a system, including orderwire items, channel banks, multiplexers, fuse/alarm panels and remote alarm items; and

(c) all equipment which is not included in Proxim's specifications.

2.4 Unless otherwise specified, equipment not manufactured by Proxim is provided "AS IS" AND WITHOUT WARRANTIES OF ANY KIND. Please refer to the original manufacturer's warranty, if any.

2.5 Any technical or other support provided for the Equipment by Proxim, such as telephone assistance or assistance regarding the installation, is provided "AS IS" AND WITHOUT WARRANTIES OF ANY KIND.

3. **REPLACEMENT, REPAIR AND RETURN PROCESSES.**

3.1 To request service under the Limited Warranty:

(a) You must, within the applicable Warranty Period, promptly notify Proxim of the problem with the Equipment, provide the serial number of the Equipment, and provide your contact information during business hours, by contacting Proxim by telephone at 408-542-5390 during the business hours of 8:00 a.m. to 5:00 p.m., Pacific Time, Monday through Friday, excluding holidays, or by e-mail at wantechnicalsupport@proxim.com or by mail to Support, Proxim Corporation, 935 Stewart Drive, Sunnyvale, CA 94085, USA, This notice is effective when received by Proxim during the business hours referenced above.

(b) Proxim shall, at its sole option, either resolve the problem over the telephone or provide you with a returned materials authorization number ("RMA Number") and the address of the location to which you may ship the Equipment at issue.

(c) If the problem is not resolved over the telephone, and Proxim gives you an RMA Number, you must, within ten (10) business days of your receipt of an RMA Number if you are located within the borders of the United States and within thirty (30) days of your receipt of an RMA Number if you are located beyond the borders of the United States, at your cost, ship the Equipment to the location specified by Proxim. The Equipment must be shipped in its original or equivalent packaging. You must also attach a label to each item of Equipment you are returning, which must include the following information: the RMA Number, a description of the problem, your return address and a telephone number where you can be reached during business hours. You must also include with the Equipment a dated proof of original purchase. **YOU ARE RESPONSIBLE FOR ALL EQUIPMENT UNTIL PROXIM RECEIVES IT, AND YOU ARE RESPONSIBLE FOR ALL SHIPPING, HANDLING AND INSURANCE CHARGES, WHICH MUST BE PREPAID.**

(d) Proxim is not responsible for Equipment received without an RMA Number and may reject the return of such Equipment. **PROXIM IS ALSO NOT RESPONSIBLE FOR ANY OF YOUR CONFIDENTIAL, PROPRIETARY OR OTHER INFORMATION OR DATA CONTAINED IN EQUIPMENT YOU RETURN TO PROXIM.** You should remove any such information or data from the Equipment prior to making any return to Proxim.

(e) The replacement or repair of Equipment in locations outside of the United States may vary depending on your location.

(f) **FAILURE TO FOLLOW THE PROCEDURES FOR RETURNS LISTED ABOVE MAY VOID THE LIMITED WARRANTY.**

3.2 If the Equipment does not function as warranted, as determined by Proxim in its sole discretion, Proxim shall either repair or replace the returned Equipment at its sole option.

(a) The replacement Equipment or parts may be new or refurbished. All parts removed from repaired Equipment and all returned Equipment that is replaced by Proxim become the property of Proxim.

(b) Proxim shall, at its cost (which shall not include international customs, freight forwarding, or associated fees) ship the repaired or replacement Equipment to any destination, by carrier and method of delivery chosen by Proxim, in its sole discretion. Proxim will not pay, and you will be solely responsible for, any international customs, freight forwarding, or other associated fees related to such shipment. If you request some other form of conveyance, such as express shipping, you must pay the cost of return shipment.

3.3 Equipment which is repaired or replaced by Proxim under this Limited Warranty shall be covered under all of the provisions of this Limited Warranty for the remainder of the applicable Warranty Period or ninety (90) days from the date of shipment of the repaired or replacement Equipment, whichever period is longer.

4. **LIMITATIONS OF RIGHTS AND DISCLAIMER OF OTHER WARRANTIES**

4.1 **THE LIMITED WARRANTY CONTAINS LIMITATIONS ON YOUR RIGHTS AND REMEDIES AGAINST PROXIM. YOU ACKNOWLEDGE HAVING READ, UNDERSTOOD AND AGREED TO THOSE LIMITATIONS.**

4.2 Proxim does not warrant that the functions contained in the Equipment will meet your requirements or that any Equipment's operation will be uninterrupted or error free. **REPAIR OR REPLACEMENT OF THE EQUIPMENT AS PROVIDED HEREIN IS THE EXCLUSIVE REMEDY AVAILABLE TO YOU, AND IS PROVIDED IN LIEU OF ALL OTHER WARRANTIES, WHETHER ORAL OR WRITTEN, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT OF THIRD PARTY RIGHTS. ALL OTHER WARRANTIES ARE EXCLUDED TO THE FULLEST EXTENT PERMITTED BY LAW AND EXCEPT FOR THE LIMITED WARRANTY PROVIDED HEREIN, THE EQUIPMENT IS PROVIDED "AS IS".** No dealer, agent, or employee is authorized to make any modification, extension, or addition to the Limited Warranty.

5. **LIMITATION OF LIABILITY**

PROXIM SHALL NOT BE LIABLE TO YOU FOR INDIRECT, SPECIAL, PUNITIVE, INCIDENTAL OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, LOST PROFITS) OF ANY KIND SUSTAINED OR INCURRED IN CONNECTION WITH, OR RELATED TO, THE EQUIPMENT OR YOUR USE OF THE EQUIPMENT REGARDLESS OF THE FORM OF ACTION OR NATURE OF THE CLAIM (INCLUDING, BUT NOT LIMITED TO, BREACH OF WARRANTY, BREACH OF CONTRACT, TORT, NEGLIGENCE OR STRICT LIABILITY) AND WHETHER OR NOT SUCH DAMAGES ARE FORESEEABLE, AND EVEN IF PROXIM HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH LOSS. IN NO CASE WILL PROXIM BE LIABLE FOR ANY REPRESENTATION OR WARRANTY MADE BY ANY PARTY OTHER THAN PROXIM. PROXIM'S TOTAL LIABILITY TO YOU SHALL NOT EXCEED THE AMOUNT PAID BY YOU FOR THE EQUIPMENT AT ISSUE. This limitation of liability also applies to Proxim's authorized resellers and distributors and it is the maximum amount for which Proxim and the reseller or distributor who sold you the Equipment are collectively responsible.

6. **DISCLAIMERS**

This Limited Warranty gives you specific legal rights, and you may also have other rights that vary from jurisdiction to jurisdiction. Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages, may not allow limitations on how long an implied warranty lasts, and may not allow provisions that permit a warranty to be voided. Consequently, such limitations and exclusions may not apply to you. In the event an implied warranty cannot be excluded under the law of the applicable jurisdiction, it is limited in duration to the applicable Warranty Period.

7. **MISCELLANEOUS**

7.1 *Transfer.* You may not transfer or assign this Limited Warranty. Any transfers or assignments made in violation of this Paragraph shall be void.

7.2 *Governing Law.* The Limited Warranty shall be governed by the laws of the State of California, without reference to its conflicts of laws provisions. The United Nations Convention on the International Sale of Goods shall not apply to this Limited Warranty.

7.3 *Arbitration/Dispute Resolution.* **Any dispute, controversy or claim arising out of or in connection with the Equipment shall be finally resolved by arbitration under the International Arbitration Rules of the American Arbitration Association**. The place of arbitration shall be Sunnyvale, California. The number of arbitrators shall be one. The language of arbitration shall be English.

7.4 ***Indemnification*. You shall indemnify and hold harmless Proxim (including its directors, officers, employers and agents) against any and all claims (including all expenses and reasonable attorneys' fees) arising from or relating to the operation of the Equipment due to, in whole or in part, your (including your agents' or employees') negligence, gross negligence or misconduct.**

Acronyms / Glossary

10 Base-T/F
This designation is an Institute of Electrical and Electronics Engineers (IEEE) shorthand identifier. The "10" in the media type designation refers to the transmission speed of 10 Mbps. The "Base" refers to baseband signaling, which means that only Ethernet signals are carried on the medium. The "T" represents twisted-pair; the "F" represents fiber optic cable.

100 Base-TX/FX
The "100" in the media type designation refers to the transmission speed of 100 Mbps. The "Base" refers to baseband signaling, which means that only Ethernet signals are carried on the medium. The "TX" represents two pairs of data grade twisted-pair wire; the “FX” represents a two-strand optical fiber cable.

AC
Alternating Current

Alternating current
In electricity, alternating current (AC) occurs when charge carriers in a conductor or semiconductor periodically reverse their direction of movement.

amp
Ampere. An ampere is a unit of measure of the rate of electron flow or current in an electrical conductor. One ampere of current represents one coulomb of electrical charge (6.24×10^{18} charge carriers) moving past a specific point in one second.

amplifier
An electronic device that increases the voltage, current, or power of a signal.

analog
An analog signal is one in which a base carrier’s alternating current frequency is modified in some way, such as by amplifying the strength of the signal or varying the frequency, in order to add information to the signal.

antenna
A device used for radiating or receiving electromagnetic energy.

attenuate
To lessen the strength of.

AUX
Auxiliary

azimuth
Azimuth and elevation are angles used to define the apparent position of an object in the sky, relative to a specific observation point. The observer is usually (but not necessarily) located on the earth's surface. The azimuth (az) angle is the compass bearing, relative to true (geographic) north, of a point on the horizon directly beneath an observed object. As seen from above the observer, compass bearings are measured clockwise in degrees from north. Azimuth angles can thus range from 0 degrees (north) through 90 (east), 180 (south), 270 (west), and up to 360 (north again).
The elevation (el) angle, also called the altitude, of an observed object is determined by first finding the compass bearing on the horizon relative to true north, and then measuring the angle between that point and the object, from the reference frame of the observer.

Elevation angles for objects above the horizon range from 0 (on the horizon) up to 90 degrees (at the zenith).

back-to-back testing
A simple way to verify that the radios are fully operational before they are installed.

bandwidth
The width of a band of electromagnetic frequencies. Used to mean (1) how fast data flows on a given transmission path, and (2), somewhat more technically, the width of the range of frequencies that an electronic signal occupies on a given transmission medium. Any digital or analog signal has a bandwidth.

baseband
Any frequency band on which information is superimposed, whether or not the band is multiplexed and information is sent on sub-bands. The frequency band is not shifted to some other frequency band but remains at its original place in the electromagnetic spectrum.

baud
Baud was the prevalent measure for data transmission speed until replaced by a more accurate term, bps (bits per second).

beamwidth, half power
In a plane containing the direction of the maximum lobe of the antenna pattern, the angle between the two directions in which the radiated power is one-half the maximum value of the lobe.

BER
Bit Error Rate. The bit error rate (BER) is the percentage of bits that have errors relative to the total number of bits received in a transmission, usually expressed as ten to a negative power.

BNC connector
Developed in the late 1940’s as a miniature version of the Type C connector, BNC stands for Bayonet Neill Concelman and is named after Amphenol engineer Carl Concelman. The BNC product line is a miniature quick connect/disconnect RF connector.

broadband
In general, broadband refers to telecommunication in which a wide band of frequencies is available to transmit information. Because a wide band of frequencies is available, information can be multiplexed and sent on many different frequencies or channels within the band concurrently, allowing more information to be transmitted in a given amount of time (much as more lanes on a highway allow more cars to travel on it at the same time).

CLI
Command Line Interface.

coax
Coaxial cable. A cable comprised of a center conductor, surrounded by an insulating core, with a braided or solid shield. Conductive shield surrounds the core with outside insulation.

codec
The term **codec** is also an acronym that stands for "**co**mpression/**dec**ompression." A codec is an algorithm or specialized computer program that reduces the number of bytes consumed by large files and programs.

dB
Decibel. In electronics and communications, the decibel (abbreviated as dB, and also as db and DB) is a logarithmic expression of the ratio between two signal power, voltage, or current levels.

dBi
Used to define the gain of an antenna system relative to an isotropic radiator at radio frequencies. The symbol is an abbreviation for "decibels relative to isotropic."

dBm
Used to define signal strength in wires and cables at radio and audio frequencies. The symbol is an abbreviation for "decibels relative to one milliwatt," where one milliwatt (1 mW) equals 1/1000 of a watt (0.001 W or 10^{-3} W).

DC
Direct Current

DCE
Distributed Computing Environment. An industry-standard software technology for setting up and managing computing and data exchange in a system of distributed computers.

demux
De-multiplexer

diffraction
The apparent bending of light waves around obstacles in its path.

digital
Electronic technology that generates, stores, and processes data in terms of two states: positive and non-positive.

diplexer
Combines signals so only one coaxial wire needs to be run.

dipole antenna
A straight electrical conductor measuring ½ wavelength from end to end and connected at the center to a radio-frequency feed line.

direct current
DC (Direct current) is the unidirectional flow or movement of electric charge carriers, usually electron.

DTE
Data Terminal Equipment. In computer data transmission, the RS-232C interface that a computer uses to exchange data with a modem or other serial device.

duplex
Duplex communication means that both ends of the communication can send and receive signals. Full duplex communication is where this happens simultaneously. Half duplex is also bidirectional communication, but signals only flow in one direction at a time.

DVM
Digital Volt Meter.

E1
E1 (or E-1) is a European digital transmission format devised by the ITU-TS and given the name by the Conference of European Postal and Telecommunication Administration (CEPT). It is the equivalent of the North American T-carrier system format.

The E1 signal format carries data at a rate of 2.048 million bits per second and can carry 32 channels of 64 Kbps each. E1 carries at a somewhat higher data rate than T-1 (which carries 1.544 million bits per second) because, unlike T-1, it does not do *bit-robbing* and all eight bits per channel are used to code the signal. E1 and T-1 can be interconnected for international use.

EIA
Electronic Industries Association. Comprises individual organizations that together have agreed on certain data transmission standards such as EIA/TIA-232 (formerly known as RS-232).

EIRP
Effective Isotropic Radiated Power. The product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna.

elevation
See azimuth.

ERP
Effective Radiated Power. The product of the power supplied to the antenna and its gain relative to a half-wave dipole in a given direction.

fade margin
Difference between the actual received signal level and the radio's threshold.

FCC
Federal Communications Commission.

FEC Forward Error Correction.
Forward Error Correction is a coding scheme used to improve the performance of digital signal transmission. It utilizes a mechanism for correcting bits that may otherwise be received incorrectly.

Fresnel Zone
Parabolic areas around the visual line-of-sight that define the even and odd reflection points where multipath signals will either be constructive or destructive to the radio waves. Based on the frequency of the signal, the Fresnel zones help define the proper antenna heights to establish ideal path clearance for optimum signal reception.

FTP
File Transfer Protocol. A standard Internet protocol; the simplest way to exchange files between computers on the Internet.

gain
A ratio, expressed in decibels, of the action of an antenna increasing the strength of a signal.

GPS
Global Positioning System. Lets you ascertain your location anywhere on earth.

HD
High Density.

heatsink
A device that is attached to a microprocessor chip to keep it from overheating by absorbing its heat and dissipating it into the air. Most heatsinks are aluminum and have "fins" that extend from the base.

hertz
The unit for expressing frequency, (f). One hertz equals one cycle per second.

HTTP
Hypertext Transfer Protocol. The set of rules for exchanging files (text, graphic images, sound, video, and other multimedia files) on the World Wide Web.

HyperTerminal
A program that you can use to connect to other computers, Internet telnet sites, bulletin board systems (BBSs), online services, and host computers, using either your modem or your network card.

IDU
Indoor Unit.

IF
Intermediate Frequency.

IP
Internet Protocol. The method or protocol by which data is sent from one computer to another on the Internet. Each computer (known as a host) on the Internet has at least one IP address that uniquely identifies it from all other computers on the Internet.

ISM
Industrial, Scientific and Medical. The designation for specific bands for license-exempt use of radio devices by the FCC and other regulatory agencies.

isotropic antenna
An antenna capable of radiating or receiving equally well in all directions, and equally responsive to all polarization of electric and/or magnetic fields.

isotropic radiator
An electronic device that converts energy from one form to another, producing useful electromagnetic field output in all directions with equal intensity and at 100% efficiency, in three-dimensional space.

ITE
Information Technology Equipment.

kbit
Kilobit. A transmission rate of 1 **kbit**/s corresponds to 1,000 bits per second.

kHz
The kilohertz, abbreviated kHz or KHz*, is a unit of alternating current (AC) or electromagnetic (EM) wave frequency equal to one thousand hertz (1,000 Hz).

LED
Light-emitting diode. A device that emits visible light when an electric current passes through it.

link testing
The preferred way to evaluate a radio link's performance. It can be performed from end-to-end or in link test mode (which tests both directions of the radio path).

LNA
Low Noise Amplifier

lobe, antenna
A part of the antenna radiation pattern between adjacent minima.

loopback
A test signal sent to a network destination that is returned as received to the originator. The returned signal may help diagnose a problem.

Mbps
Megabits per second

MHz
Megahertz.
A unit of alternating current (AC) or electromagnetic (EM) wave frequency equal to one million hertz (1,000,000 Hz).

MIB
Management Information Base. A formal description of a set of network objects that can be managed using the Simple Network Management Protocol (SNMP) Management Information Base.

modem
MOdulator DEModulator. A device that translates a stream of digital data created by computer into the curious squeaking and hissing sounds that can be transmitted across phone lines.

multiplexing
The combining of several signals in the same communications channel, usually with the aim of increasing the amount of data that can be transmitted.

mux
Multiplexer.

mW
Milliwatt. One one-hundredth of one Watt

narrowband
Generally, narrowband describes telecommunication that carries voice information in a narrow band of frequencies. More specifically, a specific frequency range set aside by the U.S. FCC for mobile or radio services, including paging systems, from 50 cps to 64 Kbps.

NMS
Network Management System

ohm
The standard unit of electrical resistance in the International System of Units (SI). Ohms are also used, when multiplied by imaginary numbers, to denote reactance in alternating-current (AC) and radio-frequency (RF) applications.

Ohm's Law
Ohm's Law is the mathematical relationship among electric current, resistance, and voltage.

oscillator
An electronic device used for the purpose of generating a signal. Oscillators are found in computers, wireless receivers and transmitters, and audio-frequency equipment.

parabolic antenna
An antenna consisting of a parabolic reflector and a source at or near the focus. A microwave dish antenna is an example of a parabolic antenna.

parallel
More than one event happening at a time.

parallel processing
In computers, parallel processing is the processing of program instructions by dividing them among multiple processors with the objective of running a program in less time.

parity
A technique of checking whether data has been lost or written over when it has moved from one place in storage to another or when transmitted between computers.

polarization
An expression of the orientation of the lines of electric flux in an electromagnetic field. Polarization is important in wireless communications systems. The physical orientation of a wireless antenna corresponds to the polarization of the radio waves received or transmitted by that antenna.

PPP
Point-to-Point Protocol. A protocol for communication between two computers using a serial interface.

protocol
In information technology, the special set of rules that end points in a telecommunication connection use when they communicate.

QAM
Quadrature amplitude modulation. QAM is a method of combining two amplitude-modulated (AM) signals into a single channel, thereby doubling the effective bandwidth. QAM is used with pulse amplitude modulation (PAM) in digital systems, especially in wireless applications.

QPSK
Quadrature Phase Shift Keying. A digital frequency modulation technique used for sending data over coaxial cable networks. Since it's both easy to implement and fairly resistant to noise, QPSK is used primarily for sending data from the cable subscriber upstream to the Internet.

resistance
The opposition that a substance offers to the flow of electric current.

RF
Radio Frequency

RIP
Routing Information Protocol. A widely-used protocol for managing router information within a self-contained network such as a corporate local area network or an interconnected group of such LANs.

RMA
Return Material Authorization

RS-232C
A long-established standard ("C" is the current version) that describes the physical interface and protocol for relatively low-speed serial data communication between computers and related devices.

RSL
Received Signal Level

RU
Rack Unit

SELV
Safety Extra Low Voltage.

serial
One event at a time. Within electronics, digital signals carried across two-wire interfaces for transmit and receive.

SMA connector
SMA is an acronym for SubMiniature version A and was developed in the 1960's. It uses a threaded interface. 50 Ω SMA connectors are semi-precision, subminiature units that provide excellent electrical performance from DC to 18 GHz.

SMTP
A TCP/IP protocol used in sending and receiving e-mail.

SNMP
Simple Network Management Protocol. The protocol governing network management and the monitoring of network devices and their functions.

Spectrum Analyzer
An RF Spectrum Analyzer is a very special kind of superhetrodyne receiver that receives a chosen range of signals and displays the relative signal strength on a logarithmic display, usually a cathode ray oscilloscope.

T1
Also T-1. The T-carrier system, introduced by the Bell System in the U.S. in the 1960s, was the first successful system that supported digitized voice transmission. The original transmission rate (1.544 Mbps) in the T-1 line is in common use today in Internet service provider (ISP) connections to the Internet. The T-carrier system is entirely digital, using pulse code modulation and time division multiplexing. The system uses four wires and provides duplex capability (two wires for receiving and two for sending at the same time).

Telnet
A user command and an underlying TCP/IP protocol for accessing remote computers.

Tmra
Temperature, maximum room ambient.

TNC connector
TNC stands for Threaded Neill Concelman and is named after Amphenol engineer Carl Concelman. Designed as a threaded version of the BNC, the TNC series features screw threads for mating. TNC are miniature, threaded weatherproof units with a constant 75 Ω impedance and they operate from 0 - 11 GHz.

UL-listed
Listed by Underwriter's Laboratories, an independent, not-for-profit product safety testing and certification organization.

U-NII
Unlicensed National Information Infrastructure. The U-NII spectrum is located at 5.15-5.35 GHz and 5.725-5.825 GHz. U-NII devices do not require licensing.

VDC
Volts of direct current.

VF
Voice Frequency.

voltage
Voltage, also called *electromotive force*, is a quantitative expression of the potential difference in charge between two points in an electrical field.

VOM
Volt Ohm Meter.

VSWR
Return loss measurement

WAN
Wide Area Network.

waveform
A representation of how alternating current (AC) varies with time.

waveguide
A hollow, tube shaped device constructed of metal with a vinyl or polypropylene coating, used for conducting RF energy from an emission source, such as a microwave transmitter, to an antenna.