Pinnacle

155-Mbit/s Digital Microwave Radio

Installation and Operation Manual

Microwave Networks

P/N 8831700-00
Revision F
September 2005

Proprietary Notice

The manufacturer has made every effort to ensure that the instructions contained in the documents are adequate and free of errors and omissions. The manufacturer will, if necessary, explain issues that may not be covered by the documents. The manufacturer's liability for any errors in the documents is limited to the correction of errors and the aforementioned advisory services.

The documents have been prepared to be used by professional and properly trained personnel, and the customer assumes full responsibility when using them. The manufacturer welcomes customer comments as part of the process of continual development and improvement of the documentation in the best way possible from the user's viewpoint. Please submit your comments to the nearest Microwave Networks sales representative.

Pinnacle™ is a trademark of Microwave Networks, Inc.

Windows is a registered trademark of Microsoft Corporation. OpenView is a registered trademark of Hewlett Packard Company. NetView is a trademark of Tivoli Systems Inc.

To allow for the introduction of design improvements, specifications are subject to change without notice.

Printed in the USA.

Revision	*Date*
A	November, 1999
B	November, 2000
C	December, 2001
D	September, 2002
E	November, 2004
F	September, 2005

This device complies with parts 15 and 101 of the FCC rules.

CE This product meets the requirements of ETS 300 385 with Grade B equipment.

Contacting Microwave Networks

Telephone

Main Telephone Line	1-888-225-6429 (Toll free in the U.S.)
	1-281-263-6500
Main Fax Line	1-281-263-6400

Daytime & After-hour Emergency Technical Support

1-888-225-4762 (Toll free in the U.S.)

1-281-263-6501

Address

4000 Greenbriar - Suite 100A

Stafford, TX 77477

Web Site

www.MicrowaveNetworks.com

Technical Support Email

techsupport@microwavenetworks.com

Repair/RMA Email

repair@microwavenetworks.com

UK Service Center

Unit 7, Cordwallis Park

Maidenhead, Berkshire SL6 7B4

United Kingdom

Tel: +011-44-1628-788-383

Fax: +011-44-1628-788-424

WARRANTY

Microwave Networks Incorporated (MNI) manufactured products are warranted to be free from defect in material and workmanship for a period of two (2) years from date of shipment. In the event of a defect during the warranty period, Buyer will return item to the MNI depot repair facility for repair or replacement. Repair at MNI's option may include the replacement of parts or equipment, and all replaced parts or equipment shall be the property of MNI. Parts or equipment replaced during the warranty period are warranted for the remainder of the original applicable warranty period or ninety (90) days, whichever is greater. This express warranty is extended by MNI to the original Buyer for commercial, industrial or governmental use. Such action on the part of MNI shall be the full extent of MNI's liability and Buyer's exclusive remedy.

This warranty extends only to products manufactured by MNI, and it is expressly conditioned upon the equipment having been installed in accordance with the installation practices accepted by the telecommunications industry, the standard installation and configuration practices recommended by MNI, and the equipment having been maintained in accordance with MNI recommended standard maintenance practices. Frequency sensitive components, towers, vidicon tubes, test equipment, batteries, and other manufacturers' products are excluded, but carry their own separate limited warranties as authorized by the individual manufacturers.

This warranty shall automatically terminate if the product is used in other than its normal and customary manner, has been subject to misuse, accident, neglect or damage, has improper alterations or repairs made to it, or if nonconforming parts are used in the product, unless done by a service facility authorized by MNI to perform warranty service. An authorization to return products to MNI under this warranty must be obtained from the MNI Customer Care Center prior to making shipment to MNI's repair center. All returns shall be shipped freight prepaid and collect shipments will not be accepted. MNI will prepay return freight charges on repaired and replaced products found to be defective. There will be a minimum charge for each warranty module replacement requested as an emergency exchange.

Because each radio system is unique, MNI disclaims liability for range, coverage, or operation of a system as a whole under this warranty except by a separate written agreement signed by an officer of MNI. MNI's total liability is limited to the total price of the products sold. Buyer's sole remedy is to request MNI, at MNI's option, to either refund the purchase price, repair or replace product(s) that are not as warranted. No action shall be brought for any breach of this contract more than one (1) year after the accrual of such cause of action except for money due upon open account.

This MNI warranty is given in lieu of all other warranties, either expressed or implied, which are specifically excluded, including warranties of merchantability or fitness for a particular purpose. In no event shall MNI be liable for any incidental or consequential damages arising from this warranty.

Important Safeguards

CAUTION!

1. Read all of these instructions.
2. Save these instructions for later use.
3. Follow all notes, warnings, cautions, and instructions within this document.

Read Instructions

Read all safety statements before operating this microwave radio product.

Retain Instructions

Retain safety and installation instructions for future reference.

Heed Warnings

Adhere to notes, warnings, and caution statements in this manual.

Follow Instructions

Follow procedures to prevent damage to your equipment.

ESD Warning

Radio equipment contains ESD (electrostatic discharge) sensitive products. Both IDU and ODU have grounding plugs where you can ground your grounding strap. Prior to servicing, ground the equipment to a workstation ESD mat. In addition, wear a ESD wrist strap or heel strap grounded to the same workstation.

Cleaning

Dampen a cloth with water for cleaning. Do not use liquid or aerosol cleaners.

Attachments

Do not use attachments that are not listed within this document or are not recommended by manufacturer.

Water and Moisture

The ODU and antennas operate in outdoor moisture conditions but not under water. Weatherproof outdoor cable connections. Indoor units do not operate in water or moisture conditions beyond the limits specified.

Accessories

Use only equipment recommended by manufacturer. Follow manufacturer instructions to mount the radio. Use only mounting accessory recommended by manufacturer.

Power Sources

This product should be operated only from the type of power source indicated on the unit or in this manual.

Object or Liquid Entry

Never push objects through openings in this product; such actions could result in fire or electric shock. Never spill liquids on this product.

Important Safeguards (cont.)

Damage Requiring Service

Unplug the radio terminal from its power source and refer to service personnel under the following conditions:

- When the power supply cord is damaged.
- If liquid has been spilled or objects have fallen into the product.
- If the product does not operate normally. Adjust only those controls covered in the product manual. Improper adjustment may result in damage and will often require extensive work by a qualified technician to restore the product to its normal operation.
- When the product exhibits a distinct change in performance; this change indicates the need for service.

Replacement Parts

When replacement parts are required, ensure that parts are specified by manufacturer. Unauthorized substitutions could result in fire, electric shock, or other hazards.

Safety Check

Upon completing any service or repairs to this product, ensure that safety checks are performed to determine that the product is in proper operating condition.

The following are general safety precautions and instructions that personnel must understand and apply during many phases of operation and maintenance to ensure personnel safety.

Warning and Caution Statements

NOTE, WARNING, and CAUTION statements have been strategically placed in the text to emphasize certain steps or procedures for general information (NOTE), protection of personnel (WARNING), or equipment (CAUTION).

A WARNING or CAUTION, once provided, will apply each time the related step is repeated, regardless of the number of times the WARNING or CAUTION is repeated throughout the text. Prior to starting any task, the WARNINGS or CAUTIONS included in the text for that task will be reviewed and understood.

Keep Away From Live Circuits

Operating personnel must at all times observe safety regulations. Do not replace components or make adjustments inside the equipment with the voltage supply turned on. Under certain conditions, the potential for danger may still exist even when the power controls are in the OFF position, due to charges retained by capacitors. To avoid injuries, always remove power from, discharge, and ground a circuit before touching it.

Do Not Work in Front of an Energized Antenna

Prior to working on the antenna or RF Assembly, ensure that the RF Assembly is not radiating energy. When power is applied to the RF Assembly and antenna, proper precautions must be taken to avoid placing any part of the human body in front of the antenna. Failure to heed this warning may result in serious injury.

TABLE OF CONTENTS

Chapter 5 Radio Element Manager (REM)

Appendix A Installation and Site Survey

Appendix B Frequency Plans

Appendix C Alarm Descriptions

Appendix D Updating IDU Software

Appendix E PPP Connectivity

Appendix F Protected Link

Appendix G SDH/SONET Technical Information

1 INTRODUCTION

Contents

Overview

This manual contains detailed information on how to install and configure the Pinnacle radio. In addition to product descriptions and complete system specifications, it includes instructions on how to:

- Choose an appropriate site
- Install the system hardware
- Configure the system to meet your requirements
- Align the antenna properly
- Update the system software if necessary in the future

System Description

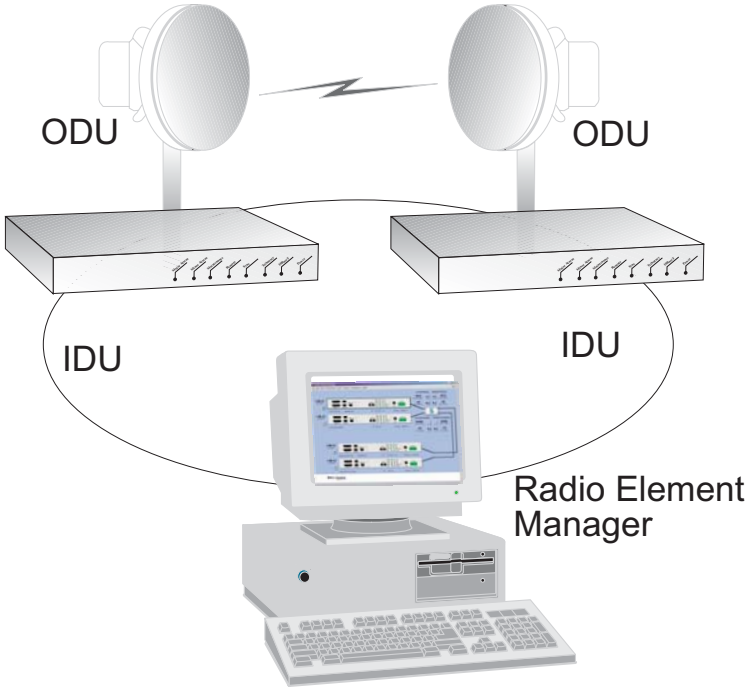
Pinnacle radios are high capacity 155-Mbits/s (SDH/SONET) microwave radios suitable for wireless communications in many types of metropolitan and rural applications. The integrated network management capabilities are based on international standard interfaces such as SNMP, Telnet, TFTP and PPP.

A radio management application allows configuration of the radio link through configuration menus. The management application also allows individual radio configuration, operation and monitoring using a graphical user interface (GUI).

The system hardware includes a low profile outdoor unit (ODU) that includes the RF assembly, high performance antenna with mount and an indoor unit (IDU).

The Pinnacle radio uses an advanced modem with a powerful Forward Error Correction (FEC) scheme. It makes extensive use of MMIC and VLSI technology, resulting in low cost, low power consumption, and high MTBF.

PINNACLE RADIO LINK



Applications

- Part of private LAN network
- Access by ISP (Internet Service Provider)
- Interconnectivity for cellular base station networks and backhaul for point-to-multipoint applications
- Full or partial radio coverage in broadband ring architectures; excellent complement to fiber rings
- Last mile broadband access service
- Protection backup to installed fiber network
- Private access between customer's equipment and point of presence (POP)

System Features

- Designed to meet international SDH/SONET standards; conforms to applicable ETSI, ITU-R, ITU-T, FCC, and BellCore recommendations
- Choice of optical or electrical interfaces at STM-1 or OC-3 access points
- Optional access to frame SOH for wayside channel and monitor/control network capability
- Common IDU mates with a family of ODUs covering the most popular ETSI and FCC frequency bands

Specifications

System Parameters

Frequency Bands ..... 13-38 GHz
Frequency Stability ..... +/- 2 ppm
Residual BER ..... $<10^{-13}$
Transmitter Type ..... Digital modulator; up-converter
Power Control (ATPC) ..... 0 to 25 db
Receiver Type ..... Down-converter, coherent demodulation

Interface Parameters

Capacity ..... 155.52 Mbits
Application ..... SDH/SONET/Ethernet
User Interface Options: .....
- STM-1/OC-3
- STM-1/OC-3 + E1/T1 + 2 x 64 kb/s
- 100BaseT
- 100 BaseT + 2E1/2T1 and E3/DS3

Monitored Hot-Standby 1+1 Protection

Main Line Bridging Loss ..... 1.5 dB
Standby Line Bridging Loss ..... 6.5 dB

Note: *Losses affect Tx and Rx parameters at a single radio terminal*

Specifications *(cont.)*

Frequency Band Dependent Parameters

	13 GHz	15 GHz	18 GHz	23 GHz	26 GHz	38 GHz
General						
Frequency Range	12.75 - 13.25 GHz	14.4 - 15.35 GHz	17.7-19.7 GHz	21.2-23.6 GHz	24.5-26.5 GHz	37.0-40.0 GHz
T/R Spacing	266 MHz	420, 490 or 728 MHz	1650 or 1010 MHz	1232, 1200 or 1008 MHz	1008 MHz	700 or 1260 MHz
Antenna Gain (typ.)						
30 cm (1')	-	34.0 dB	34.0 dB	34.5 dB	35.0 dB	38.5 dB
45 cm (1.5')	-	36.2 dB	36.0 dB	37.2 dB	37.7 dB	44.0 dB
60 cm (2')	35.2 dB	36.5 dB	39.0 dB	40.0 dB	40.5 dB	-
90 cm (3')	-	40.0 dB	42.0 dB	43.7 dB	44.6 dB	-
120 cm (4')	41.2 dB	42.5 dB	44.0 dB	45.6 dB	-	-
180 cm (8')	-	48.3 dB	50.4 dB	-	-	-
ETSI Specifications	EN 300 234 Class 5B	EN 300 234 Class 5B	EN 300 430 Class 5A	EN 300 198 Class 5A	EN 300 431 Class 5A	En 300 197 Class 5A
Standard Bandwidth						
Output Power (typ.)	-	-	17 dBm	16.5 dBm	16.5 dBm	16 dBm
Channel Bandwidth	-	-	55/40 MHz	56 MHz	56 MHz	56 MHz
Modulation	-	-	16/32 level QAM	16 QAM	16 QAM	16 QAM
Threshold @ 10^{-6} BER-	-	-73/-71 dBm	-71 dBm	-71 dBm	-70 dBm	
FCC Emission Designator	-	-	40M0F7W	50M0F7W	-	50M0F7W
Narrow Bandwidth						
Output Power (typ.)	18 dBm	19 dBm	15.5 dBm	14.5 dBm	14.5 dBm	14.5 dBm
Channel Bandwidth	28 MHz	28 MHz	27.5 MHz	28 MHz	28 MHz	28 MHz
Modulation	128 QAM	128 QAM	128 QAM	128 QAM	128 QAM	128 QAM
Threshold @ 10^{-6} BER-67 dBm	-67 dBm	-67 dBm	-66 dBm	-66 dBm	-65 dBm	
FCC Emission Designator	-	-	-	25M0F7W	-	25M0F7W

Specifications *(cont.)*

General Parameters

Antenna

Type ..... Parabolic reflector
Diameter ..... 30 cm (1'), 45 cm(1.5'), 60 cm (2'),
90 cm (3'), 120 cm (4'), 160 cm (6'), 240 cm (8')
Wind Loading ..... Operational: 160 km/h (100 mph)
Survival: 220 km/h (125 mph)
Polarization ..... Linear: vertical or horizontal
Adjustment Angle ..... ±35º Elevation, ±15º azimuth

Prime Power

Standard Input ..... -36 VDC to -60 VDC
Optional Inputs ..... a. -24 VDC ±20% b. 90 VAC to 240 VAC
Power Consumption ..... 115 watts

Environmental

Operating Range ..... ODU: -50ºC to +55ºC
Full Performance ..... ODU: -33ºC to +55ºC
IDU: -5ºC to +45ºC
Relative Humidity ..... ODU: 100%
IDU up to 95% non-condensing
Altitude ..... 45,500 m (15,000 feet)

Mechanical

IDU Dimensions ..... Height: 1RU (4 cm)
Width: 44.5 cm (19')
Depth: 30.5 cm (12")

ODU Dimensions
38 GHz ..... 33 cm x 33 cm x 30.5 cm
(13" x 13" x 12")
13-26 GHz ..... 30 cm x 23 cm x 30.5 cm
(11.8" x 9" x 6.3")

ODU Weight (Includes ..... 7 kg (15.4 lbs)
RF Assembly without
antenna and mount)

IDU to ODU Connection ..... Single coaxial cable, Belden 9913 (RG-8) or
equivalent, up to 300 m (1000 feet);
2 "N" Type male connectors

Network Management

Type ..... Integral SNMP Agent
Craft Terminal Interface (CTI)
Graphical Interface (GUI)

* Microwave Networks may change specifications at any time without notice. The following typical specifications are current as of September 2001.

***General Parameters* (cont.)**

Physical Interface	a. PPP over RS-232 modem port (up to 56 kb/s) b. 10BaseT Ethernet port c. VT100 Craft Terminal port
User Interface	SNMP CTI via Telnet CTI via direct serial interface GUI Interface (Graphical)
Security	Three-Level, Password Protection, Challenge Protocol (CHAP) security
Fault Management	Alarms reported via SNMP traps and MIB variables
Performance Management	Alarms based on adjustable thresholds such as Received Signal Level (RSL), BER and temperature. Performance statistics per ITU-T G.826
Automatic Management	Automatic transmit power control (ATPC)
Configuration Management	All configuration parameters may be set via the various management interfaces
Remote Software Updates	Flash download via TFTP over Ethernet or dial-up PPP
Inter-Radio Routing	IP-based
NMS Compatibility	OpenView™, NetView™, or any SNMP based NMS

Standards Compliance

System	FCC Part 101, ETSI EN 301 751
Antenna	FCC Part 101 Category A, or ETSI High Performance, BABT 211 ZV Class 2
EMC	FCC Part 15 Class B, ETSI ETS 300 385, ETSI EN 301 489-04
Payload/Interface	SONET Applicable standards, ITU-T G.703
Mechanical and Safety	UL, EIA-310-D, TUV, ETSI EN 60 950

155 Mb/s Line Interfaces

Fiber Interfaces

Code	OIMSC	OIMST	OSSSC	OSSFC	OLSSC
Application	Intra-Office	Intra-Office	Short-Haul	Short-Haul	Long-Haul
G.957 Code	N/A	N/A	S-1.1	S-1.1	L-4.4
Typ distance	2 km	2 km	15 km	15 km	40 km
Type	Fiber	Fiber	Fiber	Fiber	Fiber
Fiber Mode	Multimode	Multimode	Single Mode	Single Mode	Single Mode
Wavelength (nm)	1310	1310	1310	1310	1310
Tx Output (dBm)	-19 min -14 max	-19 min -14 max	-15 min -8 max	-15 min -8 min	-5 min 0 max*
Rx Input (dBm)	-32.5 min -14 max	-32.5 min -14 max	-31 min -8 max	-31 min -8 max	-34 min -8 max
Connector Type	SC	ST	SC	FC	SC

* Optical TX output may be up to 4 dBm higher.

Electrical Interfaces	
Code	ELC
Application	Electrical
G.703 Specs	Meets Para 12
Impedance	75 ohm
Code	CMI
Connector Type	BNC

Ethernet Interfaces	
Code	CA
Application	100BaseT
Connector	RJ45
Wayside Channel Options	2E1, Balanced 2E1, Unbalanced 2T1, Balanced 2E1, Balanced + E3 2T1, Balanced +DS3

2 IDU INSTALLATION

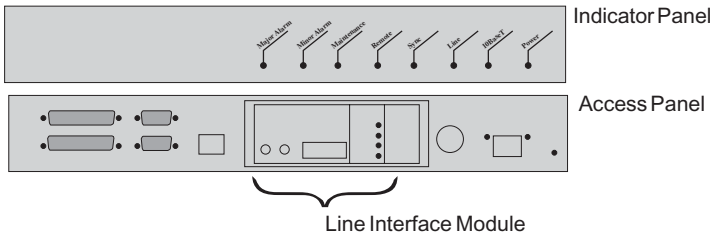
Contents

Indoor Unit (IDU)

Each Pinnacle terminal consists of the following components:

- indoor unit (IDU) with replaceable LIM (line interface module)
- coaxial cable
- outdoor unit (ODU) (see Section 3 for installation instructions)

IDU Front and Rear Panels



This section covers the installation of the IDU and cable connection:

- environment
- unpacking
- mounting
- LED indicators
- grounding
- power supply
- other connections

Environment

The IDU operates between the temperatures of -5^0C and $+45^0$C.

Ventilation apertures on the side panels of the IDU must be kept open and clear of obstruction.

Mount the IDU away from all heat sources and in a weather–protected area.

Unpacking

Carefully unpack the contents of one package and inspect them for any damage that may have occurred.

Check for accessories packed in the IDU box:

1. Power mating connector
2. Angle mounting brackets
3. Mounting screws for brackets

Check that the package contains the required Line Interface Module (LIM), which is the plug–in module customized to the particular user interface at the site.

Line Interface Module (LIM) Types and Options

The table below lists all LIM types. The LIM is a field-replaceable module. The IDU does not have to be sent to the factory or need software upgrades (most cases) to change LIMs. Call to verify compatibility of any LIM in an IDU.

Category	*Type*	*Optional Channels*	*Interface Connectors*	*Part Number*
OC-3/STM-1 w/o SOH	Optical; Multimode, Intra-office	None	OC-3/STM-1: SC	*8209266-00*
	Optical; Single Mode, Short-haul	None	OC-3/STM-1: SC	*8209266-01*
	Electrical, G.703	None	OC-3/STM-1: BNC	*8209266-02*
	Optical; Multimode, Intra-office	None	OC-3/STM-1: ST	*8209266-03*
	Optical; Single Mode, Short-haul	None	OC-3/STM-1: FC	*8209266-04*
OC-3/STM-1 w/ SOH	Optical; Multimode,Intra-office	E1 Unbal	OC-3/STM-1: SC	*8209267-00*
		E1 Bal	OC-3/STM-1: SC	*8209267-01*
		T1 Bal	OC-3/STM-1: SC	*8209267-02*
	Optical; Single Mode, Short-haul	None	OC-3/STM-1: SC	*8209267-03*
		E1 Unbal	OC-3/STM-1: SC	*8209267-04*
		T1 Bal	OC-3/STM-1: SC	*8209267-05*
	Electrical, G.703	E1 Unbal	OC-3/STM-1: BNC	*8209267-06*
100BaseT		None	100BaseT: RJ45	*8209268-04*
		2E1, Bal + E3	100BaseT: RJ45 2E1: RJ-45 E3: BNC	*8209268-05*
		2E1, Unbal	100BaseT: RJ45 2E1: BNC	
		2E1, Bal	100BaseT: RJ45 2E1: RJ-45	*8209268-06*
		2T1, Bal +DS3	100BaseT: RJ45 2T1: RJ-45	*8209268-07*
		2T1, Bal	100BaseT: RJ45 2T1: RJ-45	*8209268-08*

LIM types with service channels support DCE/DTE, and RS422 V.11, RS232 V.28, V.35, V.36, X.21. The service channel port is the RJ45.

.

Mounting

The IDU can be mounted in a 19” radio relay rack with cabling connections accessed from either the front or the rear. Two metal angle mounts are supplied in each IDU package.

To mount the IDU for rear cable access:

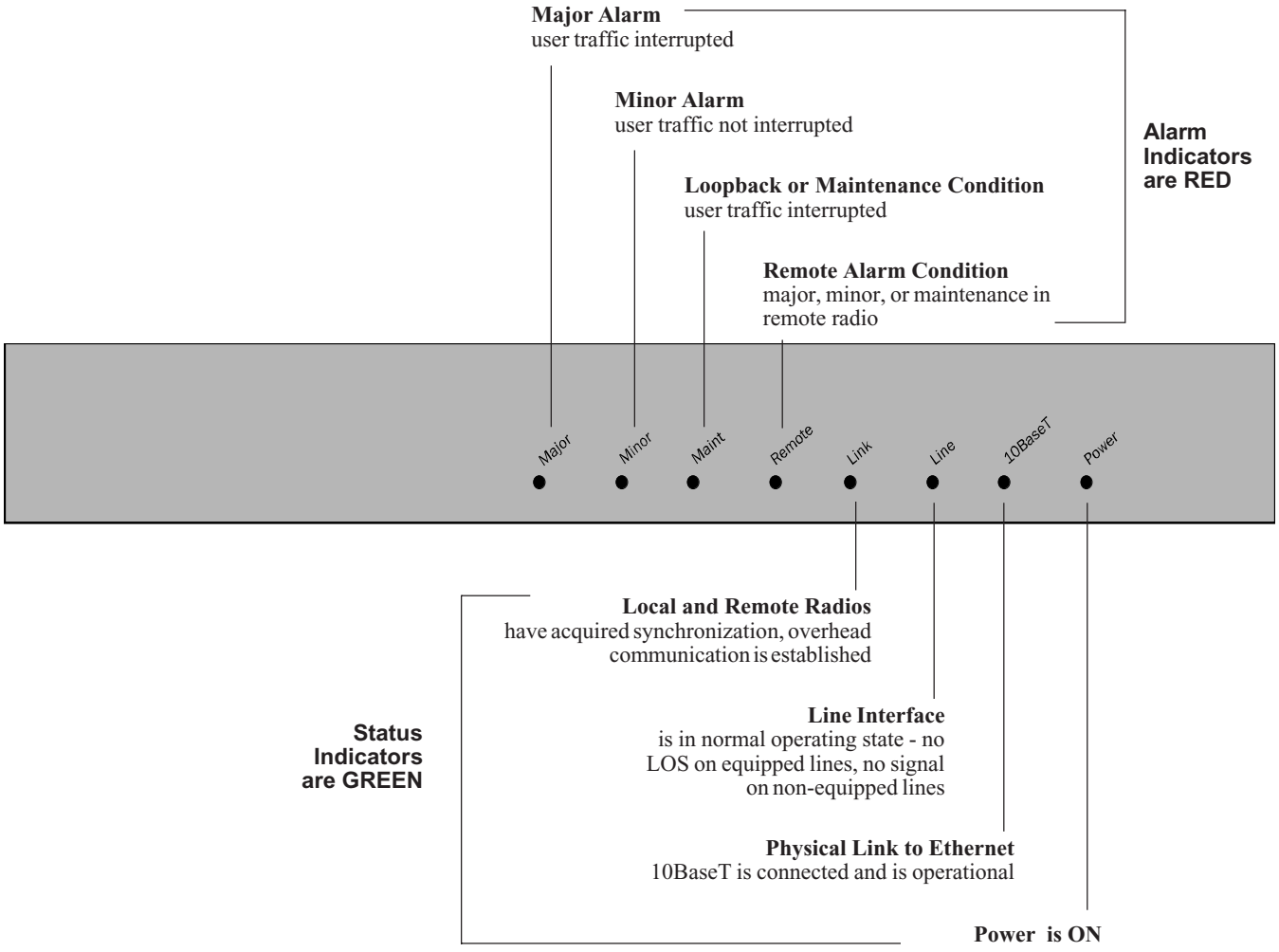
1. Using the four screws supplied, attach a metal angle mount to each side of the shelf adjacent to the front cover (with row of 8 LED's).

Note: LEDs are repeated on both the front and rear panels.

2. Ensure that the IDU and the angle mounts are on a level plane when they are fastened together, so that the shelf will mount straight when in the rack.
3. The angle mounts can be mounted in one of two ways:
   - The angle mount flush to the front panel.
   - The angle mount set back from the front panel so that the shelf can be positioned forward in the rack.

To mount the IDU for front cable access follow the steps above; except mount the two angle brackets adjacent to the rear connector panel.

IDU Indicators



On a power-up cycle all LEDs turn on and then go off in the following sequence: 10BaseT, Line, Link, Remote, Maint, Minor, Major, as the boot code runs through its start up stages.

IDU Rear Panel Connections

Accessory (25 pin)

Available for RS-232 asynchronous data channel for external use and protected link connections to switching shelf for hot standby 1+1 applications.

Computer

Used for RS-232 connection to craft terminal or PC. Used to access menu-driven network management functions and initial link configuration.

Line Interface Module (LIM)

Various connectors used depending upon the interface module (LIM).

Power Supply Input

DC Power Input.

Alarm I/O (25 pin)

Provides up to 8 external alarm/status inputs and 5 isolated relay outputs.

10BaseT

10 Mbps Ethernet connection for network management access. Use straight RJ-45 cable when attached to a hub. Use a cross-connect RJ-45 cable when attached directly to a PC.

LED Indicators

for Alarms and Status (same as front panel LEDs)

GND

Ground Screw

Modem

Direct RS-232 connection to external modem for remote dial-up access.
Not available on protected system.

ODU Cable

Coaxial connection from IDU to ODU using RG-8 cable (Belden 9913 or equivalent). See Page 2-7 for installation and assembly instructions for the cable.

The coaxial cable supplies DC power from the IDU to the ODU. Do NOT plug in standard test equipment to this point without the use of a DC block; damage to the test equipment may result.

Grounding

The IDU is equipped with a grounding screw (NC8) to attach to a chassis ground. Connect a grounding lug firmly to a ground on the relay rack where the IDU is installed.

Power Supply

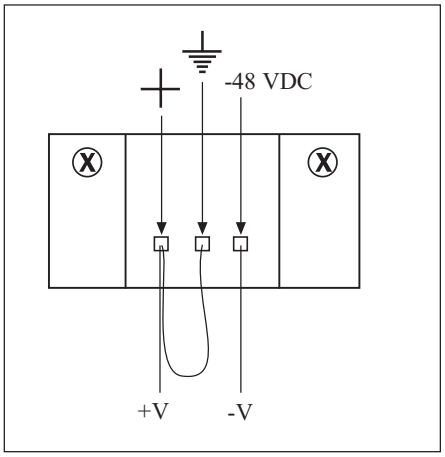
The primary input voltage requirement for the IDU is -48 VDC with a specified range between -36 VDC and -60 VDC.

The nominal IDU power consumption is 115 Watts for a non-protected terminal (one transmitter/receiver) when connected to an ODU.

The three IDU power supply connector terminals are located on the right side of the connector panel as follows:

Terminal	Location	Power Supply
+	Leftmost terminal	Positive voltage from prime supply
Ground	Center terminal	Ground/Earth
-48 VDC	Right most terminal	Negative voltage from prime supply

IDU Power Supply



When a -48 VDC supply (positive ground) supply is used, wire the mating power connector to the prime power source shown here.

Coaxial Cable Connections

The coaxial cable connects the IDU to the ODU. RG-8 coaxial cable with a double shield (Belden 9913 or equivalent) should be used with male N-connectors at each end of the cable.

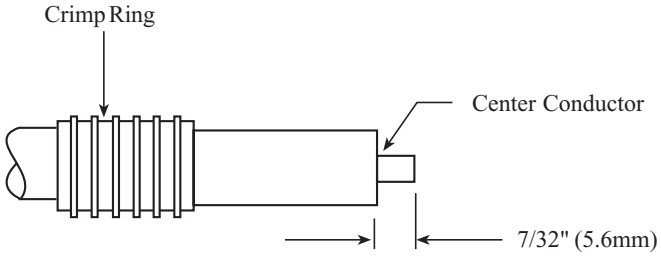
1. Cut the cable, allowing for an 18 inch service loop.

2. Attach an N-connector at each end, using the following procedure:

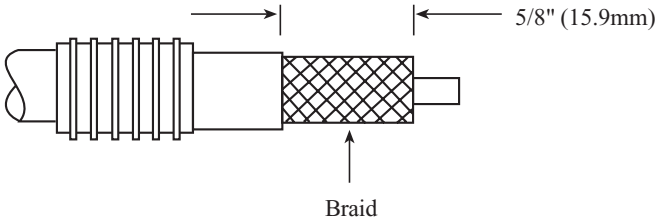
   a. Slide a crimp ring on to the cable.

   b. Expose 7/32" (5.6mm) of the center conductor. Do not score the center conductor.

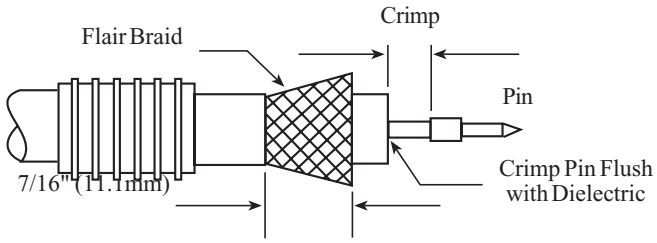
Attaching An N-Connector



   c. Remove 5/8" (15.9mm) of the cable jacket. Do not cut through the braid.

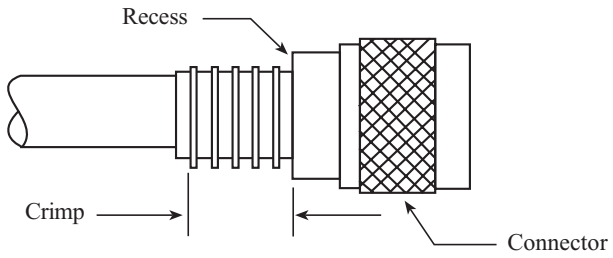


   d. Flare the braid slightly and trim it to 7/16" (11.1mm) to ensure the proper installation of the connector. Push the pin over the cable center conductor and crimp it with a hexagonal crimp tool, size 0.108" (2.7mm).

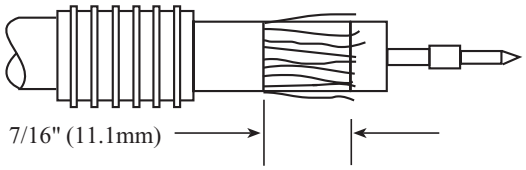


Coaxial Cable Connections (cont.)

e. Guide the pin and cable through the insulator into the back of the connector, until the pin is home. Slide a crimp ring over the braid and into the recess at the back of the connector. Crimp the connector with a hexagonal crimp tool, size 0.475" (12.1mm).



f. If the crimp ring will not pass over the braid, comb the braid and re-trim it to 7/16" (11.1mm). Repeat Step E.



Cable Connector Pin-Out Listings

Note the definition of Rx/Tx nomenclature used in this section:

Rx ..... Data coming from the user transmitted by the radio towards the antenna.

Tx ..... Data coming from the radio forwarded to the user.

The cable installation connections are as follows:

Accessory Port: DB25 Female Connector

This connector is used for protection shelf, or a 1.2 Kb to 19.2 Kb asynchronous service channel:

Connection	*Pin Numbers*
TXD	2
RXD	3
GND	7

All other pins are reserved.

WARNING!

All reserved pins MUST be unconnected in the accessory plug.

Cable Connector Pin-Out Listings (cont.)

Alarm I/O Port: DB25 Female Connector

Alarm Inputs: TTL-In with pull-up resistor. To activate, perform one of the following:

- ⇑ Create dry contact to ground
- ⇑ Connect active low-TTL output
- ⇑ Connect open collector output

Relay Out: Dry contact relay with maximum rating of 50 VDC, 100 milliAmps.

Connection	*Pin Numbers*
Alarm In 1-8	1, 3, 5, 7, 9, 11, 13, 25
Ground	2, 4, 6, 8, 10, 12, 24
Relay Out 1	14, 15
Relay Out 2	16, 17
Relay Out 3	18, 19
Relay Out 4	20, 21
Relay Out 5	22, 23

Computer (Terminal) Port: DB9 Female Connector

RS 232 connection to external terminal: Operates at 9600 baud, 8 bit, 1 stop, no parity, no flow control.

Connection	*Pin Numbers*
DCD Out*	1
RS 232 TXD	2
RS 232 RXD	3
Ground	5
DSR Out*	6
RTS In*	7

*Optional pins, not required for normal operation

Cable Connector Pin-Out Listings (cont.)

Modem Port: DB9 Male Connector

RS 232 connection to external modem: Enables PPP connection to system. Default configuration is 38.4 Kbaud, 8 bit, 1 stop, no parity, no flow control hardware.

Connection	*Pin Numbers*
DCD	1
RXD	2
TXD	3
DTR	4
CND	5
DSR	6
RTS	7
CTS	8
RI	9

Ethernet: 10Base-T Port, RJ45 Connector

Ethernet connection to NMS station: located on TCP/IP network. TX refers to data leaving the radio towards the user.

Connection	*Pin Numbers*
TX+	1
TX-	2
RX+	3
RX-	6

3 ODU INSTALLATION & ALIGNMENT

Contents

Warnings

WARNING!

This equipment cannot safely be attached to a mast that is less than 2.5" (6.4 cm) or greater than 4.5" (11.4 cm) in diameter.

WARNING!

Do not install radios closer than the recommended distances in the table below unless using the manual Tx attenuation option.

1' antenna (30 cm)	At least 300 meters between radios
1.5' antenna (45 cm)	At least 600 meters between radios
2' antenna (60 cm)	At least 1200 meters between radios
4' antenna (1.2m)	At least 2400 meters between radios
6' antenna (180 cm)	At least 3600 meters between radios

IMPORTANT

To ensure the efficiency of an installation, a proper Site Survey should be conducted by an approved survey team. See Appendix A for Site Survey Guidelines.

Ensure Radio Compatibility

Before starting installation, ensure that radios are compatible for the required frequency range. The following table shows that sub-band numbers must be the same but the letters different. The number notes the sub-band while the letter designates the frequency range within that sub-band.

For example, in the US 38-GHz band a **1A** radio matches a **1B** radio. The **1** indicates it is the lower half sub-band or FCC low sub-band while the letter "**A**" or "**B**" indicates the radio has either a low transmitter frequency (A) or a high transmitter frequency (B).

The following are the common frequency bands. Appendix B details other bands and specific channel plans.

38 GHz Sub-bands

US Domestic

Band	Transmit Freq. (GHz)	Receive Freq. (GHz)
1A	38.600-38.950	39.300-39.650
2A	38.950-39.300	39.650-40.000
1B	39.300-39.650	38.600-38.950
2B	39.650-40.000	38.950-39.300

European 56/28 MHz

Band	Transmit Freq. (GHz)	Receive Freq. (GHz)
1A/3A	37.058-37.618	38.318-38.878
2A/4A	37.618-38.178	38.878-39.438
1B/3B	38.318-38.878	37.058-37.618
2B/4B	38.8778-39.438	37.618-38.178

26 GHz Sub-bands

European 56/28 MHz

Band	Transmit Freq. (GHz)	Receive Freq. (GHz)
1A/3A	24.500-25.000	25.500-26.000
2A/4A	25.000-25.500	26.000-26.500
1B/3B	25.500-26.000	24.500-25.000
2B/4B	26.000-26.500	25.000-25.500

23 GHz Sub-bands

US Domestic

Band	Transmit Freq. (GHz)	Receive Freq. (GHz)
1A	21.200-21.800	22.400-23.000
2A	21.800-22.400	23.000-23.600
1B	22.400-23.000	21.200-21.800
2B	23.000-23.600	21.800-22.400

European 56/28 MHz

Band	Transmit Freq. (GHz)	Receive Freq. (GHz)
1A/2A	22.000-22.600	23.000-23.600
1B/2B	23.000-23.600	22.000-22.600

18 GHz Sub-bands

US Domestic

Band	Transmit Freq. (GHz)	Receive Freq. (GHz)
1A	17.700-18.140	19.260-19.700
1B	19.269-19.700	17.700-18.140

European 55/27.5 MHz

Band	Transmit Freq. (GHz)	Receive Freq. (GHz)
1A/3A	17.700-18.200	18.700-19.200
2A/4A	18.200-18.700	19.200-19.700
1B/3B	18.700-19.200	17.700-18.200
2B/4B	19.200-19.700	18.200-18.700

15 GHz Sub-bands

European 490 MHz T/R Spacing

Band	Transmit Freq. (GHz)	Receive Freq. (GHz)
1A	14.403-14.627	14.893-15.117
2A	14.627-14.851	15.117-15.341
1B	14.893-15.177	14.403-14.627
2B	15.117-15.341	14.627-14.851

European 420 MHz T/R Spacing

Band	Transmit Freq. (GHz)	Receive Freq. (GHz)
1A	14.501-14.725	14.921-15.145
2A	14.725-14.921	15.145-15.341
1B	14.921-15.145	14.501-14.725
2B	15.145-15.341	14.725-14.921

European 728 MHz T/R Spacing

Band	Transmit Freq. (GHz)	Receive Freq. (GHz)
1A	14.515-14.599	15.243-15.327
1B	15.243-15.327	14.515-14.599

13 GHz Sub-bands

European

Band	Transmit Freq. (GHz)	Receive Freq. (GHz)
1A	12.765-12.849	13.031-13.115
2A	12.877-12.961	13.143-13.227
1B	13.031-13.115	12.765-12.849
2B	13.143-13.227	12.877-12.961

Installation

Tools Required

- 9/16" socket or wrench
- 1/2" socket or wrench
- DVM with BNC to banana leads
- Hexagonal crimp tool (.108", 2.7mm and .475", 12.1mm)
- Butyl or weatherproof tape
- Tie wraps

ODU Assemblies

The ODU consists of the following assemblies:

- Pinnacle ODU with Antenna
- Azimuth Adjust Plate and Hardware
- Pole Mount Plate
- Elevation Adjust Plate and Hardware

Install RF Assembly on Antenna

38 GHz Assemblies

The 38 GHz RF Assembly is a circular design. It is installed directly on to the antenna using a “push-fit” feed mechanism. Carefully line up the feed and the four mounting clamps and, one by one, tighten the clamps. It is usually tightened easier if opposite clamps are tightened first.

The antenna polarization of the 38 GHz assembly is determined by the position of the RF Assembly on the antenna. When installing it on the antenna, it can be rotated 90 degrees to select the polarization.

Vertical polarization – The RF Assembly handle is UP and the label “This side down for vertical polarization” is down on the RF Assembly.

Horizontal polarization – The RF Assembly handle is on the left side and the label “This side down for horizontal polarization” is down on the RF Assembly. Note that when in this position, the handle must be removed from the RF Assembly to allow for clearance to the antenna mount assembly.

13 to 26 GHz Assemblies

The RF Assemblies for 13 to 26 GHz are a rectangular assembly. They are mounted on to the antenna with the handle and the longer side in the upward position. An interface assembly, called the Antenna Transition Assembly, determines the polarization.

Read the instructions below before installing the antenna transition assembly on to an RF Assembly:

The antenna transition and mounting hardware are supplied in the antenna package.

1. Verify correct transition assembly is selected. *See Table 1*. The transition assembly has two parts: a circular transition and a vertical or horizontal interface. The circular transition is chosen for the frequency band in use and the interface is selected depending upon whether vertical or horizontal antenna polarization is desired.
2. Attach the transition assembly to the RF Assembly. See Figures 1 and 2.

Installation (cont.)

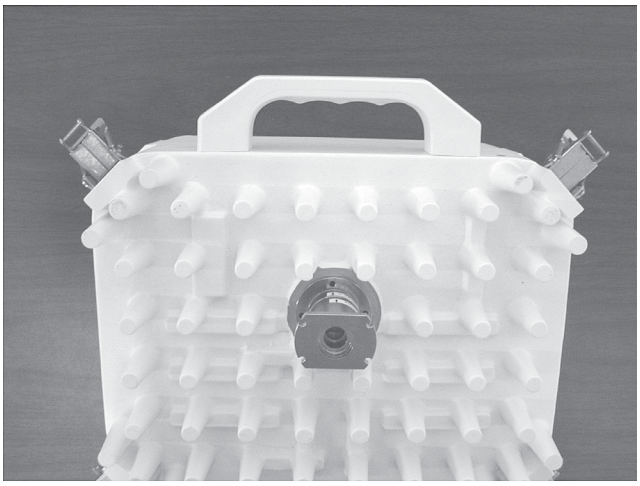
Identification of ODU/Antenna Transition Parts for Vertical or Horizontal Polarization

	Vertical Polarization		Horizontal Polarization	
13 GHz	Vertical Assembly Consisting of:	8708250-13V	Horizontal Assembly Consisting of:	8708250-13H
	Circular Transition	3800037-00	Circular Transition	3800037-00
	Vert. Interface	3800043-00	Horiz. Interface	3800047-00
15 GHz	Vertical Assembly Consisting of:	8708250-15V	Horizontal Assembly Consisting of:	8708250-15H
	Circular Transition	3800038-00	Circular Transition	3800038-00
	Vert. Interface	3800044-00	Horiz. Interface	3800047-00
18 GHz	Vertical Assembly Consisting of:	8708250-18H	Horizontal Assembly Consisting of:	8708250-18H
	Circular Transition	3800039-00	Circular Transition	3800039-00
	Vert. Interface	3800045-00	Horiz. Interface	3800049-00
23 GHz	Vertical Assembly Consisting of:	8708250-23V	Horizontal Assembly Consisting of:	8708250-23H
	Circular Transition	3800040-00	Circular Transition	3800040-00
	Vert. Interface	3800046-00	Horiz. Interface	3800050-00
26 GHz	Vertical Assembly Consisting of:	8708250-26V	Horizontal Assembly Consisting of:	8708250-26H
	Circular Transition	3800041-00	Circular Transition	3800041-00
	Vert. Interface	3800046-00	Horiz. Interface	3800051-00

If the polarization is to be **vertical**, line up the waveguide slot on both assemblies and attach them using the four 4-40 screws supplied. The completed assembly will look like Figure 1.

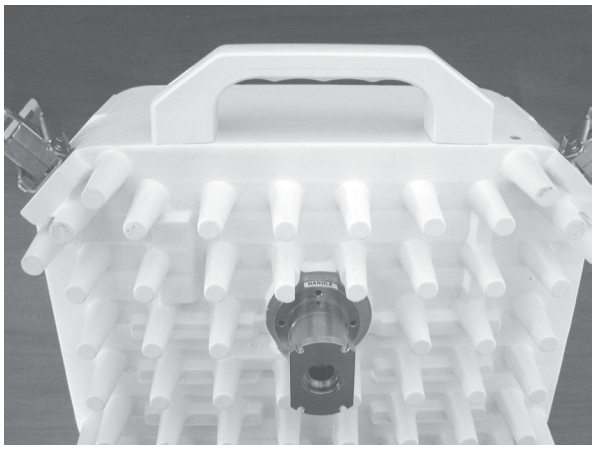
If the polarization is to be **horizontal**, the interface will have a 45-degree

Figure 1
Vertical on Radio



Installation (cont.)

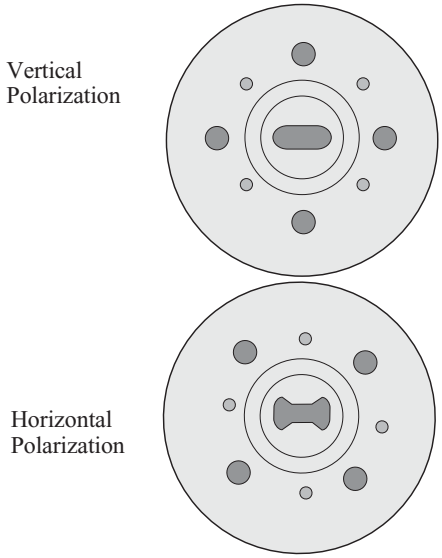
Figure 2
Horizontal on Radio



twist that mates with the RF Assembly. Attach the transition assembly to the RF Assembly using the four 4-40 screws supplied as shown in Figure 2 with the word “Handle” facing the top RF Assembly handle.

Figure 3 shows the difference between the vertical and horizontal interfaces where they mount on to the RF Assembly

Figure 3



3. If an antenna transition has to be changed from vertical to horizontal, follow the procedure below:

   a) Start with the transition assembly as shown in Figures 4 and 5.

   b) Remove four 4-40 screws from the vertical interface side and separate the two parts as shown in Figure 6.

   c) Replace the vertical interface with a horizontal interface and attach the horizontal interface to the circular transition as shown in Figures 6 and 7.

Installation (cont.)

Figure 4
Vertical Assembly

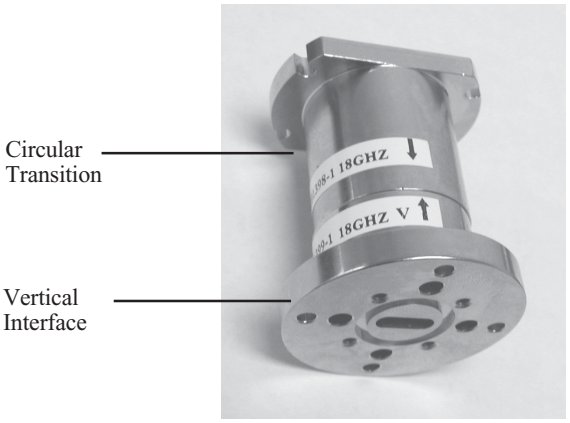
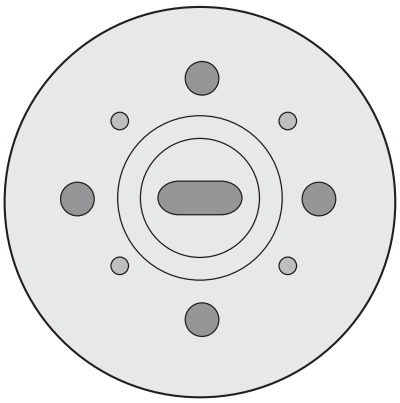


Figure 5



Installation (cont.)

Figure 6

Rectangular to Circular Transition

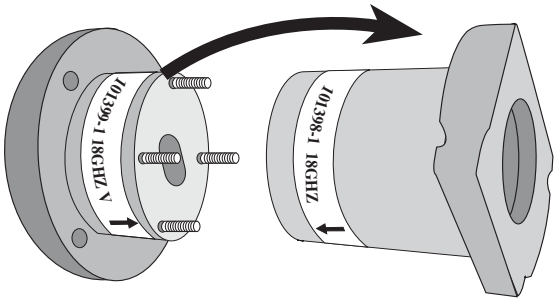
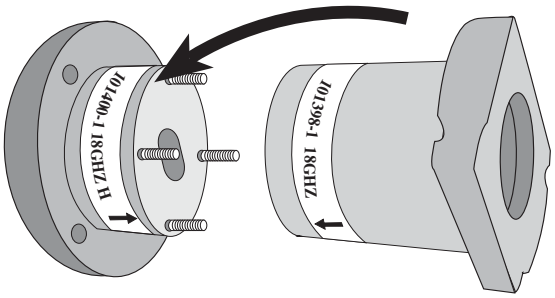


Figure 7

90 Degree Twist to Circular Transition



d) Line up the two arrows on the labels of both parts as shown in Figure 8, and insure that the O-ring between the two parts is placed properly. Tighten using the four 4-40 screws. The new horizontal interface piece will look like Figure 9.

4. Reverse the above procedure when changing a horizontal transition to a vertical one.

Installation (cont.)

Figure 8

Horizontal Twist Assembly

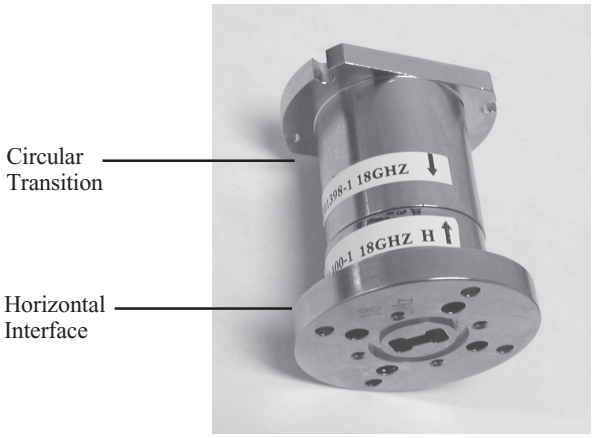
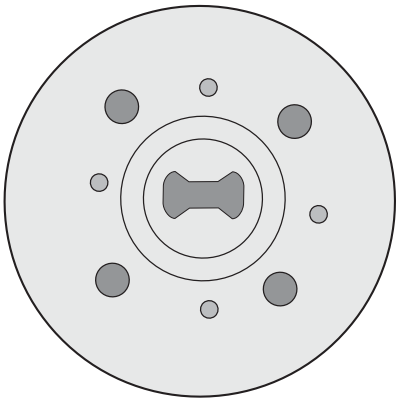


Figure 9



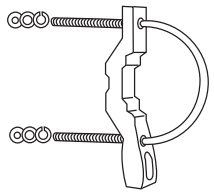
Installation (cont.)

Mounting

1. Unpack the radio antenna assembly and after inspecting it for any damage, place it aside on a clean surface.

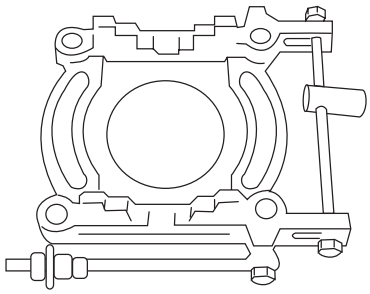
   Ensure that all required mounting hardware is enclosed:

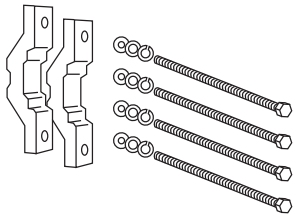
Mounting Hardware



Azimuth Adjust Plate with

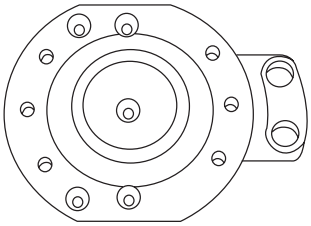
- U-Bolt
- 2 Split Lock Washers
- 2 Flat Washers
- 2 Hex Nuts

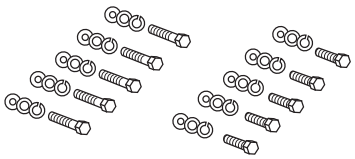




Pole Mount Plate with

- 4 Bolts
- 4 Split Lock Washers
- 4 Flat Washers
- 4 Hex Nuts





Elevation Adjustment Plate with

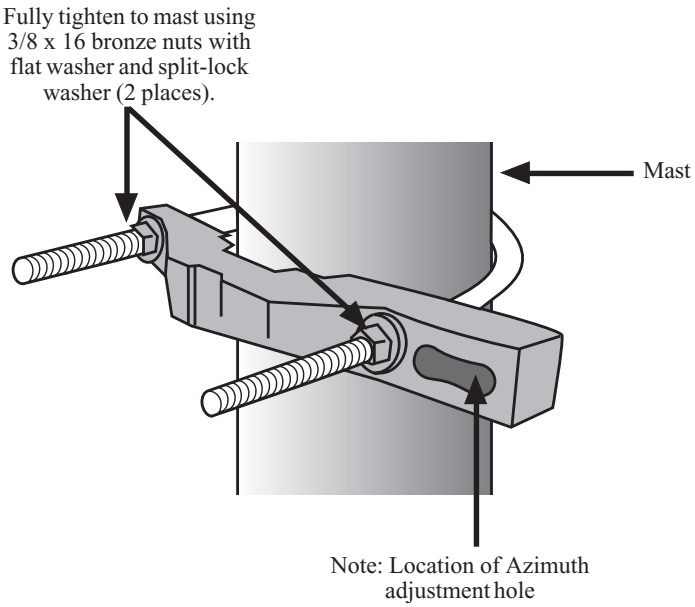
- 5 Bolts
- 5 Split Lock Washers
- 5 Flat Washers
- 5 Hex Nuts

- 4 Bolts
- 4 Nylon Washers
- 4 Lock Washers
- 4 Nuts

Installation (cont.)

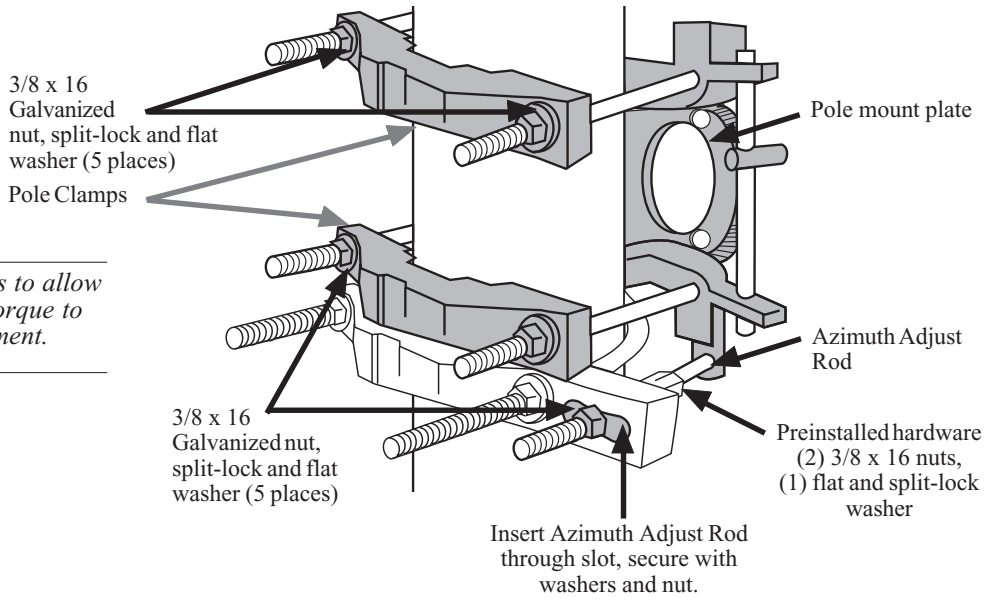
❷ Align the azimuth adjust plate with the narrow end pointing in the direction of the alignment and attach it to the mast using 3/8" U-bolt with both lock and flat washers. Secure with the bronze nuts.

Mount Azimuth Adjust Plate to Mast



❸ Attach the Pole Mount Plate to the mast using the two pole clamps and galvanized split-lock washers, flat washers and nuts. Insert the azimuth-adjust rod through the azimuth adjust hole.

Attach Pole Mount Plate to Mast



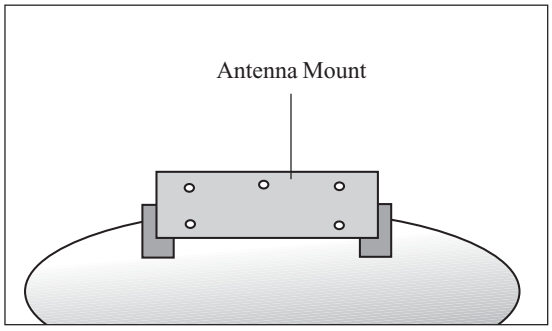
Note: *Hand tighten nuts to allow for adjusment. Torque to spec. after alignment.*

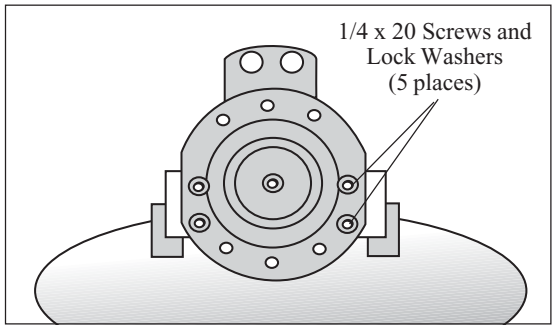
Installation (cont.)

❹ Attach the Elevation Adjustment Plate to the Antenna Mount using 5 screws and washers provided. Fully tighten the screws to the proper torque specifications.

Nominal Bolt Size	Nut Torque
1/4"	50 IN-LB
3/8"	15 FT-LB

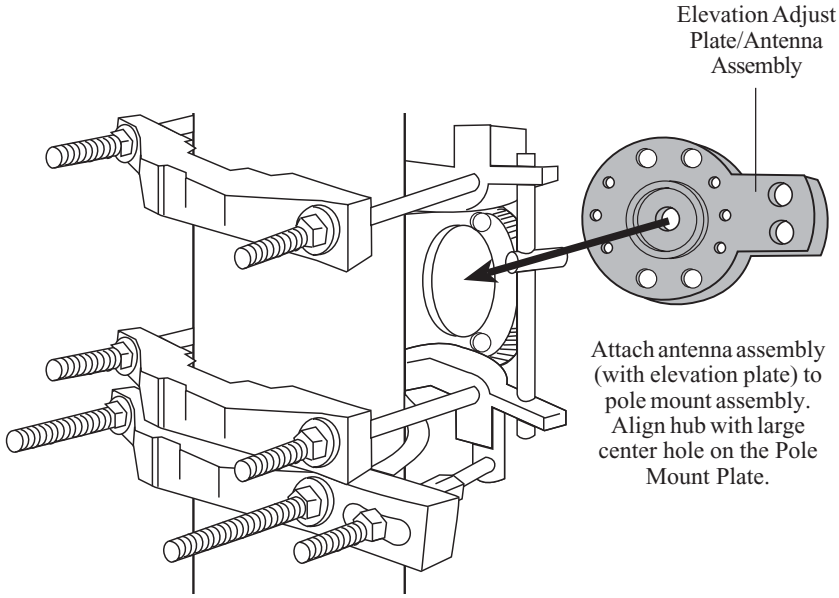
Attach Elevation Adjustment Plate to Antenna Mount





❺ Install the Antenna Assembly to the pole mount by aligning the large diameter hub on the Elevation Adjust Plate to the Pole Mount Plate.

Attach Antenna Assembly to Pole Mount Assembly

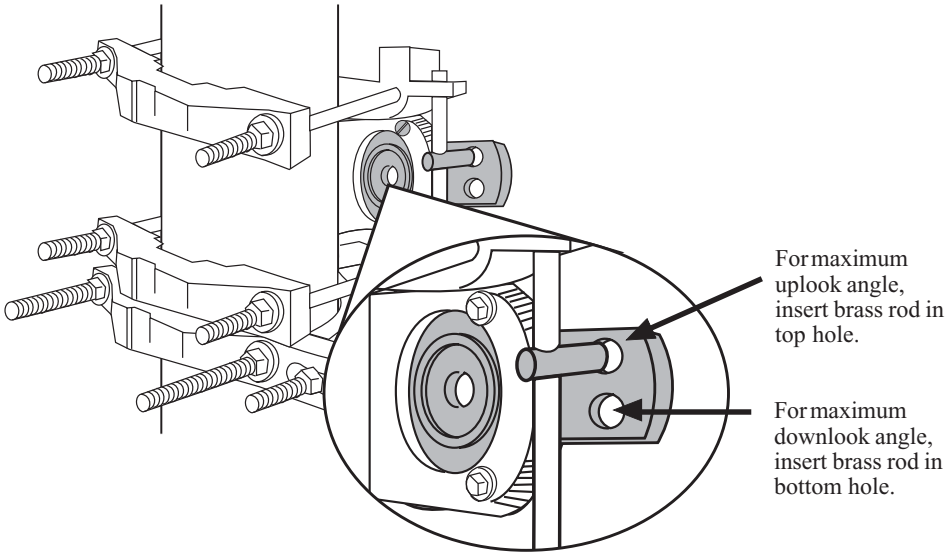


Installation (cont.)

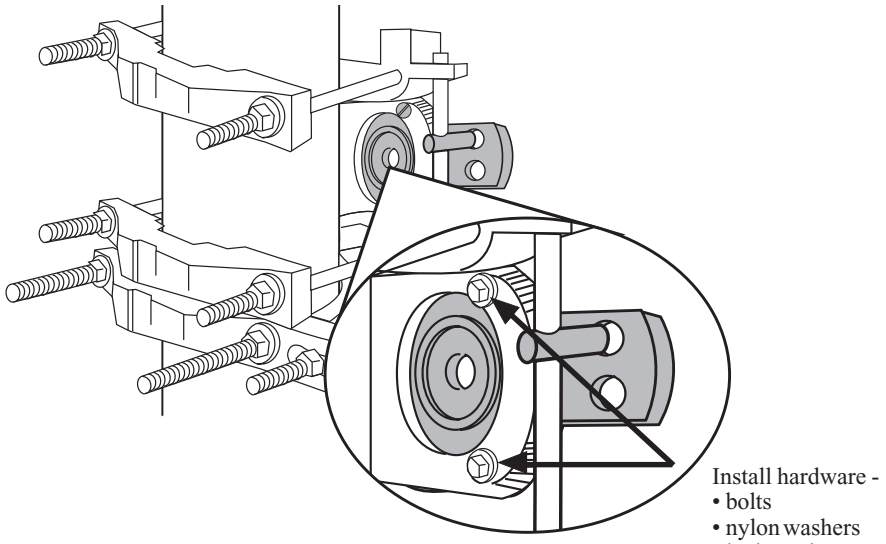
Elevation Adjust Positions

Important: Align the brass rod on the pole mount plate to the desired elevation adjustment hole.

Note: *Hand tighten the nuts at this point to allow for adjustments.*



6. After choosing maximum uplook or downlook angle, attach the two assemblies together using four hex bolts with flat washers, split washers and nylon washers.



8. Unpack ODU and inspect it for any damage. Attach it to the antenna according to desired polarization.

Note*: For 18, 23, and 26 GHz see instructions below.*

9. Remove the drain plug from the bottom of the antenna.

10. Attach a ground wire (8AWG) to the lug on the ODU and secure it to a known earth ground.

11. Attach the RG-8 with N-type connector to the ODU. Leave a 3-to-4 inch

4 SYSTEM CONFIGURATION

Contents

Initial Configuration IDU

After installation, the system must be configured for operation.

The radio can be configured in one of three ways:

- Use "Installation Reminders" with a craft terminal interface.
- Set required parameters using the basic text-driven menus with a craft terminal.
- Use the GUI interface connected to the IDU Ethernet interface.

Access to configuration is made using a HyperTerminal connection through the Craft Terminal Interface Connector located on the back of the radio. A male-to-female DB9 cable is required. Either a PC or craft terminal connection can be used to access the system for initial configuration.

If the Radio Element Manager Graphical User Interface (GUI) is to be used, the craft terminal must be used, as a minimum, to set the IP address of the IDU and to set the access mode to "Ethernet".

After the Initial Configuration, you will be able to fully configure the system using the menu commands or the GUI.

HyperTerminal Connection

Follow the steps below to access Network Management using a craft terminal.

1. Connect the serial port of a PC or terminal to the computer port of the IDU. Determine if you will be using PC COM1 or COM2.
2. Open HyperTerminal on the PC:
   Click **Start / Programs / Accessories / Communication / HyperTerminal** and double-click **HyperTerminal**.
3. In the **Connection Description** dialog box, enter a **name** (for example, “DirCOM1”—for 'direct to COM1:'). Choose an **icon** and click **OK**.
4. In the **Phone Number** dialog, go to **Connect Using** and choose **Direct to Com 1** (or the appropriate COM port.) Click **OK**.
5. In the **COM Properties** dialog, set

Bits per Second	9600
Data Bits	8
Parity	None
Stop Bits	1
Flow Control	None

   Click **OK**.
6. Choose **File / Properties**, click on **Settings**. Set **Emulation** to **VT100**. Click **OK**.

   You should now be able to communicate with the Craft Terminal Interface.
7. Choose **File / Save**, then **File / Exit**. In the future, to re-establish a connection to the radio with the same settings, double-click on the DirCOM1.ht document or open using a short cut.

Installation Reminders

Using a craft terminal connection, the Installation Reminders sequentially step through parameters for basic system configuration.

The Installation Reminders facility is an easy and methodical way to quickly setup the system for users unfamiliar with the equipment. It can be used to avoid the omission of important parameters. A complete listing of the Installation Reminders sequence follows with examples of parameters to be set. As parameters are set, they are removed from the Installation Reminders list.

1. Follow the steps 1-7 on the previous page to access the Installation Reminders on the IDU.
2. Press **Enter**. The Installation Reminders screen will appear.

Screens will now appear to remind you of steps that may be required to complete the installation. They will appear on each logon until you respond to them or dismiss them.

1. Continue with installation reminders ->
2. Go to Top Menu now, return to these reminders on next logon ->
3. Go to Top Menu now, don't present these installation reminders anymore ->

(Local, !Standby, Minor Alarm)> 1

Installation Reminders (cont.)

The following Link Parameters must be configured before the radio's antenna can be aligned and before the radio can go online: Tx Frequency, Rx Frequency.

Installation Reminders:

- Link Parameters

When the Tx frequency is entered, the Rx frequency will automatically be entered (if the IDU is connected to an ODU).

```
1. Configure Link Parameters now ->
2. Continue with installation, Remind about Link Parameters later ->
3. Continue with installation, Don't remind about Link Parameters
   anymore ->
-------------------------------------------------------------------
(Local, !Standby, !Major Alarm)> 1
Tx Frequency
Enter TX Frequency (22425 - 22975 MHz)> 22425

Rx Frequency
Enter RX Frequency (21225 - 21775 MHz)> 21225

Link Protection Type
-------------------------------------------------------------------
1. Unprotected      <—— Current value
2. Protected
-------------------------------------------------------------------
Enter Link Protection Type > 1

Note: A reboot is required for this change to take effect.
```

Continue:

```
1. Review Link Parameters again ->
2. Continue with installation ->
-------------------------------------------------------------------
(Local, !Standby, !Major Alarm)> 2
```

Installation Reminders (cont.)

Installation Reminders:

- Line Parameters

The following Line Configuration parameters should be configured to enable the radio to communicate with the line.

```
1. Configure Line Parameters now ->
2. Continue with installation, Remind about Line Parameters later ->
3. Continue with installation, Don't remind about Line Parameters
   anymore ->

(Local, !Standby, !Major Alarm)>

Line Name
Enter Line Name > Main

Line Provisioning

1. Not Equipped      <—— Current value
2. Equipped

   Enter Line Provisioning > 1
```

Line Name is optional. Line Provisioning enables and disables the LOS line input alarm.

Continue:

- Line Configuration

```
1. Review Line Parameters again ->
2. Continue with installation ->

(Local, !Standby, !Major Alarm)> 2
```

Installation Reminders (cont.)

Installation Reminders:

- System Parameters

System Configuration Parameters include a name for the radio and other optional identification fields.

All system parameters are optional.

```
1. Configure System Parameters now ->
2. Continue with installation, Remind about System Parameters later ->
3. Continue with installation, Don't remind about System Parameters
   anymore ->

(Local, !Standby, !Major Alarm)> 1

Radio Name

Enter Radio Name > West

Radio Number
Enter Radio Number > 1234

Radio Location
Enter Radio Location > Boston

Radio Contact
Enter Radio Contact > Bob Smith
```

Continue:

- System Parameters

```
Installation Review: System Configuration

1. Review System Parameters again ->
2. Continue with installation ->

(Local, !Standby, !Major Alarm> 2
```

Installation Reminders (cont.)

Installation Reminders:

- Network Management Configuration

Network Management Configuration (which runs over either Ethernet or PPP) is not required for radio operation. If you don't configure it, it will not be enabled.

Network Management setting is required when employing SNMP via Ethernet or modem.

IP Address must be set to allow Ethernet connection.

```
1. Configure Network Management (NM) Parameters now ->
2. Continue with installation, Remind about NM Parameters later ->
3. Continue with installation, Don't remind about NM Parameters
   anymore ->

(Local, !Standby, !Major Alarm)> 1

Active Interface(s)

1. None      <—— Current value
2. PPP
3. Ethernet
4. PPP & Ethernet

Enter Active Interface(s) > 3

Ethernet IP Address
Enter Ethernet IP Address > 192.168.2.1

Ethernet IP Subnet Mask
Enter Ethernet IP Subnet Mask > 255.255.255.0

Default Gateway
Enter Default Gateway > 0.0.0.0

Route to NMS

1. None (Disables traps)
2. Network Interface (NI)      <—— Current value
3. Other Radio (OR)
4. OR (Fallback to NI)
5. NI (Fallback to OR)

Enter Route to NMS > 2
NMS IP Address
Enter NMS IP Address > 192.168.1.10

SNMP Trap Community String
Enter SNMP Trap Community String > public
```

Installation Reminders (cont.)

Continue:

• Network Management Configuration

```
1. Review Network Management Parameters again ->
2. Continue with installation ->

(Local, !Standby, !Major Alarm)> 2
```

Installation Reminders:

• Power-up Mode

Initially, the radio powers up into Standby mode, and the installer turns the transmitter on manually. When it is time to commission the radio, power-up mode should be set to 'Tx On'.

```
1.Set Power-up Mode to  'Tx On ' now ->
2.Continue with installation, Remind about Power-up Mode later ->
3.Continue with installation, Don't remind about Power-up Mode
  anymore ->

(Local, !Standby, !Major Alarm)> 1
Powerup Mode changed to 'Tx On '.
```

Installation Reminders:

• Radio Mode

Activates transmitter

```
1.Turn Tx On now ->
2.Leave Tx Off ->

(Local, !TxOff, 1Major Alarm)>1
Turn Tx On (TX currently Off). Are you sure? (Y/N) [N]: y
```

Installation Complete

```
Installation Complete

1. Go to Top Menu ->

  (Local, Online Minor Alarm)> 1
Saving installation configuration changes.

Top Menu (t)

(? for help)

1.Alarms...
2.Performance...
3.Performance History ->
4.Status/Inventory ->
5.Controls ->
6.Configuration ->
7.Utilities ->
8.Log Off
```

Alignment and Operation Verification

Note: *Before beginning the alignment of the system, verify the configuration of the transmit and receive frequencies in the system software.*

Using the RS-232 craft terminal interface, go to menu t,6,1:
6,1 Link Configuration
6,1,1 Tx Frequency
6,1,2 Rx Frequency

1. Attach a DVM (Digital Voltmeter) to the RSL, BNC test port on the ODU. An RSL reading of at least 0.2V is expected. If there is a 0V reading, verify that the transmitter has been turned ON. Approximate AGC readings for given RSL values are as follows:

RSL Value	Typical AGC Reading
-20 dBm	4.5 to 4.8 Volts
-25 dBm	4.2 to 4.4 Volts
-30 dBm	3.8 to 4.1 Volts
-35 dBm	3.3 to 3.7 Volts
-40 dBm	2.9 to 3.2 Volts
-50 dBm	2.3 to 2.5 Volts
-55 dBm	1.8 to 2.2 Volts
-60 dBm	1.3 to 1.6 Volts
-65 dBm	0.8 to 1.1 Volts

2. Alignment should be done with one side of the link performing a course adjustment to maximize RSL. This should be repeated at the other end. Both Local and Remote radios should experience a rise in RSL as the alignment progresses.

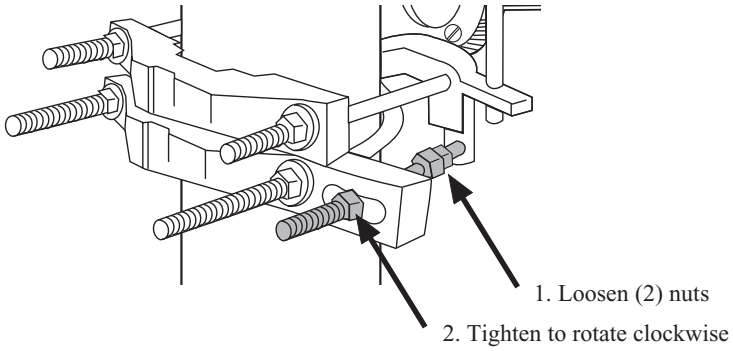
Fine Azimuth Adjustment

Important

Prior to starting the Alignment procedure, loosen the 4 bolts on the elevation adjustment assembly. Failure to loosen prior to adjustment may result in breaking the mounting hardware.

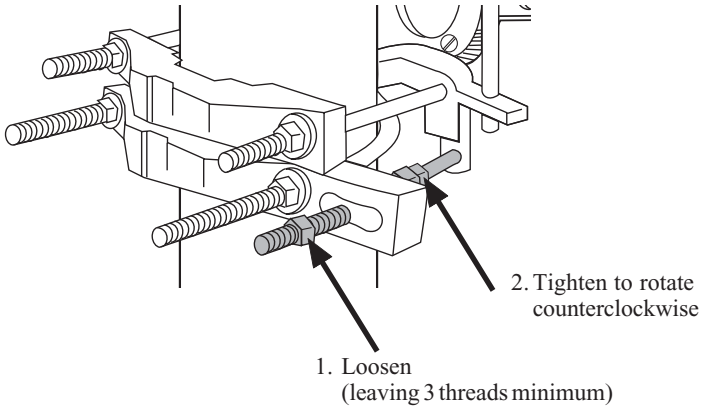
Clockwise Adjustment

Using a 9/16” wrench, loosen the (2) inside hex nuts on the Azimuth Adjustment Rod. To rotate the antenna clockwise around the pole, tighten the outer hex nut until the antenna is in the desired position.



Counterclockwise Adjustment

Using a 9/16” wrench, loosen the hex nut on the Azimuth Adjustment Rod. To rotate the antenna counterclockwise around the pole, tighten the (2) inner hex nuts on the adjustment rod until the antenna is in the desired position.



NOTE:

1. Fine Azimuth adjustment allows for +/- 10 degrees.
2. When alignment is completed, remember to fully tighten the (2) inside nuts and the (4) hex nuts on the pole mount clamps to the proper torque.

CAUTION: Be careful to tighten the pole clamps evenly to avoid a gap between the clamps and the pole.

Fine Elevation Ajustment

Uplook Adjustment

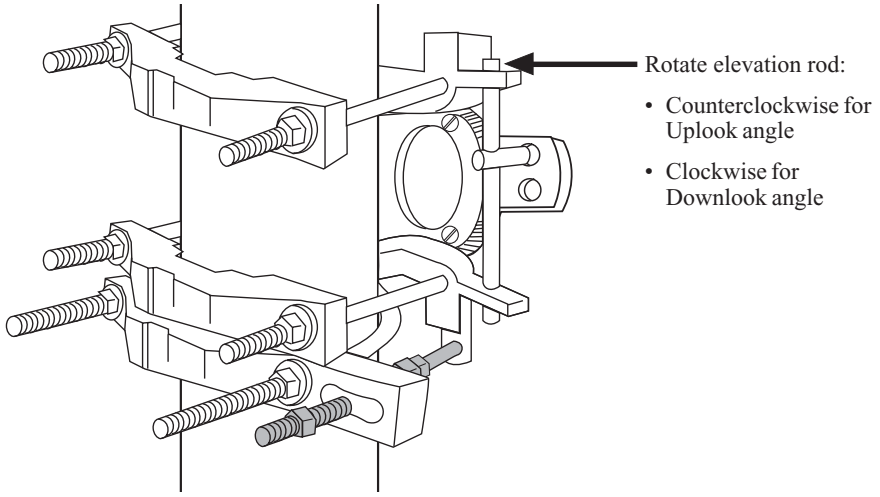
Using 1/2” wrench, rotate the Elevation Adjust Rod counterclockwise to the desired position.

Downlook Adjustment

Using 1/2” wrench, rotate the elevation adjust rod clockwise to the desired position.

NOTE:

1. *Fine elevation allows for adjustment of +/- 25 degress.*
2. *When alignment is completed, be sure to fully tighten the (4) bolts on the elevation adjustment plate to the proper torque specification.*



Alignment and Operation Cerification (cont.)

Note: Care must be taken not to align on a side lobe. A common indication will be an unstable reading on the meter.
Another indication may be a large contrast in RSL levels at each end.
A thorough Azimuth sweep will ensure proper alignment. RSL voltage will rise as it hits a side lobe, fall until it rises further on the desired signal, and then fall again until it hits the other side lobe. This repeats as one sweeps side to side.

3. Once the course alignment is complete, each end should attempt to maximize RSL by alternately making slight adjustments to the Azimuth and elevation rods (as shown on previous page).
4. Once the signal is peaked, the previously loosened nuts should be tightened. It is recommended that the RSL be monitored during the tightening of the nuts as a shift in RSL may occur. Tightening all nuts evenly as opposed to locking each one independently will help. Use the following table as a guide:

Nominal Bolt Size	Nut Torque
1/4"	50 IN-LB
3/8"	15 FT-LB

5. After alignment, take the following steps to bring the radio into operation:
   a. Check to see that the Link LED on the IDU is on continuously. This indicates both ends of the link are communicating.
   b. Verify that the Major, Minor, Maintenance, and Remote LED's on the IDU are off (not red.)
   c. Run a BER test using an external test set or the built-in BER test function. See menu command t,5,2 for details on running in integral BER test. If external equipment is used, initiate a remote loopback and apply a 155 Mb/s signal to the data port for at least 15 minutes.
   d. Verify that the Link LED is now on (green). Allow the radio to run at least 15 minutes error free.
   e. Cycle the power off/on and verify link acquisition.
   f. Record data (RSL, Tx Power, S/N) as required by installation orders.

ATPC Configuration

In many systems in an urban or congested environment, attenuation is added to the transmitter to reduce its power so as to allow reuse of the radio frequencies and minimize interference. However, in the case of a rain fade or external interference, it may be desirable to increase the transmit power by lowering the attenuation that was previously implemented.

The ATPC feature allows the user to specify a target RSL at the remote side of a radio link so that if the remote RSL falls above or below the specified target, a command will be sent from the remote end to the local end to increase or decrease the local transmit attenuation to maintain the requested remote RSL level. The maximum ATPC range that can be utilized is 30 to 40 dB as shown below.

Configuration of ATPC is performed at follows:

1. Select the local control using the craft terminal menus or the Remote Element Manager (REM) interface, also referred to as the GUI interface.
2. Go to Configuration, Link settings.

ATPC Configuration *(cont.)*

3. Set the target RSL for the remote end of the link. The default RSL's and minimum/maximum RSL's that are permitted are given below:

Modulation Type	16 QAM	32 QAM	128 QAM	192 QAM
Default Target RSL	-55 dBm	-55 dBm	-49 dBm	-47 dBm
Minimum Target RSL	-61 dBm	-61 dBm	-55 dBm	-53 dBm
Maximum Target RSL	-35 dBm	-35 dBm	-35 dBm	-35 dBm
Default Maximum Power	+19 dBm	+17 dBm	+14.5 dBm	+12.5 dBm
ATPC Attenuation	40 dB	40 dB	30 dB	30 dB

4. Set the Maximum Tx Power for the desired level. This will put a limit on the transmit power that can be used even if the remote RSL falls below its requested target. The maximum transmit power can be set by inserting the absolute power level in dBm.

   The Maximum Tx Power must be less than that specified for the ODU.

5. Set the ATPC control to Enable.

6. If desired, set the steps above for ATPC operation in the other direction of the link. Note that the ATPC may be operating in one or both directions of the link. The configuration parameters (target RSL, Maximum Tx Power) may be different in each direction of the link.

ATPC Notes

1. The enabling/disabling of the ATPC as well as changes to the ATPC configuration parameters may be changed while the radio link is on-line and ATPC is enabled.

2. If the ATPC is enabled and an operator selects a manual output power less than the current ATPC output power, the system ignores the request and shows:
   'Manual Tx Power can't be less than current Tx Power (ATPC algorithm result). It has been set to current Tx Power.'

   The value will remain at the Current Tx Power.

3. If the operator enables the ATPC (from a disabled mode) and the ATPC Maximum Tx Power (previously set) is less that the current output power, the request is allowed and the system shows:
   'Requested ATPC Max Tx Power is less than current Tx Power and might degrade performance.'

   The value changes to the operator's setting.

4. If the ATPC Maximum Tx Power is changed by user request (with ATPC enabled) and the value is less than the current ATPC determined output power, the system displays: *'Requested ATPC Max Tx Power is less than current Tx Power and might degrade performance. ATPC Max Tx Power has been set to current Tx Power.'*

5. If the ATPC Maximum Tx Power is set to a power level greater that the ODU maximum level, the following message shows:
   'Warning! Mismatch between configured and actual Tx Power.'

   Current Tx Power will be set to maximum possible.

Menu Descriptions

The Menu Functions are simply a text-based presentation of the systems' network management and configuration capabilities.

This section describes the menu functions that are used for configuration, operation and maintenance of a link.

The multi–level, menu-driven system provides access to all configuration settings, as well as to radio performance monitoring and controls. The menus are shown in this section.

When the radio terminal is first switched on and has not yet been configured, it will automatically go to Installation Reminders mode. If you want to use menu-driven commands, select 3 to go to the Top Menu.

The Minimum Settings are those which are required for operation. The Optional Settings depend upon the application of the radio link, particularly with respect to how the network management system will be used.

When the radio is first powered up and has not yet been configured, it will automatically go to the Tx Off mode with a muted transmit output. After the minimum settings are made, the radio can be activated into the Tx On mode.

Command t

The Top Menu (t) is the main menu for the link configuration and control software, and organizes the menus by topic into 9 sections. All user-accessible commands and configuration parameters are available in these 9 menus.

Note: t,0 appears only if the Link is configured as a Protected Link.

t,0 ***Protected Link Status/Performance***
Displays the protection parameters.

t,1 **Alarms**
Displays the Alarms menu. From any menu, you can also type GA (Go to Alarms Menu) and press Enter to be brought to the Alarms menu.

t,2 **Performance**
Displays the Performance menu. From any menu, you can also type GP and press Enter to be brought to the Performance menu.

t,3 **Performance History**
Displays the Performance History menu.

t,4 **Status/Inventory**
Displays the Status/Inventory menu.

t,5 **Controls**
Displays the Controls menu.

t,6 **Configuration**
Displays the Configuration menu.

t,7 ***Utilities***
Displays the Utilities menu.

t,8 **Log Off**
Ends the current menu session. If the current session is a Telnet session, the session ends.

Minimum Configuration Settings

Configuration	Command String	Description
Tx Frequency	6,1,1	Sets the transmit frequency in MHz
Rx Frequency	6,1,2	Automatically set when the Tx frequency is selected if an ODU is connected to the IDU. If there is no ODU, the Rx frequency must be set individually.
Power-up mode	6,1,4	Determines whether the radio transmitter is on or off after a power outage. Usually set to be off before the configuration settings are set. Then the mode is changed to on.
Tx Mute On/Off other	5,1	Mutes the transmitter when RF transmission is not desired. The command to turn the transmitter on will allow the radio to aquire the end of the link.

Optional Configuration Settings

Configuration	Command String	Description
Manual Tx Power	6,1,3	Default Tx power is maximum power. However the Tx power can be set directly in dBm to a lower power by 30 dB if ATPC is not enabled.
Line Provisioning	6,2,2	Selects OC.3/STM.1 to be equipped or non-equipped.
Radio Name	6,4,1	Selects an ID name for the radio.
Radio Number	6,4,2	Selects an ID number for the radio.
Radio Location	6,4,3	Selects an ID name for the radio's location.
Radio Contact	6,4,4	Selects an ID name for a contact person.
Administrator Password	6,4,5	Selects a security password to limit entry into the menu system.
NM Active Interface	6,5,1	Selects interface path for SNMP communication.
NMS IP Address	6,5,4	IP address of PC or NMS computer. Required only if downloading new software or using TFTP server.
Ethernet IP Address	6,6,1	Type in the IP address for the radio terminal. The address will be used for network management applications or when software is upgraded.
Ethernet IP Subnet Mask	6,6,2	This is the IP subnet mask of the 10BaseT Ethernet interface.
PPP Configuration	6,7	Defines the environment for a modem interface when working with PPP.
Alarm Configuration	6,9,x	Configures a specific alarm: • Defines alarm action for SNMP A – Alarm display S – Set trap C – Clear trap • Activates up to 5 output relays • Sets relays for NC or NO • Sets thresholds (if applicable)

Menu Commands

t,0 Protected Link Status/Performance

Displays protection parameters for all four (4) radio terminals in a Protected Link application, and appears only if the link is configured as a protected link.

Please refer to the Protected Link Supplement (Appendix F) for detailed information regarding Protected Link Configuration and Operation.

t,1 Alarms

Displays current and latched alarms for the Local radio and its remote Peer, if available. Latched alarms are defined as alarms that were set in the past but are not currently active. Latched alarms may be cleared from this menu.

Radio Name

Displays the name of the Local radio and its Remote peer, if available.

Individual Alarm Listing

Multiple alarms may be listed in this section. Major alarms are tagged with an exclamation point (!). Latched alarms are indented two columns and surrounded by parentheses. You may choose "0" to clear all latched alarms.

Since Reset

The amount of time that has elapsed since the latched alarms were last reset, or the system was booted. The time displayed is in days, hours, minutes and seconds (Days: Hours:Minutes:Seconds).

1,0 Latched Alarms Reset

This command (t,1,1,0) is used to reset latched alarms. This will also cause the "Since Reset" interval to be reset to zero.

t,2 Current Link Performance

Displays current values for all listed parameters, as well as historical information gathered over the Custom Interval period displayed below. Once the Custom Interval is reset, each parameter value will be reset to its Current Value and the Custom Interval will be reset to zero.

Radio Name
Displays the name of the Local radio and its Remote peer, if available.

Tx Power (dBm)
Displays the transmit power, dBm, to the nearest 0.1 dB.

RSL (dBm) (Min/Max)
The Received Signal Level in dBm as calculated by the radio terminal. The minimum and maximum RSL during the Custom Interval period is also displayed in parentheses. Values represented are to the nearest 1.0 dB.

Estimated BER

Estimated Bit Error Rate of the radio link.

Sync Losses

The number of modem synchronization losses that have occurred during the Custom Interval period.

G.826 EFS (EFSR)

ES ..... Error free seconds - Seconds with no measured data errors.

(EFSR) ..... Error free second ratio - The ratio of EFS to total seconds during a Custom Interval period.

G.826 ES (ESR)

ES ..... Errored seconds-The number of seconds with one or more measured errors per second.

(ESR) ..... Ratio of ES to total seconds in available time during a Custom Interval period.

G.826 SES (SESR)

SES ..... Severely errored seconds - A one-second period which contains >30% errored blocks. An Errored Block is a block in which one or more bits are in error.

(SESR) ..... The ratio of SES to total seconds in available time during Custom Interval period.

G.826 SEFS (SEFSR)

(SEFS)..... Count of seconds with one or more SEF (Severely Errored Frame) defects. An SEF is the occurance of 4 consecutive errored frame alignment words (A1/A2 bytes). (As defined in RFC 2558). SEFS is only displayed when the SONET/SDH framing option is equipped.

(SEFSR) ..... The ratio of SEFS to total seconds in available time during a Custom Interval period.

t,2 Current Link Performance (cont.)

G.826 UAS (UAS/totS)

UAS ..... A period of unavailable time begins at the onset of 10 consecutive SES events. These ten seconds are considered to be part of the unavailable time. Available time begins at the onset of ten consecutive non-SES events. These 10 seconds are considered to be part of available time.

(UAS/totS) .. The ratio of UAS to total seconds during a Custom Interval period.

B.826 BBE (BBER)

BBE ..... Background Block Errors. Count of errored blocks, (blocks that have one or more errored bits) that were received in seconds that were not SES (severely errored seconds). Gives an indication of line quality during the "background" in between major error events. BBE is only displayed when the SONET/SDH framing option is selected.

(BBER) ..... The ratio of BBE to total seconds during a Custom Interval period.

Line Status

Current status of the tributary line. The tributary can be assigned as “equipped” or “unequipped”. If equipped, an alarm (LOS) will occur if the line input is removed. If unequipped, the above alarm is disabled but minor alarm, "unexpected signal (US)" will occur if a line input exists.

ODU Temp. (Min/Max)

The current ODU temperature, as well as the minimum and maximum temperatures observed during the custom interval.

IDU Temp. (Min/Max)

The current IDU temperature, as well as the minimum and maximum temperatures observed during the custom interval.

Uptime

The amount of time since the system was last booted.

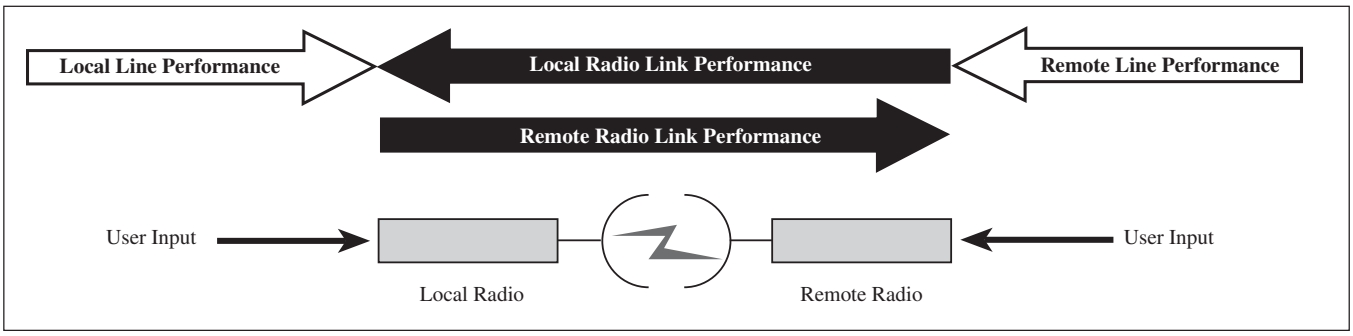
Custom Interval

The amount of time since the custom interval was last reset.

Reset Custom Interval

The command (t,2,0) will reset the custom interval, and also reset all historical information displayed in this menu.

Definition of Line and Link Performance



t,2,1

Current Line Performance (cont.)

Current Line Performance appears only if the link is equipped with the SONET/SDH framing option with SOH.

Radio Name
This item displays the name of the Local radio and its Remote peer, if available.

Line Status
Current status of the tributary line. The line can be assigned as "equipped" or "unequipped."

Line Loopback
Tests the line at various points. External equipment sends a pattern and monitors its received channel. If the sent pattern is identical to the received pattern, the loop is confirmed.

Line Type
Displays the line type.

G.826 EFS (EFSR)
EFS ..... Error free seconds - Seconds with no measured data errors.

(EFSR) Error free second ratio - The ratio of EFS to total seconds during Custom Interval period.

G.826 ES (ESR)
ES ..... Errored seconds - The number of seconds with one or more measured errors per second.

(ESR) ..... Ratio of ES to total seconds in available time during a Custom Interval period.

G.826 SES (SESR)
G.826 SES .. Severely errored seconds - A one-second period which contains >30% errored blocks. An Errored Block is a block in which one or more bits are in error.

(SESR) ..... Ratio of SES to total seconds in available time during a Custom Interval period.

G.826 SEFS (SEFSR)
SEFS ..... Count of seconds with one or more SEF (Severely Errored Frame) defects. An SEF is the occurance of 4 consecutive errored frame alignment words (A1/A2 bytes). (As defined in RFC 2558). SEFS is only displayed when the SONET/SDH framing option is equipped.

(SEFSR) ..... The ratio of SEFS to tal seconds in available time during a Custom Interval period.

G.826 UAS (UAS/totS)
UAS ..... A period of unavailable time begins at the onset of 10 consecutive SES events. These ten seconds are considered to be part of the unavailable time. Available time begins at the onset of ten consecutive non-SES events. These 10 seconds are considered to be part of available time.

(UAS/totS) . Ratio of UAS to total seconds during a Custom Interval period.

B.826 BBE (BBER)
BBE ..... Background Block Errors. Count of errored blocks, (blocks that have one or more errored bits) that were received in seconds that were not SES (severely errored seconds). Gives an indication of line quality during the "background" in between major error events.

(BBER) ..... The rate of BBE to total seconds during a Custom Interval period.

t,2,1 Current Line Performance (cont.)

Wayside Status
Current status of the wayside line.

Wayside Loopback
Tests the wayside.

Wayside Type
Displays the type of wayside line.

Custom Interval
Command 2,0 will reset a Custom Interval to 0.

t,3 Performance History

Line Uptime appears only if the link is SOH equipped.

Link Uptime Totals
Displays the Link Uptime Totals menu.

Line Uptime Totals
Displays the Line Uptime Totals menu.

t,3,1 Link Uptime Totals

This menu is similar to the Performance menu, except no current values are displayed. The Uptime Totals represent cumulative totals for each listed value since the time of initial link boot up (values are displayed from the last time the radio was booted up to the present time).

Radio Name
Display the name of the local radio and its remote peer, if available.

RSL (dBm) (Min/Max)
The Received Signal Level in dBm as calculated by the radio terminal. The minimum and maximum RSL during the uptime period is also displayed in parentheses.

Sync Losses
The number of modem synchronization losses that have occurred during the uptime period.

Descriptions for EFS, ES, SES and UAS, SEFS and BBE found with menu t,2.

G.826 EFS (EFSR)
G.826 ES (ESR)
G.826 SES (SESR)
G.826 UAS (UAS/totS)
G.826 SEFS (SEFSR)
G.826 BBE (BBER)

ODU Temp. (Min/Max)
IDU Temp. (Min/Max)
Uptime

t,3,2 Line Uptime Totals

Line Uptime Totals appears only if the link is equipped with the SONET/SDH framing option (SOH).

Descriptions for EFS, ES, SES, UAS, SEFS and BBE are found with menu t,2.

Radio Name

Displays the name of the local radio and its remote peer, if available.

G.826 EFS (EFSR)
G.826 ES (ESR)
G.826 SES (SESR)
G.826 UAS (UAS/totS)
G.826 SEFS (SEFSR)
G.826 BBE (BBER)
Uptime

t,4 Status/Inventory

Link Inventory
Displays the Link Inventory menu.

Boot Status
Displays the Boot Status menu.

Firmware Status
Displays the release numbers and dates of the flash-memory-resident firmware modules that are loaded into FPGAs during system initialization.

t,4,1 *Link Inventory*

Radio Name
Displays a radio name that may be entered by an installer during the radio configuration.

Radio Number
Displays a radio identification number that may be entered by an installer during the radio configuration.

Radio Location
A parameter that may be used to identify the physical location of the radio.

Radio Contact
A parameter that may be used to identify the person who should be contacted in case of trouble with this radio.

Radio IP Address
Main IP address of this radio. The main IP address of the radio is considered to be the IP address of the Ethernet interface.

ODU Model
ODU model name.

ODU Hardware Version / SN
Hardware version and serial number of the ODU.

ODU Software Version
Version of software that is currently running in the ODU.

Frequency Plan
A brief description of the frequency plan of the ODU showing basic frequency band, channel bandwidth, Tx/Rx frequency spacing, and whether the terminal is configured to operate with an FCC or ETSI frequency plan.

Tx Frequency Range
Permitted transmission frequency range of the ODU. The range is set by the waveguide diplexer in the ODU.

t,4,1

Link Inventory (cont.)

Rx Frequency Range
Permitted receive frequency range of the ODU. The range is set by the waveguide diplexer in the ODU.

IDU Model
IDU model name.

IDU Hardware Version / SN
Hardware version and serial number of the IDU.

IDU Software Version
Version of software that is currently running in the IDU.

LIM Model
Line Interface Module (LIM) that is currently installed.

LIM Version / SN
Current hardware version and serial number of the Line Interface Module.

t,4,2

Boot Status

Radio Name
Displays a radio name that may be entered by an installer during the radio configuration.

Boot Reason
Displays the reason the radio was last booted.

Image Booted
Displays which image the radio was booted from (Primary or Secondary).

IDU Boot SW Version
Displays the version number of the boot code in the firmware of the radio.

Current Image SW Version
Displays the version number of the Operational Code (OC) that the radio is currently running.

Primary Image Version
Displays the version number of the Operational Code (OC) that is loaded into the Primary image area.

Primary Image CRC
Displays the CRC of the Operational Code that is loaded into the Primary image area.

Primary Image Status
Displays the Status of the Operational Code that is loaded into the Primary image area. Possible status values include “OK” and “Bad CRC”.

Secondary Image Version
Displays the version number of the Operational Code (OC) that is loaded into the Secondary image area.

Secondary Image CRC
Displays the CRC of the Operational Code that is loaded into the Secondary image area.

Secondary Image Status
Displays the Status of the Operational Code that is loaded into the Secondary image area. Possible status values include “OK” and “Bad CRC”.

t,4,3

Firmware Status

Displays the release numbers and dates of the flash-memory-resident firmware modules that are loaded into FPGAs during system initialization. May be used by factory for future determination of upgrades required, and compatibility with other ODUs.

t,5 Controls

Transmit (Tx) Mute On/Off

Allows the user to toggle the transmitter from On to Off. The current Tx mode is also displayed in this item.

Integral BERT

Displays the radio's menu for its built-in test function for measuring BER (Bit Error Rate).

Radio Loopback

Displays the menu to loopback the payload in a local or remote mode.

Continuous Wave (CW)

Removes modulation on the transmit carrier (for test) and transmits in continuous wave (CW).

Wayside

Displays the menu to loopback a wayside channel in a local or remote mode.

t,5,1

Transmit Mute On/Off

Transmit (Tx) Mute On/Off

Allows the user to toggle the transmitter from On to Off. The current Tx mode is also displayed in this item.

t,5,2

Integral BERT

Elapsed BERT Time

Displays the elapsed time of BER Test.

Local Acquisition Time

Time that the Remote to Local BER Test has been running. Time begins with the start of BER Test or if acquisition is lost and then reacquired.

Remote Acquisition Time

Time that the Local to Remote BER Test has been running. Time begins with the start of BER Test or if acquisition is lost and then reacquired.

Local Coded BER

The measured Bit Error Rate for the transmission channel in the remote to local direction.

Remote Coded BER

The measured Bit Error Rate (BER) for the transmission channel in the local to remote direction.

t,5,2,1

Start BERT

Start BERT

Starts the integral Bit Error Rate Tester (BERT).

Note that the BER Test uses the full 155 Mbit/s payload and will disrupt traffice if in use.

t,5,2,2

Reset BERT

Resets the integral Bit Error Rate Tester (BERT). All values are reset to zero.

t,5,2,3

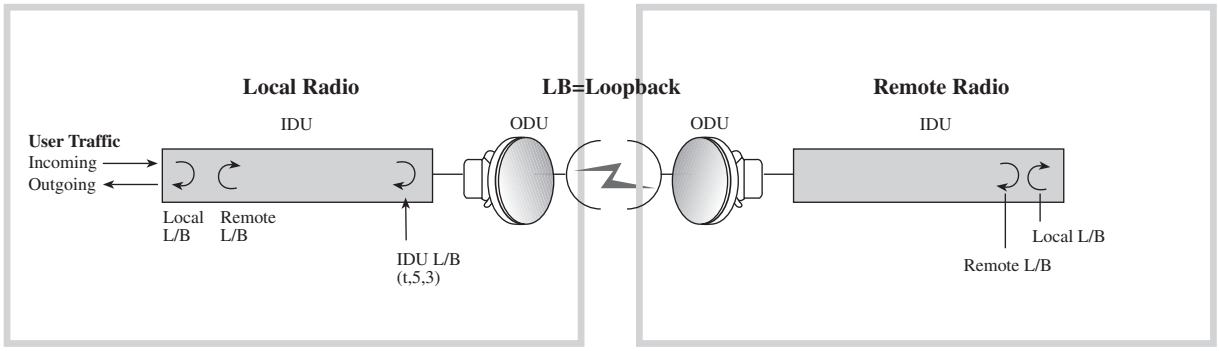
Stop BERT

Stops the integral Bit Error Rate Tester (BERT).

t,5,3

IDU Loopback

Displays the menu to loopback the payload at the output of the IDU in a local mode only. A remote IDU is not allowed since it would break the management channel and not allow the loopback to reset to normal.



t,5,3,1

IDU Loopback State

Allows the user to select an IF loopback mode for the local IDU.

t,5,4

Continuous Wave

Enables/Disables modulation on the transmit carrier (for test) and transmits in continuous wave (CW).

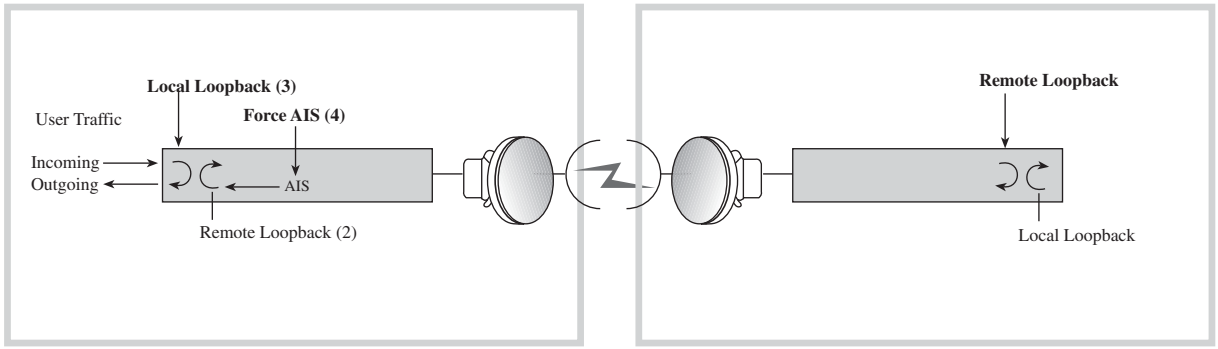
t,5,5

Wayside Loopback/Controls

Allows the user to select a loopback mode for the Local Radio Line, Remote Radio Line, Wayside Local and Wayside Remote channels.

t,5,5,1,x

Line Loopback/Control (Local Radio)

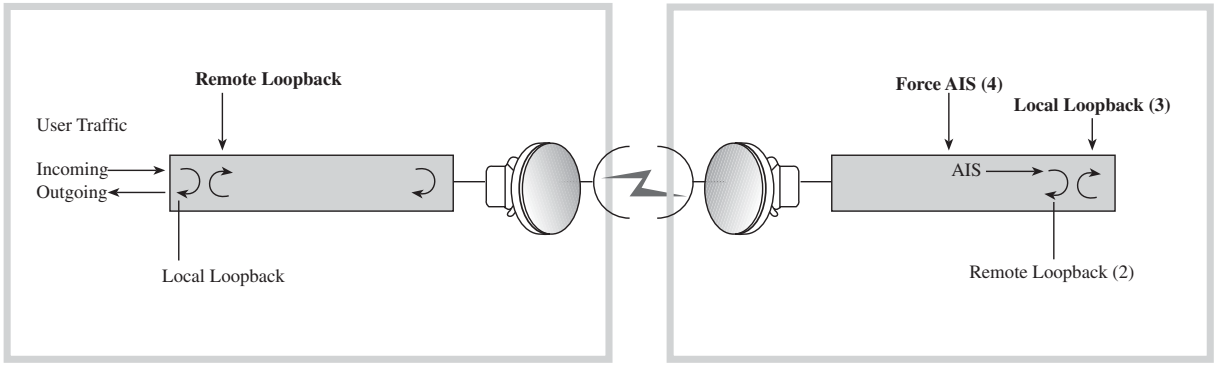


X = 1. No Loopback
2. Remote Loopback (Back to Radio)
3. Local Loopback (Back to User)
*4. Force AIS (to local user)**

**Appears only if link is SOH equipped*

t,5,5,2,x

Line Loopback/Control (Remote Radio)

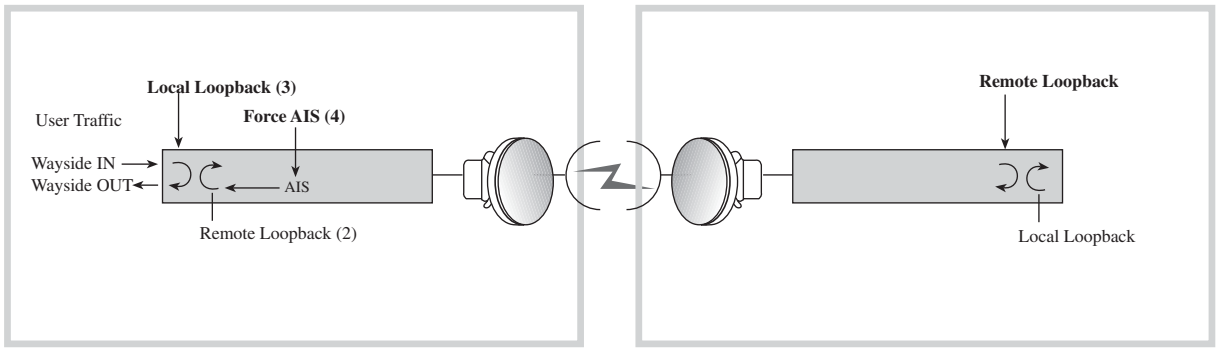


X = 1. No Loopback
2. Remote Loopback (Back to Radio)
3. Local Loopback (Back to User)
*4. Force AIS (to local user)**

**Appears only if link is SOH equipped.*

t,5,5,3,x

Wayside Loopback/Control (Local Radio)*

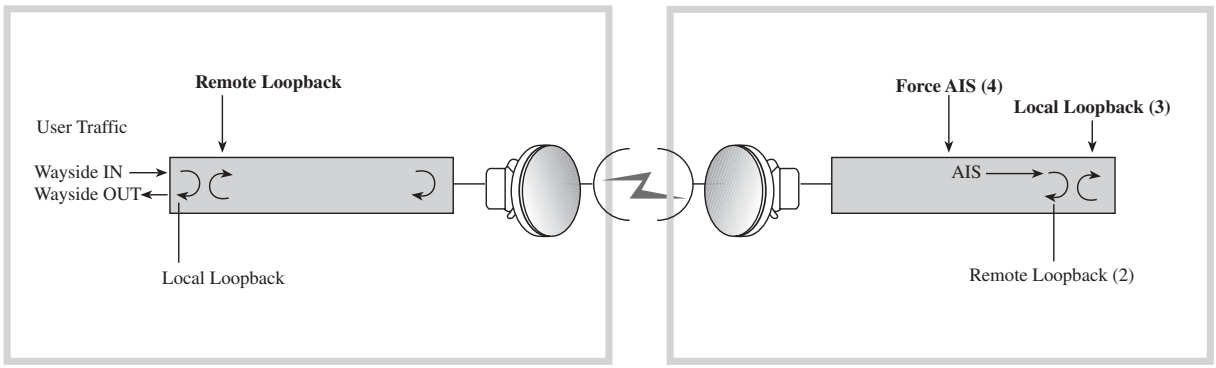


X = 1. No Loopback
2. Remote Loopback (Back to Radio)
3. Local Loopback (Back to User)
4. Force AIS (to local user)

**Appears only if link is SOH equipped*

t,5,5,4,x

Wayside Loopback/Control (Remote Radio)*



X = 1. No Loopback
2. Remote Loopback (Back to Radio)
3. Local Loopback (Back to User)
4. Force AIS (to local user)

**Appears only if link is SOH equipped.*

t,6 Configuration

t,6,1 Link

Displays the Link Configuration menu.

---

t,6,1,1 Tx Frequency (MHz)

Selects the transmit frequency in MHz. After the Tx frequency is set, the Rx frequency is automatically set if the IDU is connected to an ODU.

---

t,6,1,2 Rx Frequency (MHz)

Selects the receive frequency in MHz.

---

t,6,1,3 Manual Tx Power

Allows the user to set the Tx power level, (in dBm) if ATPC is disabled.
A 30 dB range is permitted from maximum output power.

---

t,6,1,4 Power-Up Mode

Selects the (transmit mute) mode that the radio will go to when powered up. Permitted values are “Tx Off” and “Tx On”.

---

t,6,1,5 ATPC (Automatic Transmit Power Control)

Enable if the receive side Target ATPC RSL is expected to perform.

In Unprotected Link operation, ATPC can be enabled in either the local or remote radio terminals.

Protected Link operation, ATPC should be enabled in all 4 radio terminals.

---

t,6,1,6 Far End Target ATPC RSL (dBm)

Threshold Level (in dBm) that the receive radio will tolerate before calling for ATPC (Automatic Transmit Power Control).

In Protected Link Operation the same RSL target should be set for both primary and secondary from the same side. Note that only the active radio will support the desired target level, and the non-active radio will have 6dB less for secondary and more for primary.

---

t,6,1,7 ATPC Maximum Tx Power

Allows the user to set the desired maximum transmit power (in dBm) for ATPC.

---

t,6,1,8 Link Protection Type

Allows user to select Protected or Unprotected link.

Note that after changing the protected/unprotected mode, the IDU must be rebooted.

t,6,2

Line Configuration

t,6,2,1

Line Name

Allows the user to define a name for the line input from the user.

t,6,2,2

Line Provisioning

Wayside and Service Values appear only if the link is SOH equipped.

Allows the user to decide whether or not to provision the tributary line. Permitted values are “Not Equipped” and “Equipped”. When not equipped, alarms on the tributary are not reported.

Line Type

Wayside Name
Wayside Provisioning
Wayside Channel Type
Wayside Encoding
Wayside Equalization
Service Channel A Provisioning
Service Channel A Interface
Service Channel B Provisioning
Service Channel B Interface

t,6,3

SOH Configuration

t,6,3,1 **SOH Functions**	Enables and disables the Section Overhead (SOH) functions. If set to "Enable" the SOH interfaces become capable of examining bytes in (and inserting bytes in) the SONET/SDH SOH. If set to "Disable", all read and write access to the SOH is denied, and the interfaces become completely transparent.
t,6,3,2 **Insert B1 BIP-8 bytes**	If set to "Enable" (and if "SOH Functions" is also enabled), line and link interfaces check received B1 bytes against the corresponding received frame, and determine if an error has occured in the received frame. The B1 bytes are then replaced with new, regenerated bytes and transmitted in the direction of the line and radio link.
t,6,3,3 **Propagate AIS if LOS Detected**	Enable or disable the insertion of AIS (Alarm Indication Signal) at the user interface output (remote end) in response to an Loss of Signal (LOS) indication from the incoming line (local end).
t,6,3,4 **Propogate AIS if LOF Detected**	Enable or disable the insertion of AIS (Alarm Indication Signal) at the user interface output (remote end) in response to an Loss of Frame (LOF) indication from the incoming line (local end). Also will enable or disable the insertion of AIS at the user interface output (local end) in response to an LOF indication from the incoming radio link (local end).

t,6,4 **System Configuration**	Allows the operator to configure the system.
t,6,4,1 **Radio Name**	Allows the user to define a name for the radio.
t,6,4,2 **Radio Number**	Allows the user to set a number for the radio.
t,6,4,3 **Radio Location**	Allows the user to set a location for the radio.
t,6,4,4 **Radio Contact**	Allows the user to set a contact person for the radio.
t,6,4,5 **Administrator Password**	Highest level password. Allows the user to set and change the password for the radio and perform all functions. When set, this password must be entered upon logging into the radio, before the Top Menu is displayed.
t,6,4,6 **Operator Password**	Second level password. Allows the users to perform all functions except change the password.
t,6,4,7 **Viewer Password**	Lowest level password. The viewer status allows monitoring of the link performance, but does not allow any changing of parameters (read only).
t,6,4,8 **Async Service Channel Baud Rate**	Used to set the auxilliary asynchonous service channel to operate at baud rates between 1200 bps to 19.2 Kbps.

t,6,5

Network Management Configuration

Allows the operation to establish and change the network management parameters.

t,6,5,1

Active Interfaces

Allows the user to select which TCP/IP network interfaces will be used. The choices are:

- None ..... This option disables TCP/IP network access to this radio. A craft terminal must be used for Network Management access if TCP/IP is disabled.
- PPP ..... This option allows network access only via the dial-up PPP modem connection.
- *Ethernet ... This option allows network access only via the 10BaseT Ethernet adapter.*
- Both ..... This option allows network access via both PPP and Ethernet and additionally permits packet routing between the two interfaces.

t,6,5,2

Default Gateway

If the NMS resides on a different subnet than the radio, then the Default Gateway is used as the IP address of the network router or gateway that can provide connectivity to the NMS. If the NMS resides on the same subnet as the radio, then leave this field set to "0.0.0.0".

t,6,5,3

Route to NMS

Controls the way that the radio accesses the NMS. Each option is described below.

- None (Disables all traps) – This option means that the radio does not have access to an NMS. No SNMP traps will be delivered.
- Via Network Interface – This option means that SNMP traps will be delivered via the local network interface.
- Via Remote Radio – This option means that SNMP traps will be delivered via the remote radio's network interface. If the RF link to the remote radio is not available, traps will not be delivered.
- Via Remote Radio (Fallback to Network Interface) – This option means that SNMP traps will be delivered via the remote radio's network interface. If the RF link to the remote radio is not available, traps will be delivered via the local network interface.

t,6,5,4

NMS IP Address

The IP address of the NMS (Network Management Station) that will be communicating with the radio.

t,6,5,5 **Trap Community String**	The SNMP Community identifier that will be used when traps are delivered to the NMS.
t,6,5,6 **Cold Start Traps**	Sends standard SNMP Traps at start-up if enabled.
t,6,5,7 **Authentication Failure Traps**	Sends an alert when an invalid password is used to access the radio.
t,6,5,8 **Heartbeat Trap Frequency**	A manually set trap (3600 sec will send a heartbeat every hour) that tells NMS that the radio is still alive. Set in seconds to determine the interval between heartbeat traps.
t,6,5,9 **TFTP Default Directory Path**	The string that will be added to the front of file names used in all TFTP transfer requests made by the radio. For example, if the TFTP Server is pointing at the directory "/download", and the TFTP Default Directory Path is "radio", and the user attempts to download"moc11.bnc" to the radio, the radio's request to the TFTP server will be for"radio/moc11.bnc", and the serverwill access "/download/radio/moc11.bnc" if it exists. This mechanism canbe used to have different radios (or categories of radios) point at different download directories. It can also be used when a TFTP server is incapable of pointing to anything other than the root directory.
t,6,5,10 **Static Routes**	This menu item gives access to a facility for maintaining a list of static routes that will always be added to the radio's IP routing table. An IP routing table for a radio (or other IP host) describes all the IP subnets and hosts that the radio (or host) "knows" about, and, for each subnet, points to the interface (Ethernet, PPP or radio overhead) to use to get to that subnet. Some entries are added to the table automatically, but "static" routes are added by the user to facilitate routing that the radio otherwise would not "know" how to do. A white paper is available that describes this and other advanced routing topics.

t,6,6

Ethernet Configuration

t,6,6,1

Ethernet IP Address

The IP address of the 10BaseT Ethernet interface used by this radio terminal.

Note: When the IP address is changed, it immediately takes effect without loss of traffic and does not require rebooting the IDU.

t,6,6,2

Ethernet IP Subnet Mask

The IP Subnet Mask of the 10BaseT Ethernet interface.

t,6,7

PPP Configuration

t,6,7,1

Maximum Output Queue Size (K bytes)

Maximum number of kilobytes of IP packets that will be buffered for delivery to the PPP peer. This buffer is used to hold packets that are sent while PPP dialing and option negotiation are in progress. The default is 32 K bytes.

t,6,7,2

Modem Baud Rate

Baud rate at which the radio will talk to the modem. This is not necessarily the same speed that the modem will transmit and receive from the remote modem. The actual transmission speed can be affected by telephone line conditions.

t,6,7,3

Modem Initialization String

The Modem Initialization String is sent to the modem once per minute, with a Carriage Return (<CR>, ASCII 0x0D) appended. This will typically be an "AT" style modem command string that sets any desired options on the modem. The Modem Initialization String is transmitted at the configured Modem Baud Rate.

t,6,7,4

Remote Phone Number

Telephone number that is dialed when attempting to connect to the NMS. This string has "ATD" appended to it (standard Hayes-compatible modem dial command) and has a <CR> appended to it before it is sent to the modem. Legal characters in this string include "T" (select Touch Tone dialing), "P" (select Pulse dialing), "0" – "9", "#", "*" (standard DTMF/Touch Tone digits), "," (two second pause between digits), "!" (wait for the calling card number entry tone), plus any additional dialing commands that your modem may permit. See the documentation that came with your modem for more details.

t,6,7,5

Maximum Dial Retries

The number of times the radio will attempt a PPP connection with the NMS before "giving up". If a connection cannot be established in the specified number of attempts, all queued TCP/IP packets are discarded, and the MIB error counters are incremented. The next packet queued for delivery to PPP will start the retry process over again.

t,6,7,6

CHAT Script

A list of send/receive commands, separated by commas (","). Certain "special" characters can be used in the various <string> arguments, to specify one of the special characters, use a backslash ("\") followed by one of these characters – "\n" is a new line (linefeed, ASCII 0x0A), "\r" is a carriage return (CR, ASCII 0x0D), "\t" is a tab (TAB, ASCII 0x08). Legal commands are as follows:

- **input <timeout>, <string>** - Wait for <string> to be received from the remote computer before continuing script. If <string> is not seen before <timeout> seconds have elapsed, the script and the dialing attempt are considered to have failed.
- **output <string>** - Send <string> to the remote computer.
- **echo <string>** - echo <string> to the radio console. Use for script debugging only.
- **wait <seconds>** - waits for the specified number of seconds to elapse before continuing chat script.

t,6,7,7

Authentication

Possible values are:

- None (don't authenticate remote users in either direction).
- CHAP (Use the Challenge Handshake Authentication Protocol for inbound and outbound user authentication). This is the default.

t,6,7,8 **Local CHAP Username**	Username that is used to authenticate inbound callers, in conjunction with Local CHAP Secret Password.
t,6,7,9 **Local CHAP Secret**	Secret Password that is used to authenticate inbound callers, in conjunction with Local CHAP Username.
t,6,7,10 **Remote CHAP User Name**	Username that is used to authenticate with the router during an outbound call, in conjunction with Remote CHAP Secret.
t,6,7,11 **Remote CHAP Secret**	Secret Password that is used to authenticate with the router during an outbound call, in conjunction with Remote CHAP Username.
t,6,7,12 **PPP IP Address**	IP address of the dial-up PPP interface.
t,6,7,13 **PPP IP Subnet Mask**	IP Subnet Mask of the dial-up PPP interface.
t,6,7,14 **Link Inactivity Timeout**	The length of time, in seconds, that the PPP link is allowed to be idle (no packets sent or received) before the connection is terminated.
t,6,7,15 **PPP Console Logging**	Controls whether PPP debugging messages are displayed on the radio console. Use at the direction of Microwave Networks Technical Support only.
t,6,8 **Overhead IP Configuration**	Specify the Overhead SOH Interface type (numbered or unnumbered).

t,6,9

Alarm Configuration

Alarm Configuration

#	Alarm	Action	Relays	NC/NO	Th1	Th2
1.	Power-Up Boot	ASC	.....			
2.	User-requested Reboot	ASC	.....			
3.	Fatal Error Reboot	ASC	.....			
4.	Image CRC failure	ASC	.....			
5.	IDU Hwr Conflict	ASC	.....			
6.	ODU Hwr/Swr Conflict	ASC	.....			
7.	Peer Swr Conflict	ASC	.....			
8.	Configuration Error	ASC	.....			
9.	IDU Hardware Failure	ASC	.....			
10.	ODU Hardware Failure	ASC	.....			
11.	Fan Failure	ASC	.....			
12.	ODU Current Failure	ASC	.....			
13.	Supply Voltage Failure	ASC	.....			
14.	Tx Failure	ASC	.....			
15.	Rx Failure	ASC	.....			
16.	FE Rx Failure	ASC	.....			
17.	Tx Muted	ASC	.....			
18.	Maintenance Mode	ASC	.....			
19.	Receive Protection Switch	ASC	.....			
20.	Transmit Protection Switch	ASC	.....			
21.	BER Threshold 1	ASC	.....	(—)	0	0
22.	BER Threshold 2	ASC	.....	(—)	0	0
23.	RSL Threshold	ASC	.....		0	
24.	RSL Mismatch Threshold	ASC	.....		0	
25.	IDU Temperature Threshold	ASC	.....		0	0
26.	ODU Temperature Threshold	ASC	.....		0	0
27.	ODU Telemetry Failure	ASC	.....			
28.	Peer Comm Failure	ASC	.....			
29.	NM Comm Failure	ASC	.....			
30.	Login Alarm	ASC	.....			
31.	Test Alarm	ASC	.....			
32.	Misc Maj	ASC	.....			
33.	Misc Min	ASC	.....			
34.	Line LOS	ASC	.....			
35.	Wayside A LOS	ASC	.....			
36.	Line UnexpSignal	ASC	.....			
37.	Wayside A UnexpSignal	ASC	.....			
38.	Line Loopback	ASC	.....			
39.	Wayside A Loopback	ASC	.....			
40.	Wayside A AIS	ASC	.....			
41.	Line LOF	ASC	.....			
42.	Radio Link SOH LOF	ASC	.....			
43.	EAI1: Ext Alarm 1	ASC	.....	NO		
44.	EAI2: Ext Alarm 2	ASC	.....	NO		
45.	EAI3: Ext Alarm 3	ASC	.....	NO		
46.	EAI4: Ext Alarm 4	ASC	.....	NO		
47.	EAI5: Ext Alarm 5	ASC	.....	NO		
48.	EAI6: Ext Alarm 6	ASC	.....	NO		
49.	EAI7: Ext Alarm 7	ASC	.....	NO		
50.	EAI8: Ext Alarm 8	ASC	.....	NO		
51.	Rly1: Relay Output 1	A		NO		
52.	Rly2: Relay Output 2	A		NO		
53.	Rly3: Relay Output 3	A		NO		
54.	Rly4: Relay Output 4	A		NO		
55.	Rly5: Relay Output 5	A		NO		
56.	Link Failure Summary	ASC		.....		
57.	IDU Summary	ASC		.....		
58.	ODU Summary	ASC		.....		
59.	Remote Alarm Summary	ASC		.....		

Wayside Alarms appear only if the link is SOH equipped.

t,6,10

Link Configuration Summary

Radio Name
Name of the radio, set in the System Configuration menu.

Tx Frequency (MHz)
Transmit frequency of the ODU, in MHz.

Rx Frequency (MHz)
Receive frequency of the ODU, in MHz.

Power-up Mode
Power-up Mode of the radio, either Online or Standby.

Line
Indication of whether the main line interface is provisioned as equipped or not.

Active Interface(s)
Displays which IP interfaces have been configured on this radio, one of "None", "Ethernet", "PPP", or "PPP & Ethernet".

Ethernet IP Address
The IP Address of the 10BaseT interface used by this radio terminal.

Ethernet IP Subnet Mask
The IP Subnet Mask of the 10BaseT interface.

Default Gateway

PPP IP Address
The IP Address of the dial-up PPP interface.

PPP Subnet Mask
The IP Subnet Mask of the dial-up PPP interface.

Route to NMS
Route to the NMS that SNMP trap messages will take, one of "None", "Via Network Interface", "Via Remote Radio", or "Via Remote Radio (Fallback to Network Interface)".

NMS IP Address
IP address of the Network Management Station (NMS).

Trap Community String
The SNMP community indentifier that will be used when traps are delivered to the NMS.

TFTP Default Path

t,7 Utilities

t,7,1 Send a ping to the NMS

Send a ping to the Network Management Station (NMS). A ping is a TCP/IP packet (ICMP Echo Request) that will be returned to the radio when it is received by the NMS. The round-trip time of the ping packet is displayed. This command is useful for testing connectivity with the NMS.

t,7,2 Toggle test alarm, send trap

Sets a Test alarm in the radio. It will also send a Test trap via SNMP to the NMS. This is another way of testing connectivity with the NMS, specifically connectivity for SNMP (Simple Network Management Protocol) trap messages. The test alarm will remain as a minor alarm and must be toggled again to disable the alarm.

t,7,3 Send test alarm trap set/clear pair in 120 seconds

Similar to Toggle test alarm, send trap (t,7,2). The difference is that 120 seconds after the Test alarm is set, and a Test trap is sent to the NMS, the Test alarm will be automatically cleared, and a clear trap will be sent to the NMS. This command is useful for testing both connectivity to the NMS and automatic dialing via PPP.

t,7,4 Close Current PPP Session

Causes the current PPP session, if any, to be terminated. Closing the PPP session causes the modem to hang up and reset and await a new inbound call.

t,7,5 Software Update

Displays the Software Update menu. See Appendix D for instructions on loading software.

t,7,5,1 Update Primary Image from NMS

Causes the radio to retrieve a new version of its software from the NMS, via the TFTP server. Note that the NMS must be running a properly-configured TFTP server for this command to succeed. If the code download is successful, the new software will be programmed into the Primary Image slot in flash memory.

t,7,5,2 **Update Secondary Image from NMS**	Causes the radio to retrieve a new version of its software from the NMS, via the TFTP server. Note that the NMS must be running a properly-configured TFTP server for this command to succeed. If the code download is successful, the new software will be programmed into the Secondary Image slot in flash memory.
t,7,5,3 **Update Secondary Image from Peer Radio's Secondary**	Causes the radio to copy software from the remote radio's Secondary Image slot into its own Secondary Image slot. The radios must be in communication with each other, and the remote radio must have a valid image in its Secondary slot for this command to succeed.
t,7,5,4 **Update Primary Image from This Radio's Secondary**	Causes the radio to copy the software that resides in its Secondary Image slot into its Primary Image slot.
t,7,6 **Reboot**	Displays the Reboot menu.
t,7,6,1 **Boot Primary Software Image**	Causes the radio to reboot using the software in its Primary Image slot.
t,7,6,2 **Boot Secondary Software Image**	Causes the radio to reboot using the software in its Secondary Image slot.

t,7,6,3 **Boot Primary Software Image (Both Radios)**	Causes both the local and remote radios to reboot using the software in their respective Primary Image slots.
t,7,6,4 **Boot Secondary Software Image (Both Radios)**	Causes both the local and remote radios to reboot using the software in their respective Secondary Image slots.
t,7,7 **Boot Status**	Displays the Boot Status menu, described earlier in this document.
t,7,8 **Upload/Download Configuration Parameters**	Allows access to the following related menu commands: 1. Upload Current Configuration Parameters (CPs) to NMS (Uploads all the current IDU's configuration parameters to a uniquely- named file on the NMS's TFTP server). 2. Download Saved Configuration Parameters (CPs) from NMS (Restores a previously uploaded file of configuration parameters (CPs) back to the radio, setting the radio's CPs to the values they had when the file was originally uploaded from the radio). 3. Download Alarm Configuration Parameters (CPs) from NMS (Same, but only the Alarm Configuration parameters are restored). In all cases, the default file name is related to the radio number, if it is non-zero in the System Configuration menu, or otherwise to the radio's IP address. This mechanism can be used to save radio configurations so they can be quickly restored in the field if a new IDU needs to be installed as a replacement.
t,7,9 **Restore Configuration to Factory Settings, Restart**	Causes all configuration data entered to date to be erased, and all Factory Default settings to be used in their place. After this operation has been completed, the radio will reboot. This command must be issued while the transmitter is in the "Tx Off" mode. After rebooting, the IDU will start in the "installation reminders" mode. **Caution: Frequencies at both ends will have to be reconfigured.**
t,7,10 **Calculate RSL Value**	Allows a user to calculate an RSL value on a link by inputting values for frequency band, link distance, Tx power and Tx and Rx antenna size.
t,8 **Log Off**	Ends the current menu session. If the current session is a Telnet session, the Telnet session is terminated.

Menu Commands

The following commands can be used to navigate through the Menus. Enter ? to get this list.

```
H or ?   Help:          Show this help.
Enter:   Again:         Redisplay the current menu.
Esc:     Previous:      Go to previous (parent) menu.
T:       Top:           Go to Top menu.
R:       Remote:        Switch to remote radio.
L:       Local:         Switch to local radio.
S:       Save:          Save Current Configuration Parameters.
U:       Update:        Continuously update this menu.
E:       Exit:          Log off.
GA:      Alarms:        Go to Alarms menu
GP:      Performance:   Go to Performance menu
GB:      BERT:          Go to Integral BERT menu
Press any key to return to the current menu.
```

t,1

Alarms

Displays the Alarms menu. From any menu, you can also type "GA" (Go to Alarms Menu) and press Enter to be brought to the Alarms menu.

```
(Local, online, Minor Alarm)> 1
Alarms
  Local Alarms: Radio A     Remote Alarms: Radio B
 ------------------------------------------------------
(User-requested Reboot)   (User-requested Reboot)
                          Line UnexpSignal
  Wayside A UnexpSignal   Wayside A UnexpSignal
  Remote Alarm Summary    Remote Alarm Summary
 ------------------------------------------------------
(0d 21:41:19 since reset) (0d 21:41:18 since reset)
0. Latched Alarms Reset
 ------------------------------------------------------
!=Major Alarm. ()=Latched (not current) alarm.  (? for help)
```

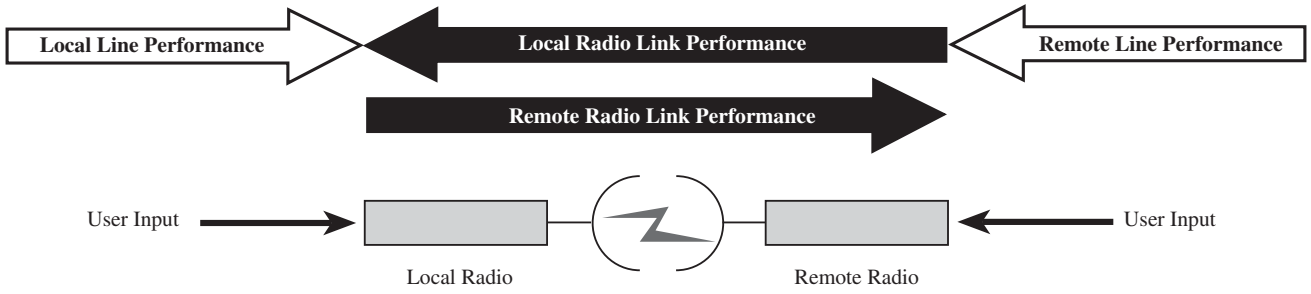
t,2

Performance (cont.)

Displays the Performance menu of the Radio Link. From any menu, you can also type "GP" and press Enter to jump to the Performance menu.

```
Current Link Performance
(? for help)
                                  Local                Remote
 ------------------------------------------------------------
Radio Name:                       Radio A              Radio B
 Tx Power (dBm):                  10.0                 17.0
  RSL (dBm) (Min/Max):            -46   ( -47/-45)     -52   ( -53/-51)
 Estimated BER:                   <1E-12               <1E-12
 Sync Losses:                     0                    0
  G.826 EFS  (EFSR):              3291  (1.000000)     3290  (1.000000)
  G.826 ES   (ESR):               0   (0.000000)       0   (0.000000)
  G.826 SES  (SESR):              0   (0.000000)       0   (0.000000)
  G.826 SEFS (SEFSR):             0   (0.000000)       0   (0.000000)
  G.826 UAS  (UAS/totS):          0   (0.000000)       0   (0.000000)
  G.826 BBE  (BBER):              0   (0.000000)       0   (0.000000)
1. Line Status:                   Online               Online
  ODU Temp. (Min/Max):            51  ( 22/ 51)        52  ( 22/ 52)
  IDU Temp. (Min/Max):            39  (24/ 40)         41  (26/ 41)
  Uptime:                         0d 00:54:51          0d 00:54:50
  Custom Interval:                0d 00:54:51          0d 00:54:50
0. Reset Custom Interval
 ------------------------------------------------------------
Pinnacle (local, online, Minor Alarm)>
```

Definition of Line and Radio Link Performance



t,2,1

Current Line Performance

Current Line Performance
(? for help)

	Local	Remote
Radio Name:	Radio A	Radio B
Line Status:	Online	Online
Line Loopback:	None	None
Line Type:	OC3	OC3
G.826 EFS (EFSR):	138 (1.000000)	138 (1.000000)
G.826 ES (ESR):	0 (0.000000)	0 (0.000000)
G.826 SES (SESR):	0 (0.000000)	0 (0.000000)
G.826 SEFS (SEFSR):	0 (0.000000)	0 (0.000000)
G.826 UAS (UAS/totS):	0 (0.000000)	0 (0.000000)
G.826 BBE (BBER):	0 (0.000000)	0 (0.000000)
Wayside Status:	US	US
Wayside Loopback:	None	None
Wayside Type:	E1	E1
Custom Interval:	0d 00:02:18	0d 00:02:18

t,3,1

Link Uptime Totals

Link Uptime Totals
(? for help)

	Local	Remote
Radio Name:	Radio A	Radio B
RSL (dBm) (Min/Max):	(-44/-40)	(-44/-40)
Sync Losses:	0	0
G.826 EFS (EFSR):	78667 (0.999631)	78665 (0.999631)
G.826 ES (ESR):	0 (0.000000)	0 (0.000000)
G.826 SES (SESR):	0 (0.000000)	0 (0.000000)
G.826 SEFS (SEFSR):	0 (0.000000)	0 (0.000000)
G.826 UAS (UAS/totS):	0 (0.000000)	0 (0.000000)
G.826 BBE (BBER):	0 (0.000000)	0 (0.000000)
ODU Temp. (Min/Max):	(56/ 61)	(56/ 62)
IDU Temp. (Min/Max):	(40/ 46)	(42/ 47)
Uptime:	0d 21:51:36	0d 21:51:35

t,3,2

Line Uptime Totals

```
Line Uptime Totals
(? for help)
                                  Local                    Remote
Radio Name:                       Radio A                  Radio B
G.826 EFS  (EFSR):                78797  (0.999632)        78796  (0.999632)
G.826 ES   (ESR):                 0  (0.000000)           0(0.000000)
G.826 SES  (SESR):                0  (0.000000)           0(0.000000)
G.826 SEFS (SEFSR):               0  (0.000000)           0(0.000000)
G.826 UAS  (UAS/totS):            0  (0.000000)           0(0.000000)
G.826 BBE  (BBER):                0  (0.000000)           0(0.000000)
   Uptime:                        0d 21:53:46              0d 21:53:45
```

t,4

Status/Inventory

```
(Local, online, Minor ALarm)>4                          Status/Inventory
(? for help)

1. Link Inventory...
2. Boot Status...
3. Firmware Status...
```

t,4,1

Link Inventory

```
Link Inventory
(? for help)
                                  Local                    Remote
                                                           Radio Name:
Radio A                                                    Radio B
  Radio Number:                   1                        1
  Radio Location:                 na
  Radio Contact:                  na
  Radio IP Address:               192.168.200.200          192.168.1.16

  ODU Model:                      AS70XFS1A                AS70XFS1B
  ODU HW Vers / SN:               1.5, 7036                1.5, 7019
  ODU SW Vers (Boot/Op):          1.0, 3.2                 1.0, 3.2
  Frequency Plan:
                                  23GHz/50MHz/TR=1200/FCC  (Remote)
                                  23GHz/50MHz/TR=1200/FCC  (Local)
  Tx Frequency Range:             22425 - 22975 MHz        21225 - 21775 MHz
  Rx Frequency Range:             21225 - 21775 MHz        22425 - 22975 MHz

  IDU Model:                      AS30XF-1BD               AS30XF-1BDA
  IDU HW Vers / SN:               1.1, 416                 1.1, 410
  IDU SW Vers (Boot/Op):          0.5.3.2,1.2.1.98         0.5.3.2,1.2.1.98
  LIM Model:                      AS33BDA                  AS33BDA
  LIM Vers / SN:                  0.1, 7777                0.1, 7777
```

t,4,2

Boot Status

```
(Local, online, Minor Alarm)> 2
Boot Status
(? for help)
                                Local                Remote
Radio Name:                     Radio A              Radio B
 Boot Reason:                   User Request         User Request
Image Booted:                   Primary              Primary
IDU Boot SW Version:            0.5.3.2              0.5.3.2
Current Image SW Version:       1.2.1.98             1.2.1.98
Primary Image Version:          1.2.1.98             1.2.1.98
Primary Image CRC:              0C2E0C66             0C2E0C66
Primary Image Status:           Good CRC             Good CRC
Secondary Image Version:        1.2.1.98             1.2.1.98
Secondary Image CRC:            0C2E0C66             0C2E0C66
Secondary Image Status:         Good CRC             Good CRC

(Local, online, Minor Alarm)>
```

t,4,3

Firmware

```
(Local, online) >3
Block 00: txf1012.bin 11/10/1999 13:87
Block 01: rxf10009.bin 10/10/1999 10:45
Block 02: equ1004.bin 17/10/1999 11:53
Block 03: mod1030.bin 24/8/1999 10:40
Block 04: met1145.bin 15/11/1999 13:23
Block 05: pex 1046.bin 2.11.1999 14:29
Block 06: ltre0000
Block 07: ltre0000
Block 08: is empty
Block 09: is empty
Block 10: is empty
Block 11: lmod0002
```

t,5

Controls

```
Controls
 (? for help)
─────────────────────────────────────────────────────────────
1. Tx Mute
2. Integral BERT...
3. Radio Loopback...
4. Continuous Wave...
5. Line / Wayside / Service Channel Loopback/Controls...
─────────────────────────────────────────────────────────────
(Local, online, Minor Alarm)> 1
Put Radio into Standby (Currently Online). Are you sure? (Y/N) [N]: n
Command canceled.
```

t,5,1

Tx Mute

```
Tx Mute
(? for help)
─────────────────────────────────────────────────────────────
  Current Tx State:          On
  User-Requested Tx State:   On
  1. Turn Tx Off
─────────────────────────────────────────────────────────────
(Local, online, !Major Alarm) > 1
Turn Tx Off (TX Currently On), Are you sure? (Y/N) [N]: n
```

t,5,2

Integral BERT

From any menu, you can also type "GB" and press enter to be brought to the Integral BERT menu

```
Integral BERT
 (? for help)
─────────────────────────────────────────────────────────────
  Elapsed BERT Time: 0d 00:00:00

Local  Acquisition Time:     0d 22:23:20  Sync Losses:  0  RSL:  -43
Remote Acquisition Time:     0d 22:23:22  Sync Losses:  0  RSL:  -43

        Last second          Accumulated          Total Errors
      ──────────────       ──────────────         ────────

Local  Coded BER:            N/A
Remote Coded BER:            N/A
1. Start BERT
2. Reset BERT
3. Stop  BERT
```

t,5,3

IDU Loopback

```
IDU Loopback
(? for help)
─────────────────────────────────────────────────────────────
1. IDU Loopback State (Local Radio): No Loopbacks
   ──────────────────────────────────────────────────────────
```

t,5,3,1

Loopback State

THIS COMMAND WILL LOOPBACK THE IF SIGNAL AT THE OUTPUT OF THE IDU.

```
IDU Loopback
(? for help)
_____________________________________________________

1. IDU Loopback State (Local Radio): No Loopbacks
_____________________________________________________

(Local, online, Minor Alarm)> 1
  Change IDU Loopback State?
  (This will interrupt user traffic). Confirm (Y/N) [N]:y
  IDU Loopback
  (? for help)
_____________________________________________________

1. IDU Loopback State (Local Radio): IDU Analog Loopback
_____________________________________________________
```

t,5,4

Continuous Wave

```
Continuous Wave
(? for help)
_____________________________________________________

1. Continuous Wave State (Local Radio): CW Disabled
_____________________________________________________

Pinnacle (local, online)>1
  Change Continuous Wave State?
     (This will interrupt user traffic). Confirm (Y/N) [N]:y
  Continuous Wave
     (? for help)
  _____________________________________________________

1.Continuous Wave State (Local Radio): CW Enabled
  _____________________________________________________
```

t,5,5

Loopback/Controls

WAYSIDE AND SERVICE CHANNELS APPEAR ONLY IF THE LINK IS SOH EQUIPPED.

```
Line / Wayside / Service Channel Loopback/Controls
(? for help)
_____________________________________________________

1. Line      Loopback/Control (Local Radio):     No Loopback
2. Line      Loopback/Control (REMOTE Radio):    No Loopback
3. Wayside   Loopback/Control (Local Radio):     No Loopback
4. Wayside   Loopback/Control (REMOTE Radio):    No Loopback
_____________________________________________________
```

t,6

Configuration

```
Configuration
(? for help)
_____________________________________________________

1. Link ->
2. Line / Wayside / Service Channel ->
3. SOH ->
4. System ->
5. Network Management ->
6. Ethernet ->
7. PPP ->
8. Overhead IP ->
9. Alarm ->
10. Link Configuration Summary...
11. Save Current Configuration Changes
_____________________________________________________
```

t,6,1

Link Configuration

```
Link Configuration
(? for help)
_____________________________________________________

1. Tx Frequency (MHz):                          22325.0
2. Rx Frequency (MHz):                          23525.0
3. Manual Tx Power (if ATPC disabled)(dBm):     17.0
   Equivalent Attenuation (dB):                 0
4. Power-up Mode:                               TxOn
5. ATPC (Automatic Transmit Power Control):     Disable
6. Far End Target ATPC RSL (dBm):               -55
7. ATPC Maximum Tx Power (dBm):                 17.0
   Equivalent Attenuation (dB):                 0
8. Link Protection Type:                        Unprotected
```

t,6,1,1

Tx Frequency (MHz)

```
Tx Frequency
Enter TX Frequency (22425 - 22975 MHz)>          22425
```

t,6,1,2

Rx Frequency (MHz)

```
Rx Frequency
Enter RX Frequency (21225 - 21775 MHz)>          21225
```

t,6,1,3

Manual Tx Power

```
Manual Tx Power
Enter Manual Tx Power >
```

t,6,1,4

Power-Up Mode

T,6,1,4 Power-up Mode
Power-up Mode

1. TxOff
2. TxOn <—— Current value

t,6,1,5

ATPC

ATPC (Automatic Transmit Power Control)

1. Enable
2. Disable <—— Current value

t,6,1,6

Far End Target ATPC RSL (dBm)

Far End Target ATPC RSL
Enter Target ATPC RSL (dBm) > -55

t,6,1,7

ATPC Maximum Tx Power

ATPC Maximum Tx Power
Enter ATPC Maximum Tx Power (dBm) > 5.0

t,6,1,8

Link Protection Type

Link Protection Type

1. Unprotected <—— Current value
2. Protected

Enter Link Protection Type > 1
Note: A reboot is required for this change to take effect

t,6,2

Line/Wayside/Service Channel Configuration (with SOH)

WAYSIDE AND SERVICE CHANNELS APPEAR ONLY IF THE LINK IS SOH EQUIPPED.

```
(Local, online, Minor Alarm, UNSAVED CHANGES)> 2

Line / Wayside / Service Channel Configuration
(? for help)
_____________________________________________________________
—
 1. Line Name:
 2. Line Provisioning:          Equipped
    Line Type:                  OC3
 3. Wayside Name:
 4. Wayside Provisioning:       Not Equipped          Different for T1
    Wayside Channel Type:       E1
 5. Wayside Encoding:           Unkn val: 0
 6. Wayside Equalization:       Unkn val: 0           Different for T1
 7. Service Channel A Provisioning:                   Not Equipped
 8. Service Channel A Interface:                      RS232/V.28
 9. Service Channel B Provisioning:                   Not Equipped
 10. Service Channel B Interface:                     RS232/V.28
_____________________________________________________________
—
(Local, online, Minor Alarm, UNSAVED CHANGES)> 1
```

t,6,2

Line/Wayside/Service Channel Configuration (without SOH)

```
Line Configuration
(? for help)
_____________________________________________________________
—
1.   Line Name:
2.   Line Provisioning:        Not Equipped
     Line Type:                OC-3/STM-1
_____________________________________________________________
—
```

t,6,2,6

Wayside Equalization

```
Wayside Equalization
_____________________________________________________________

1. Short Haul/   0-133 ft/0.6 dB/ 12 dB Gain
2. Short Haul/ 133-266 ft/1.2 dB/ 12 dB Gain
3. Short Haul/ 266-399 ft/1.8 dB/ 12 dB Gain
4. Short Haul/ 399-533 ft/2.4 dB/ 12 dB Gain
 5.Short Haul/ 533-655 ft/3.0 dB/ 12 dB Gain
 6.Long Haul /  0.0 dB pulse / 26 dB Gain
7. Long Haul / -7.5 dB pulse / 26 dB Gain
8. Long Haul /-15.0 dB pulse / 26 dB Gain
9. Long Haul /-22.5 dB pulse / 26 dB Gain
10. Long Haul /  0.0 dB pulse / 36 dB Gain
11. Long Haul / -7.5 dB pulse / 36 dB Gain
12. Long Haul /-15.0 dB pulse / 36 dB Gain
13. Long Haul /-22.5 dB pulse / 36 dB Gain
_____________________________.________________________________

Choose Wayside Equalization>
```

```
  Line Provisioning
_____________________________________________________________

1.Not Equipped
2.Equipped      <—— Current value
_____________________________________________________________

Choose Line Provisioning>
  (1 – 10 on these are essentially Equipped/Not Equipped, Values, etc.)
```

t,6,3

SOH Configuration

IF THE LINK IS NOT SOH EQUIPPED, THIS MENU IS NOT USED.

```
SOH Configuration
  (? for help)
_____________________________________________________________

1.  SOH Functions:                              Enable
    If SOH Functions Enabled:
2.  Insert B1 BIP-8 bytes:                      Enable
3.  Propagate AIS if LOS detected:              Enable
4.  Propagate AIS if LOF detected:              Enable
    (all choices are Disable/Enable)
_____________________________________________________________
```

t,6,4

System Configuration

```
System Configuration
 (? for help)
_____________________________________________________________

1. Radio Name:                              Radio A
2. Radio Number:                            1
3. Radio Location:                          na
4. Radio Contact:                           na
5. Administrator Password:
6. Operator Password:
7. Viewer Password:
8. Async Service Channel Baud Rate:         9600
```

t,6,5

Network Management Configuration

```
Network Management Configuration
 (? for help)
_____________________________________________________________

1. Active Interface(s):                     PPP & Ethernet
2. Default Gateway:                         192.168.1.1
3. Route to NMS:                            Network Interface (NI)
4. NMS IP Address:                          192.168.1.12
5. Trap Community String:                   public
6. Coldstart Traps:                         Enable
7. Authentication-Failure Traps:            Enable
8. Heartbeat Trap Frequency (sec):          0
9. TFTP Default Directory Path:
10. Static Routes (none)->
```

t,6,6

Ethernet Configuration

```
Ethernet Configuration
 (? for help)
_____________________________________________________________

1. Ethernet IP Address:                     192.168.1.15
2. Ethernet IP Subnet Mask:                 255.255.255.0
_____________________________________________________________
```

t,6,7

PPP Configuration

```
PPP Configuration
 (? for help)
─────────────────────────────────────────────────────────────
  1. Maximum Output Queue Size (K bytes):      32
  2. Modem Baud Rate:                          38400
  3. Modem Initialization String:              AT&F0
  4. Remote Phone Number:
  5. Maximum Dial Retries:                     8
  6. Chat Script:
  7. Authentication:                           CHAP
  8. Local CHAP Username:                      demo
  9. Local CHAP Secret:                        demoso
  10. Remote CHAP Username:                    demo
  11. Remote CHAP Secret:                      demosi
  12. PPP IP Address:                          192.168.200.200
  13. PPP IP Subnet Mask:                      255.255.255.0
  14. Link Inactivity Timeout (secs):          600
  15. PPP Console Logging:                     Disable
```

t,6,8

Overhead IP Configuation

```
Overhead IP Configuration
 (? for help)
─────────────────────────────────────────────────────────────
  1. Overhead Interface Type:   Unnumbered
─────────────────────────────────────────────────────────────
  Overhead Interface Type
─────────────────────────────────────────────────────────────
  1. Numbered
  2. Unnumbered      <—— Current value
─────────────────────────────────────────────────────────────
```

t,6,9

Alarm Configuration

SEE COMPLETE LISTING OF ALARMS ON PAGE 4-36.

t,6,10

Link Configuration Summary

Link Configuration Summary
(? for help)

	Local	Remote
Radio Name:	Radio A	Radio B
Tx Frequency (MHz):	22425	21225
Rx Frequency (MHz):	21225	22425
Power-up Mode:	Standby	Online
Line:	Equipped	Not Equipped
Active Interface(s):	PPP & Ethernet	Ethernet
Ethernet IP Address:	192.168.1.15	192.168.1.16
Ethernet Subnet Mask:	255.255.255.0	255.255.255.0
Default Gateway:	192.168.1.1	192.168.1.1
PPP IP Address:	192.168.200.200	192.168.200.200
PPP Subnet Mask:	255.255.255.0	255.255.255.0
Route to NMS:	Network Interface (NI)	None (Disables traps)
NMS IP Address:	192.168.1.12	192.168.1.11
Trap Community String:	public	public
TFTP Default Path:		

t,6,11

Save Current Configuration Changes
Note: *Saves changes to permanent flash memory.*

Save current changes. Are you sure? (Y/N) [N]: y

If Y (yes)
Configuration parameters saved

t,7

Utilities

Utilities
(? for help)

1. Send a ping to the NMS
2. Toggle test alarm, send trap
3. Send test alarm trap set/clear pair in 120 seconds
4. Close Current PPP Session
5. Software Update ->
6. Reboot ->
7. Boot Status...
8. Upload/Download Configuration Parameters ->
9. Restore Configuration to Factory Settings, Restart
10. Calculate Estimated RSL Value ->

t,7,1

Send a ping to the NMS

```
(Local, online, Minor Alarm)> 1
Ping sent. Waiting for ping response.
Press any key to stop waiting.
Ping reply from 192.168.1.12 #1 received, round trip time 0.010 seconds
Ping successful.
```

t,7,2

Toggle test alarm, send trap

```
t, 7, 2. Toggle test alarm, send trap
```

t,7,3

Send test alarm trap set/clear pair in 120 seconds

```
t, 7,3. Send test alarm trap set/clear pair in 120 seconds
```

t,7,4

Close Current PPP Session

```
t, 7, 4. Close Current PPP Session
```

t,7,5

Software Update

```
Software Update
 (? for help)
 ──────────────────────────────────────────────────────
 1. Update PrimaryImage from NMS
 2. Update SecondaryImage from NMS
 3. Update SecondaryImage from Peer Radio's Secondary
 4. Update PrimaryImage from This Radio's Secondary
  ──────────────────────────────────────────────────────
(Local, online, Minor Alarm)> 1
Enter name of image file to download (ESC to cancel): V1.2.5 bnc
Update Primary  Image from NMS (file: V1.2.5 bnc): Confirm (Y/N) [N]:y
```

t,7,5

Software Update (cont.)

```
Software Update
  (? for help)
─────────────────────────────────────────────────────────────
1. Update Primary  Image from NMS
2. Update Secondary Image from NMS
3. Update Secondary Image from Peer Radio's Secondary
4. Update Primary Image from This Radio's Secondary
─────────────────────────────────────────────────────────────
(Local, online, Minor Alarm)> 4
Update Primary  Image from This Radio's Secondary: Confirm (Y/N) [N]:y
Secondary to Primary copy starting...
Press any key to cancel transfer.
Alarm SET:  "Test Alarm"
Alarm clear: "Test Alarm"
Secondary to Primary copy completed successfully, 382715 bytes received.
```

t,7,6

Reboot

```
Reboot
(? for help)
─────────────────────────────────────────────────────────────
1. Boot Primary  Software Image (Current Radio)
2. Boot Secondary Software Image (Current Radio)
3. Boot Primary  Software Image (Both Radios)
4. Boot Secondary Software Image (Both Radios)
```

t,7,7

Boot Status

```
Boot Status
 (? for help)
                                Local          Remote
──────────────────────────── ──────────────── ──────
 Radio Name:                  Radio A
  Boot Reason:                User Request   User Request

 Image Booted:                Primary        Primary
 IDU Boot SW Version:         0.5.3.2        0.5.3.2
 Current Image SW Version:    1.2.1.98       1.2.1.98

 Primary Image Version:       1.2.1.98       1.2.1.98
 Primary Image CRC:           0C2E0C66        0C2E0C66
 Primary Image Status:        Good CRC       Good CRC

 Secondary Image Version:     1.2.1.98       1.2.1.98
 Secondary Image CRC:         0C2E0C66       0C2E0C66
 Secondary Image Status:      Good CRC       Good CRC
```

t,7,8

Upload/Download Configuration Parameters

```
Configuration Parameter Upload/Download
(? for help)
_____________________________________________________________

1. Upload Current Configuration Parameters (CPs) to NMS
2. Download Saved Configuration Parameters (CPs) from NMS
3. Download Alarm Configuration Parameters (CPs) from NMS
```

t,7,9

Restore Configuration Factory Settings, Restart

```
Restore Configuration to Factory Settings, Restart
This will interrupt user traffic). Confirm (Y/N) [N]:
```

t,7,10

Calculate Estimated RSL Value

```
Choose Metric System
(? for help)
_____________________________________________________________

1. Calculate Using Metric Units
2. Calculate Using English Units

(Local, online, Minor Alarm)> 1

Estimated RSL Calculator
 (? for help)
_____________________________________________________________

  1. Frequency Band          23GHz
  2. Distance (km)           1.0
  3. Tx Power (dBm):         4.9
  4. Tx Antenna Size (cm)    30 cm
  5. Rx Antenna Size (cm)    30 cm
     Estimated RSL (dBm)      -46.2
```

t,8

Log Off

```
Top Menu
 (? for help)
_____________________________________________________

1. Alarms...
2.  Performance...
3. Performance History ->
4. Status/Inventory ->
5. Controls ->
6. Configuration ->
7. Utilities ->
8. Log Off
_____________________________________________________

(Local, online, Minor Alarm)> 8
Logged off.
```

5 RADIO ELEMENT MANAGER

Contents

Ethernet Access

Ethernet access to the radios can be gained by simply using a cross-over cable and hooking directly between a PC and the 10BaseT Ethernet port located on the IDU.

However, sometimes when a radio link is installed where an Ethernet hub is located or in a laboratory situation (both radios adjacent to each other), it is desirable to access a hub and then connect to the IDU using straight-through cables.

1. Connect a cable from the Ethernet port on the IDU to the PC or hub. You should configure one IDU as follows:
2. Set “Active Interface(s)” to “PPP & Ethernet” or "Ethernet".
3. Configure the Ethernet interface as follows:

Note: T*o perform configuration via Ethernet access, you will first need to access the Configuration Menus,* **t,6** *as presented in Section 4 of this manual using a Craft Terminal on the RS-232 input port.*

```
Network Management Configuration
(? for help)
-------------------------------------------------------------------
1. Active Interface(s):       Ethernet
2. Default Gateway:           192.168.2.1  (Typical)
3. Route to NMS:              None (Disables traps)
4. NMS IP Address:            <does not matter>
5. Trap Community String:     <does not matter>
-------------------------------------------------------------------
Ethernet Configuration
(? for help)
-------------------------------------------------------------------
1. Ethernet IP Address:       192.168.2.2  (Typical)
2. Ethernet IP Subnet Mask:                          255.255.255.0
-------------------------------------------------------------------
```

4. Set the IP address of the PC to the same subnet as the IP address on the IDU. For example, if the IDU IP address is "192.168.2.1" and the IP subnet mask is "255.255.255" as shown above, change the PC IP address to "192.168.2.XXX" where "XXX" is any 1-3 digit number not used in the subnet.

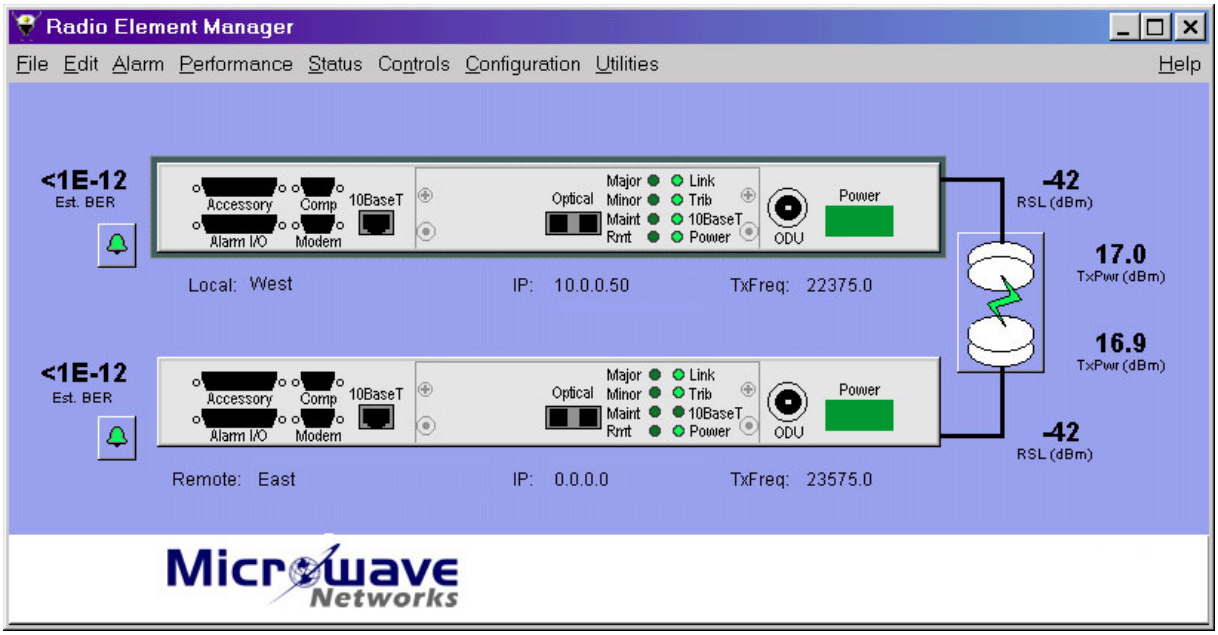
Graphical User Interface Screens

THE RADIO ELEMENT MANAGER IS AN EASY-TO-USE GRAPHICAL USER INTERFACE (GUI) FOR RADIO CONFIGURATION AND OPERATION. CORRESPONDING MENU COMMANDS ARE SHOWN IN THE COLUMN TO THE RIGHT.

Menu	Command
Protected Link	t,0
Main Screen	—
Alarms Menu	t,1
Current Alarms	—
Performance Menu	t,2
Current Link/Radio Performance	t,2
Current Line Performance	t,2
Status Menu	t,4
Link Inventory	t,4,1
Boot Status	t,4,2
Controls Menu	t,5
Tx Mute Control	t,5,1
Integral BERT	t,5,2
If Loopbacks	t,5,3
Continuous Wave	t,5,4
Line Loopbacks	t,5,5
Configuration Menu	t,6
Link Configuration	t,6,1
Line-Wayside-Service Channel Configuration	t,6,2
SOH Configuration (if present)	t,6,3
System Configuration	t,6,4
Network Management Configuration	t,6,5
Ethernet Configuration	t,6,6
PPP Configuration	t,6,7
Alarm Configuration	t,6,9
Threshold Alarm Configuration	t,6,9
External I/O Alarm Configuration	t,6,9
Link Configuration Summary	t,6,10
Utilities Menu	t,7
Send Ping to NMS	t,7,1
Toggle Test Alarm	t,7,2
Send Test Alarm Pair	t,7,3
Close Current PPP Session	t,7,4
Software Update	t,7,5
Reboot	t,7,6
Boot Status	t,7,7
Upload/Download Software Configuration	t,7,8
Restore Configuration to Factory Settings	t,7,9
Calculate RSL Value	t,7,10

MENU DESCRIPTIONS AND MENU COMMANDS ARE FOUND IN SECTION 4 OF THIS MANUAL.

Main Screen



Local Radio Name assigned by user

Local Radio IP Address (if set)

Darker rule around IDU graphic indicates radio selected (Local or Remote)

Local Radio Tx Frequency (MHz)

Local Radio Estimated BER

Remote Radio Estimated BER

Indicates configuration change. Click to save changes.

Local Receive Signal Level (RSL)

Local Tx Power Output

Remote Tx Power Output

Green: Link Up
Red: Link Down

Alarm for status:
Red: Major
Yellow: Minor
Blue: Latched
Green: No Alarm

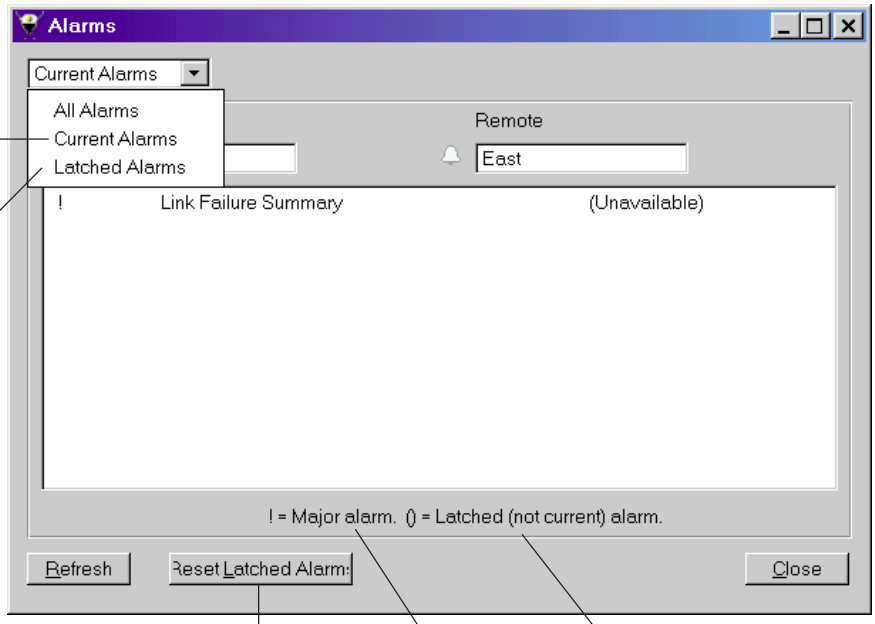
Remote Radio name assigned by user

Remote Radio IP Address (if set)

Remote Radio Tx frequency (MHz)

Remote Receive Signal Level (RSL)

Alarm Menu



CURRENT ALARMS LISTS ALL ALARMS THAT ARE CURRENTLY ACTIVE.

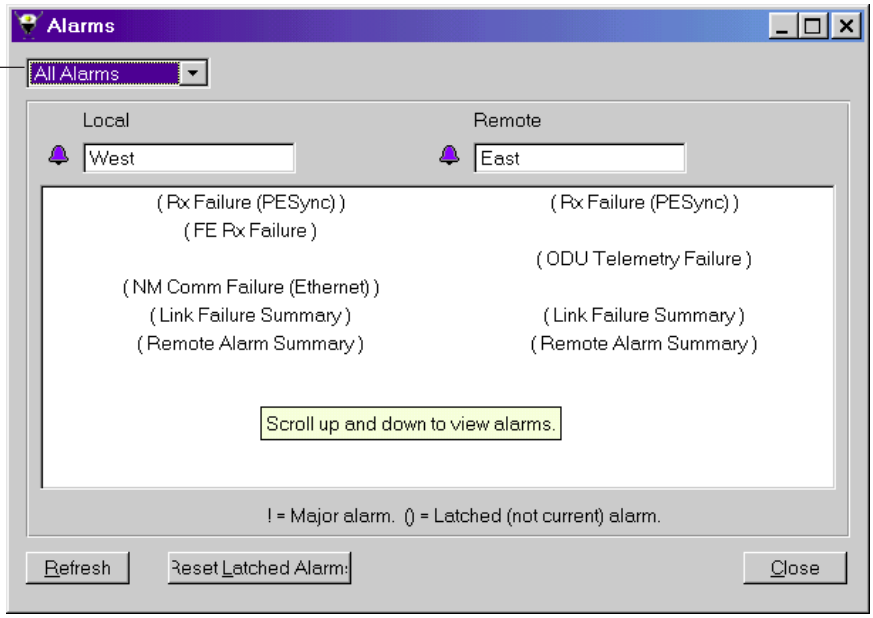
LATCHED ALARMS LISTS CLEARED ALARMS NO LONGER ACTIVE.

CLICK TO RESET LATCHED ALARMS

! INDICATES MAJOR ALARM

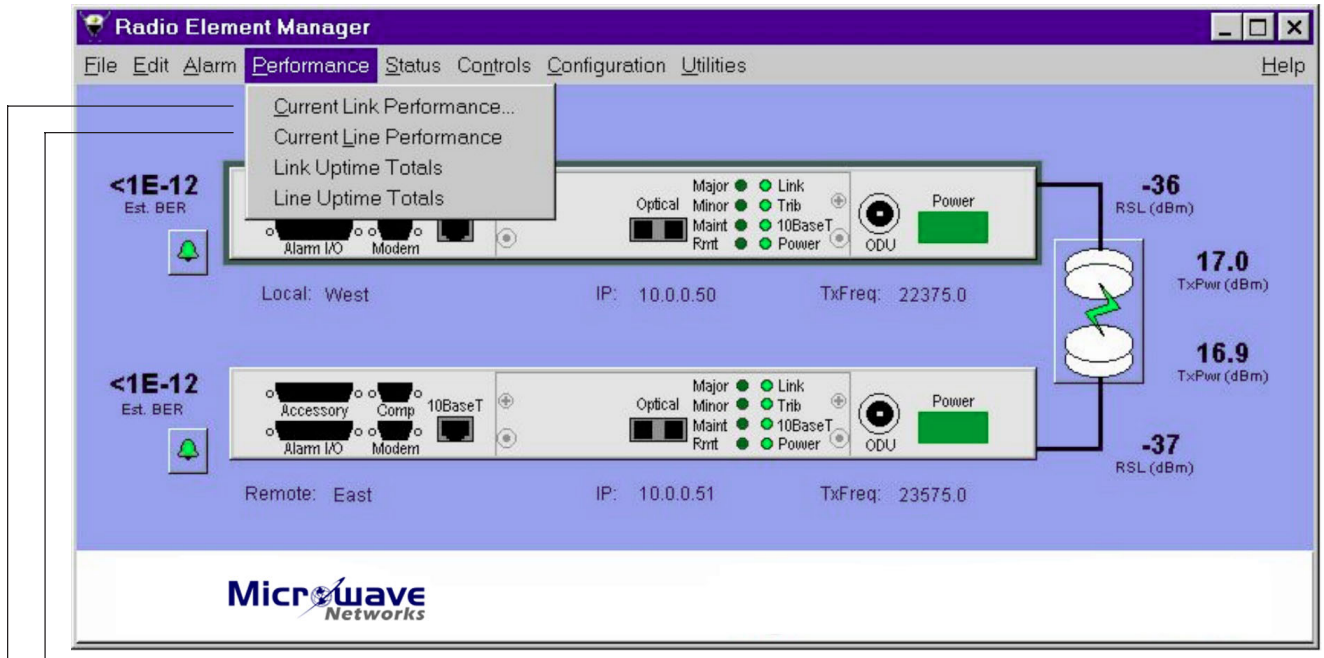
( )INDICATES LATCHED ALARM

All Alarms



ALL ALARMS LISTS ALL ALARMS, CURRENT AND LATCHED.

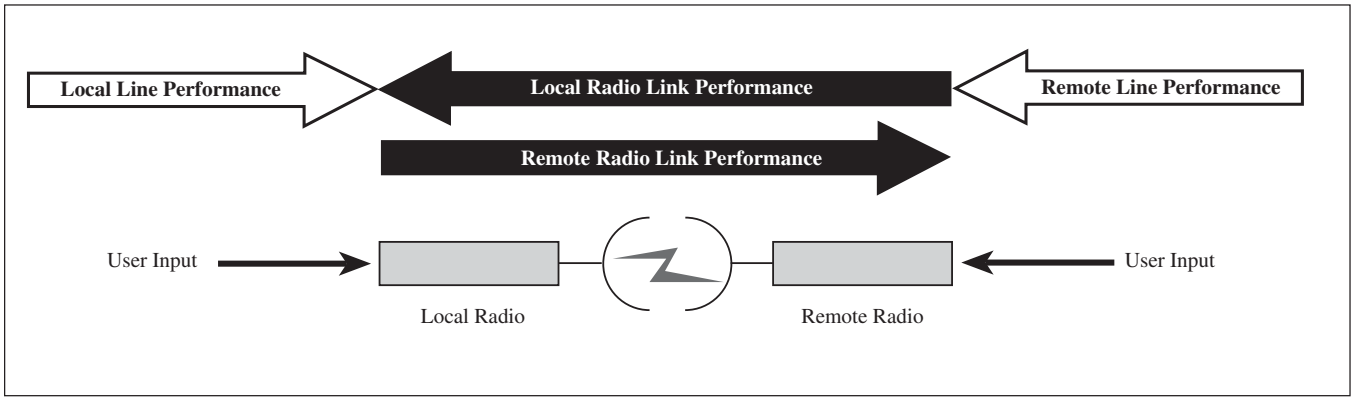
Performance Menu



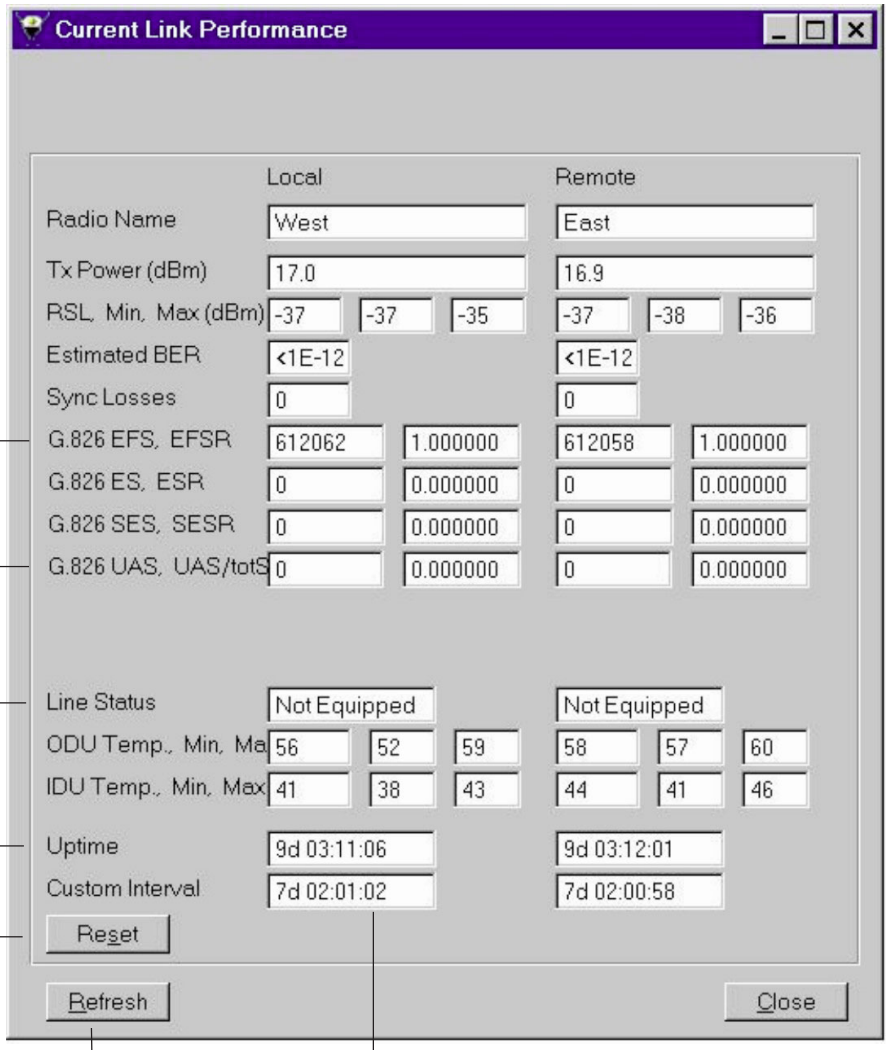
"LINE PERFORMANCE" IS PERFORMANCE OVER THE LINE FROM THE USER AS SHOWN BELOW (G.826 STATISTICS PROVIDED ONLY WHEN SOH IS EQUIPPED).

"LINK PERFORMANCE" IS PERFORMANCE OVER THE RADIO LINK AS SHOWN BELOW.

Definition of Line and Radio Link Performance



Current Link Perfomance



G.826 Statistics:

- *Calculated from SOH parity byte when SOH-capable LIM in use*
- *Calculated from S/N Ratio when SOH-capable LIM NOT in use*

Status of OC3/STM-1 Line Input

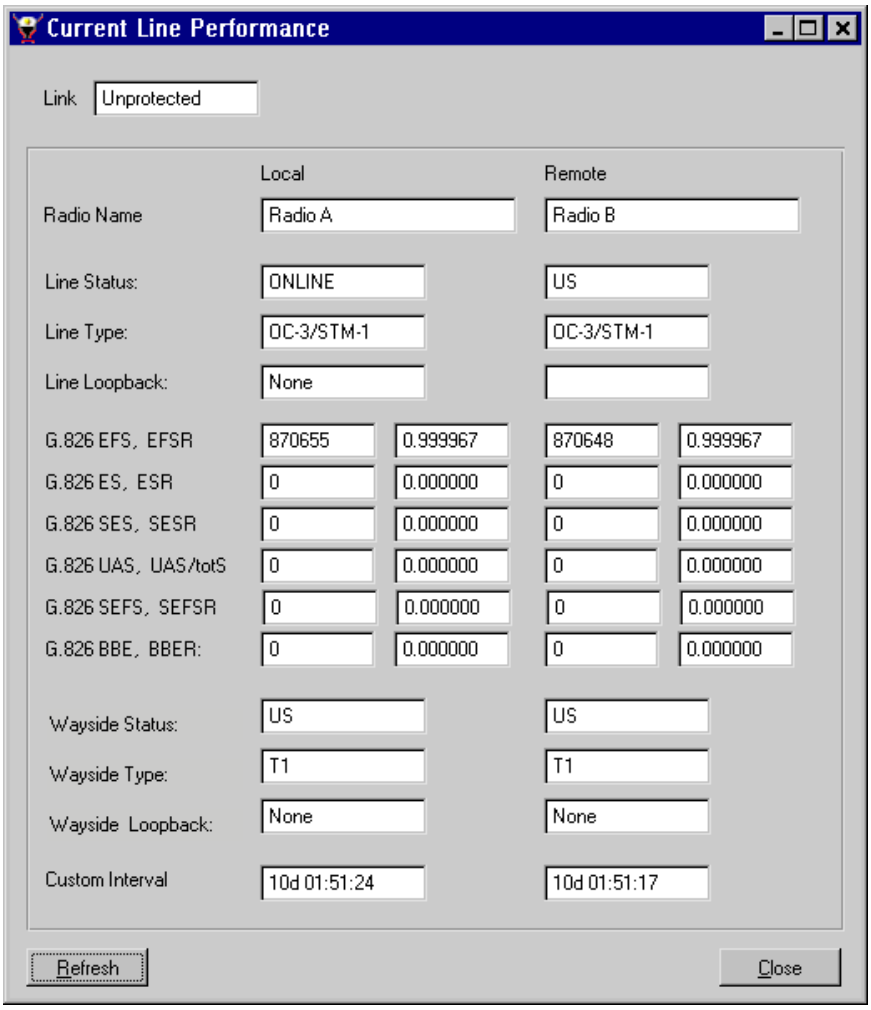
Total Time since Power Up

Starts new Custom Interval

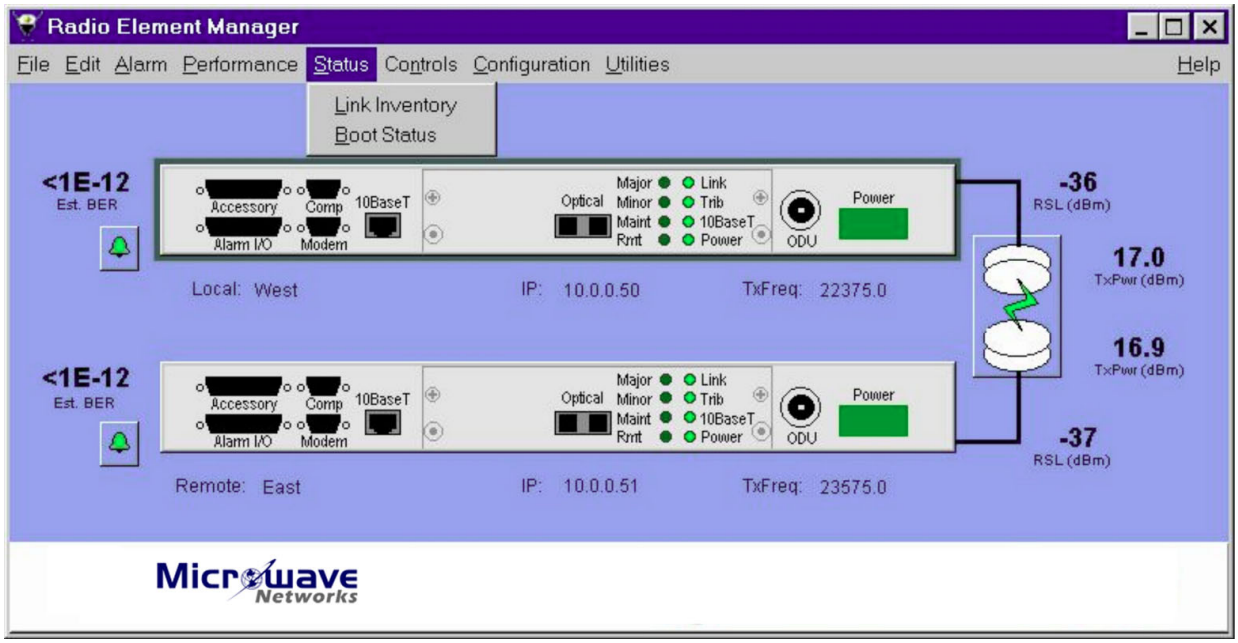
Update screen manually. Auto refresh occurs every 8-10 seconds.

Total Time since Custom Interval Reset.

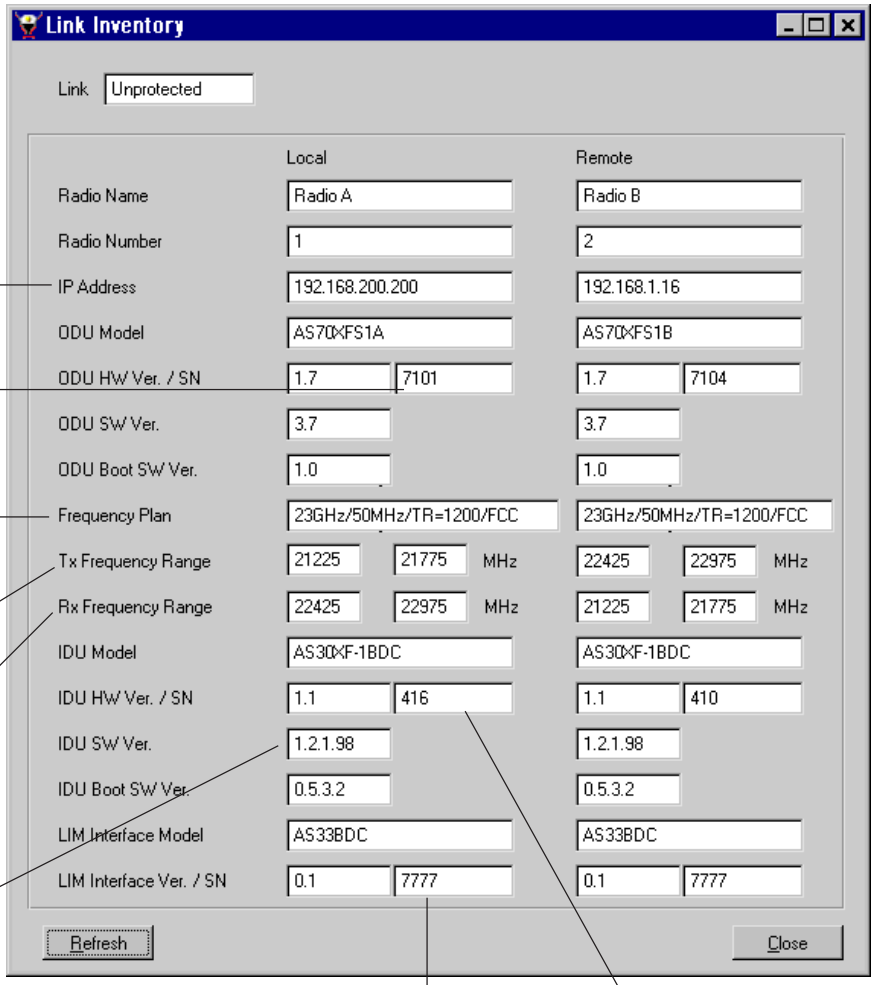
Current Line Performance



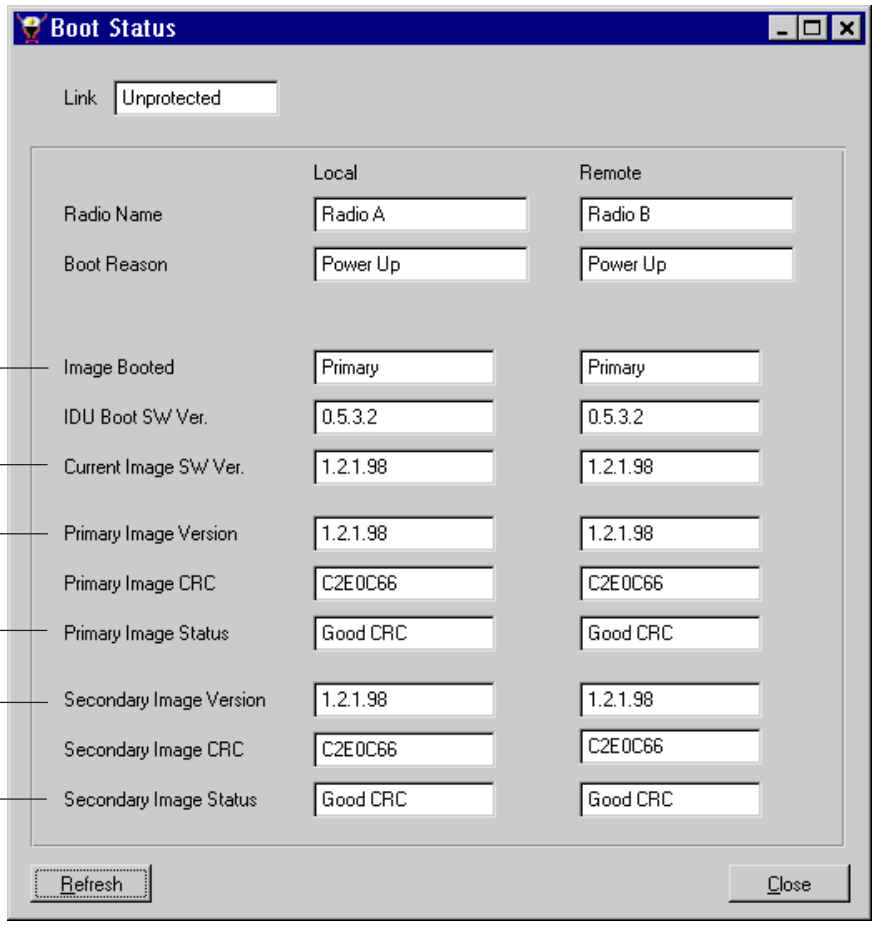
Status Menu


Radio Element Manager
File Edit Alarm Performance Status Controls Configuration Utilities Help
Link Inventory
Boot Status
<1E-12
Est. BER
Accessory
Comp
10BaseT
Alarm I/O
Modem
Optical
Major
Minor
Maint
Rmt
Link
Trib
10BaseT
Power
ODU
Power
-36
RSL (dBm)
17.0
TxPwr (dBm)
Local: West
IP: 10.0.0.50
TxFreq: 22375.0
<1E-12
Est. BER
16.9
TxPwr (dBm)
-37
RSL (dBm)
Remote: East
IP: 10.0.0.51
TxFreq: 23575.0
Microwave Networks

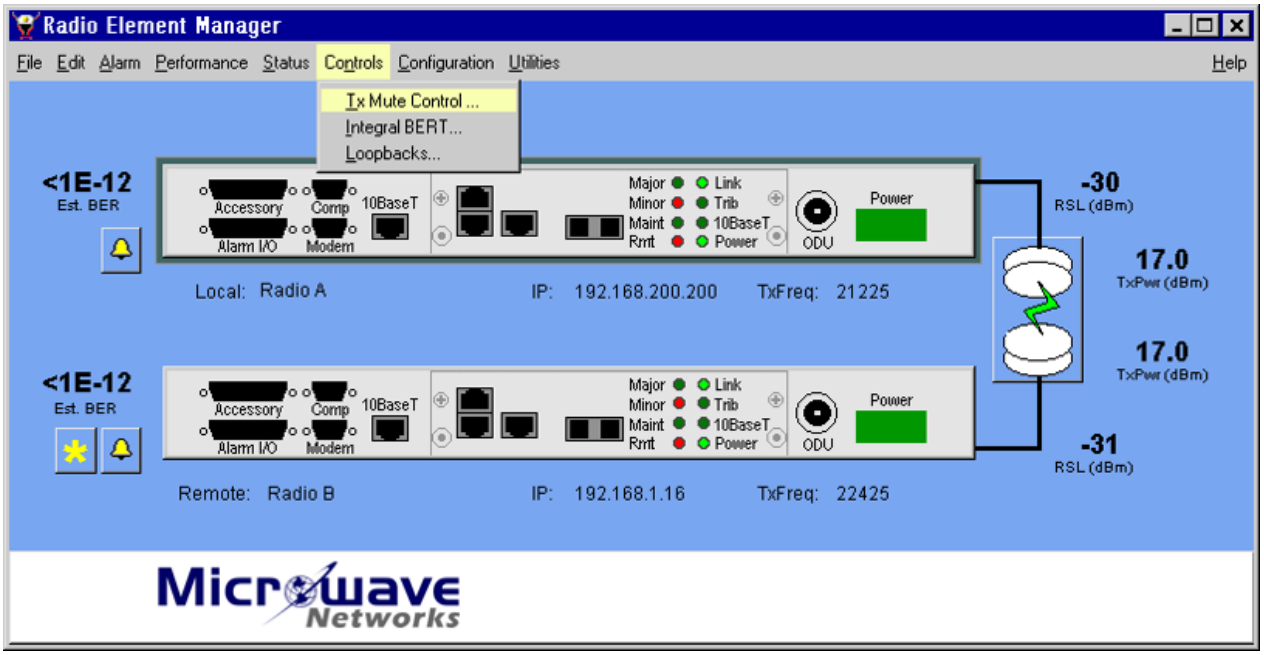
Link Inventory



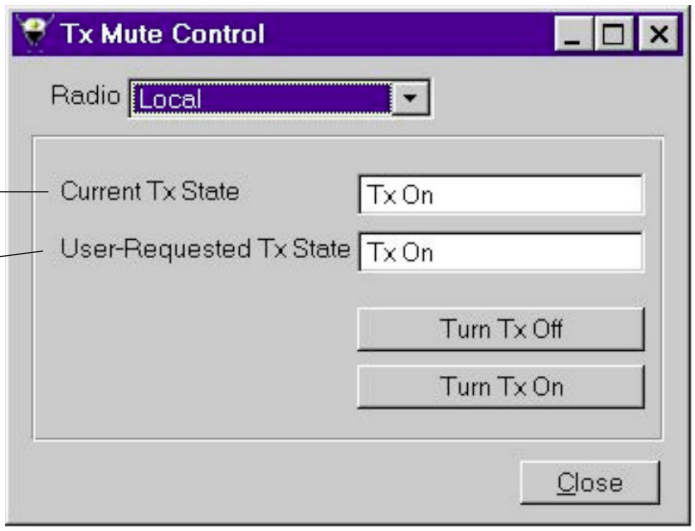
Boot Status


Boot Status
Link
Unprotected
Local
Remote
Radio Name
Radio A
Radio B
Boot Reason
Power Up
Power Up
Image Booted
Primary
Primary
IDU Boot SW Ver.
0.5.3.2
0.5.3.2
Current Image SW Ver.
1.2.1.98
1.2.1.98
Primary Image Version
1.2.1.98
1.2.1.98
Primary Image CRC
C2E0C66
C2E0C66
Primary Image Status
Good CRC
Good CRC
Secondary Image Version
1.2.1.98
1.2.1.98
Secondary Image CRC
C2E0C66
C2E0C66
Secondary Image Status
Good CRC
Good CRC
Refresh
Close
CURRENT IN USE
PRIMARY CODE
SECONDARY CODE

Control Menu



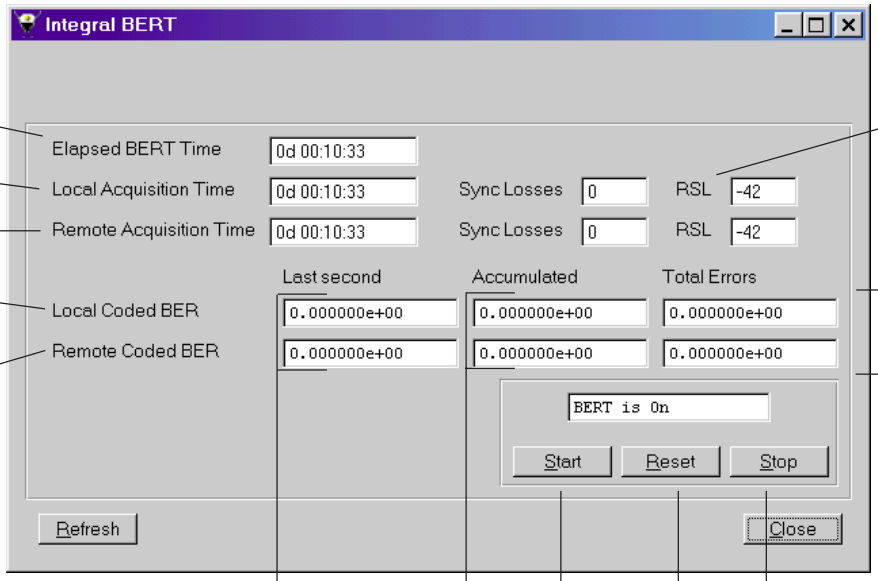
Tx Mute Control



STATUS OF TRANSMITTER, ON OR MUTED

LAST COMMAND GIVEN BY A USER (TX ON OR MUTED); MAY HAVE CHANGED DUE TO PROTECTION SWITCHING OR INTERNAL ALARM

Integral BERT



Time since BER Test began

Remote to Local direction

Local to Remote direction

Data at Local Receiver

Data at Remote Receiver

Current Receive Signal Level (dBM)

Total Errors in elapsed time

BER ratio in the last second

BER ratio in total elapsed time

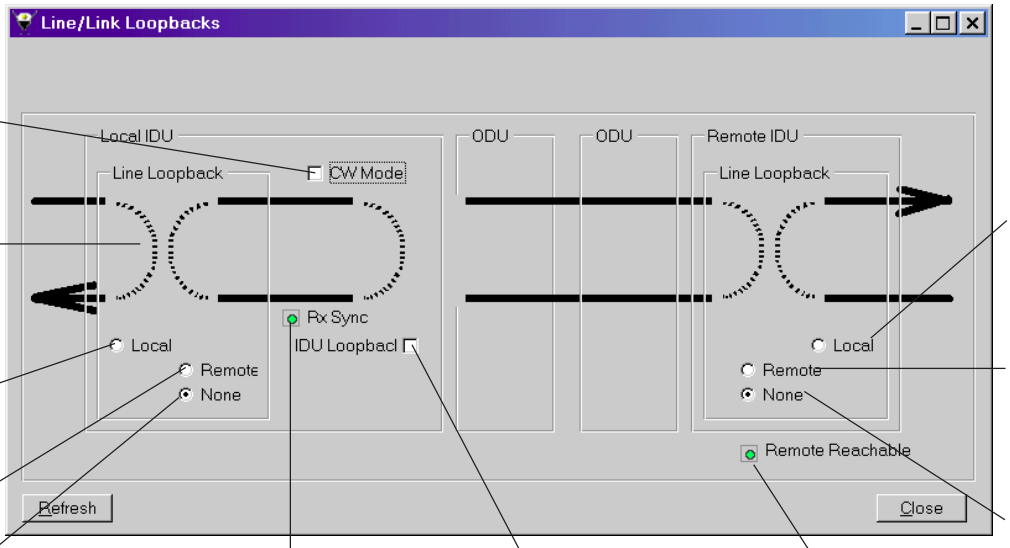
*Starts BER Test**

Clears timers/data and restarts BER Test.

Stops test, freezes data for analysis, puts system back in service.

***CAUTION!** BER Test is an out-of-service test and disrupts payload!*

Line/Link Loopbacks



Set to remove modulation from transmit carrier. Remove to restore modulation.

Lines becomes solid to indicate loopbacks are enabled.

Click to initiate local loopback to user.

Click to initiate remote loopback to radio.

Click to remove loopbacks and put data into normal operation.

Green indicates that local receiver is synced to distant end (without IDU loopback) and synced to its own transmitter (with IDU loopback).

Click to initiate loopback at output of IDU to test integrity of IDU signal.

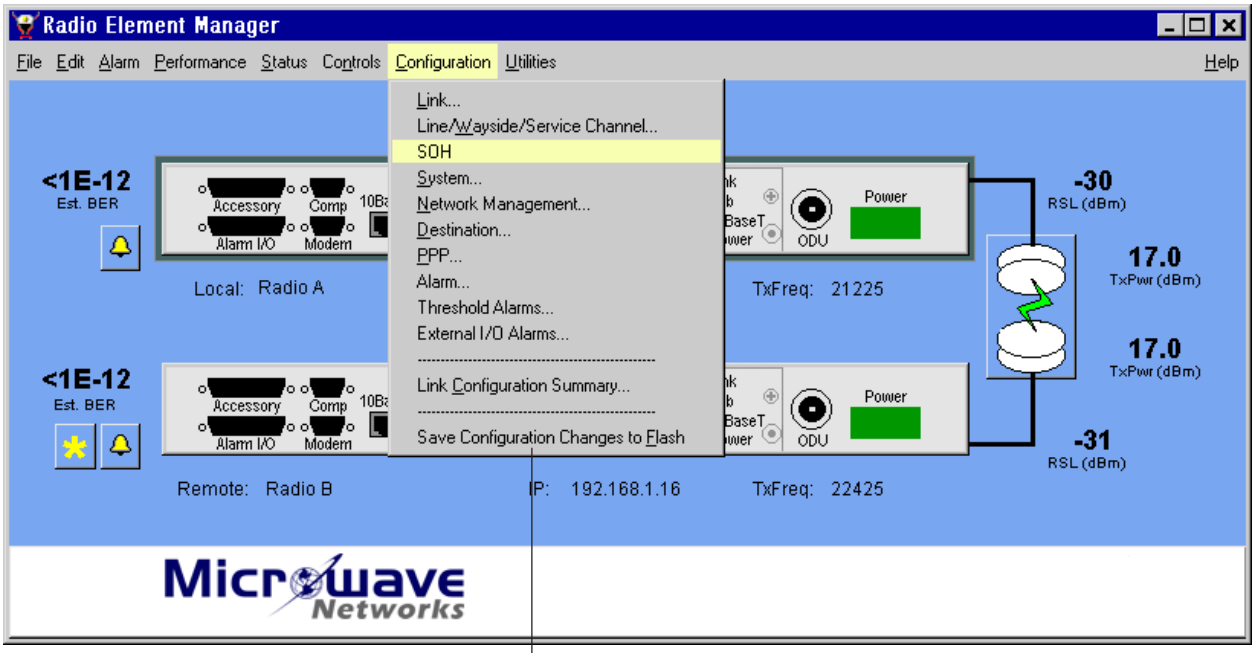
Green indicates that Network Management communication is active with remote end.

Click to initiate local loopback to user.

Click to initiate remote loopback to radio.

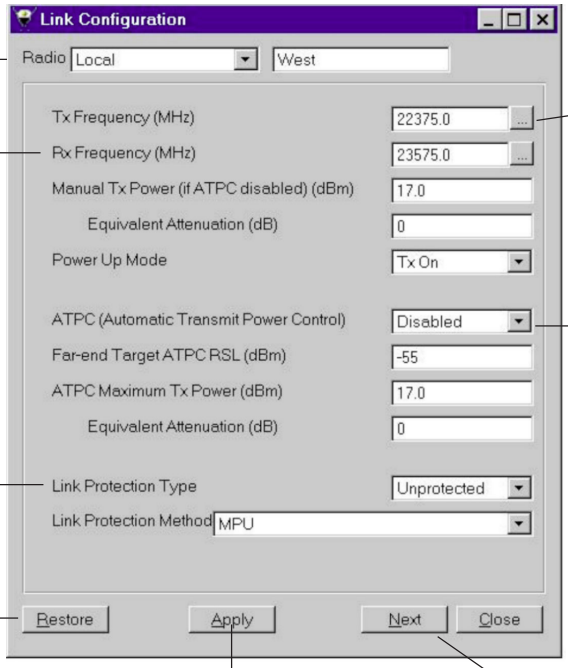
Click to remove loopbacks at remote.

Configuration Menu



Drop Down Configuration Menu

Link Configuration



Select Local or Remote

Changes frequency of radio. First, set remote radio frequency, then change local. Changing Tx frequency automatically changes Rx frequency.

If Protected Link selected, must reboot link after selected.

Restores pre-existing parameters (if not applied) and does not save changes.

Click to view listing of valid Tx frequencies. Click on desired frequency to select.

Enable or Disable ATPC

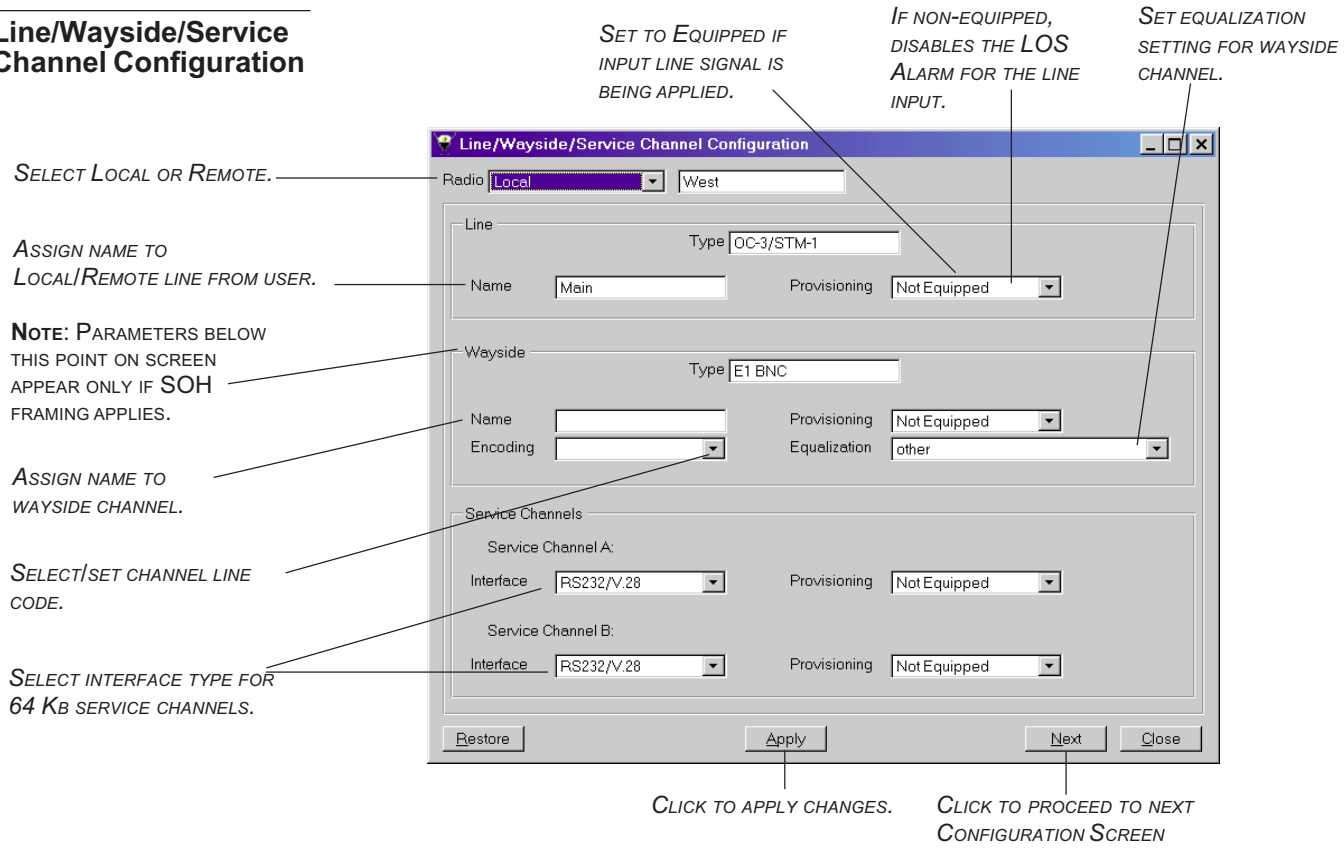
To enable ATPC:

1. Set far end Target ATPC RSL
2. Set near end maximum Tx power.
3. Enable ATPC
4. ATPC begins operating

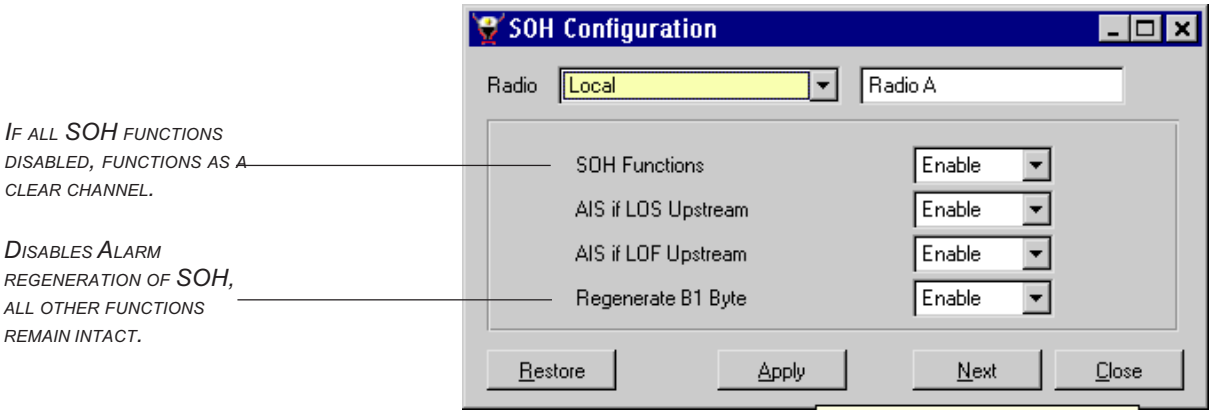
Applies changes and begins operating with new parameters.

Click to proceed to next Configuration Screen.

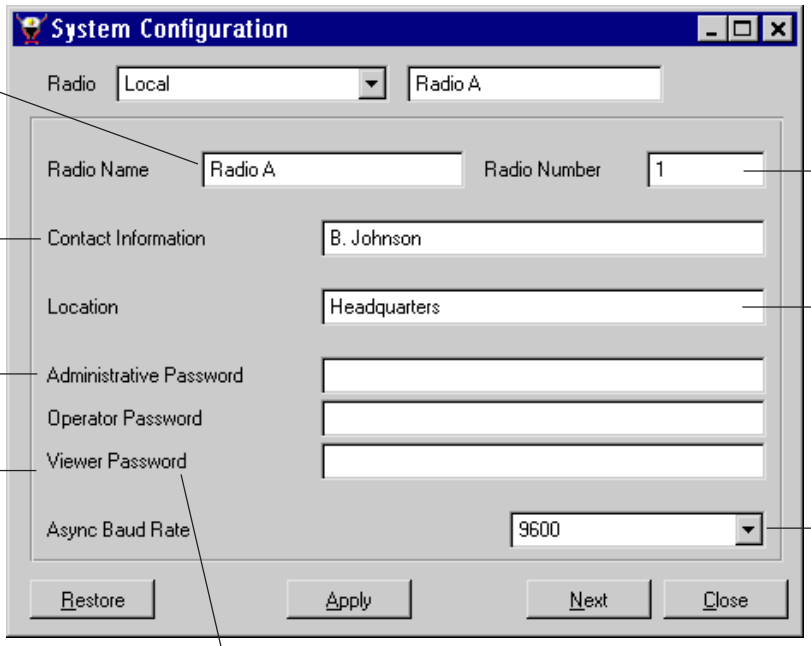
Line/Wayside/Service Channel Configuration



SOH Configuration



System Configuration



USER ASSIGNED NAME

USER ENTERED CONTACT INFORMATION; UP TO 78 CHARACTERS

SET PASSWORDS (UP TO 20 CHARACTERS)

- *ADMINISTRATIVE: HIGHEST LEVEL, CAN CHANGE PASSWORD AND PERFORM ALL FUNCTIONS*
- *OPERATOR: SECOND LEVEL, CAN PERFORM ALL FUNCTIONS EXCEPT CHANGE PASSWORD*
- *VIEWER: LOWEST LEVEL, READ ONLY*

ON STARTUP:
- *ENTER PASSWORD (DEFAULT PASSWORD IS PUBLIC)*

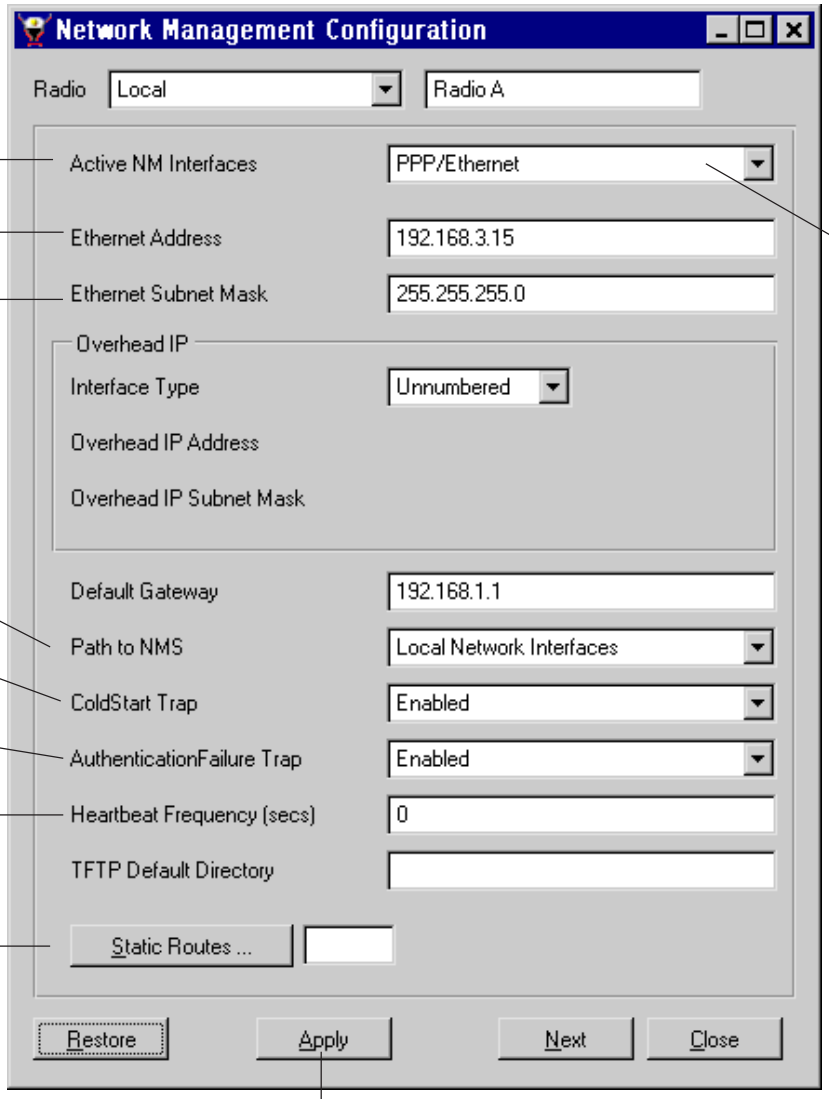
USER ASSIGNED ID 0-65,535 UP TO 5 CHARACTERS

USER ASSIGNED LOCATION, UP TO 78 CHARACTERS

SELECT BAUD RATE FOR EXTERNAL ASYNCHRONOUS DATA CHANNEL:

-1200, 2400, 4800, 9600 OR 19,200 BAUD

Network Management Configuration



CONFIGURES THE ACTIVE NETWORK MANAGEMENT INTERFACE

SET ETHERNET ADDRESS FOR IDU

SET TO THE DESIRED NM INTERFACE:

- *NONE*
- *ETHERNET*
- *PPP*
- *PPP/ETHERNET*

DEFINES THE SNMP PATH OF INFO FROM TERMINAL TO NMS

IF ENABLED, SENDS TRAP ON COLD START.

IF ENABLED, SENDS TRAP IF PASSWORD ENTRY TO IDU FAILS.

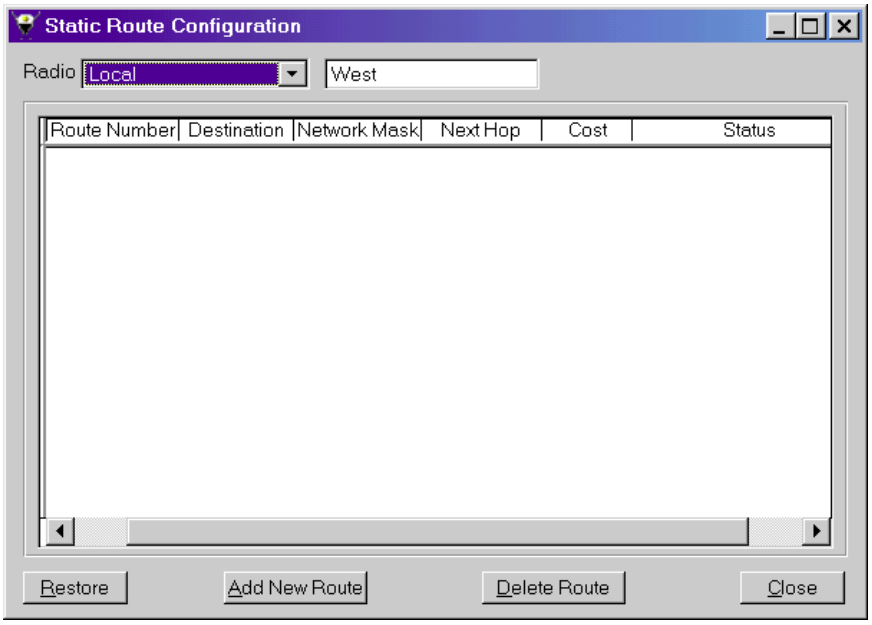
SENDS TRAPS OF HEARBEAT IN OPTIONAL TIME INTERVALS.

CLICK TO VIEW AND SET STATIC ROUTES.

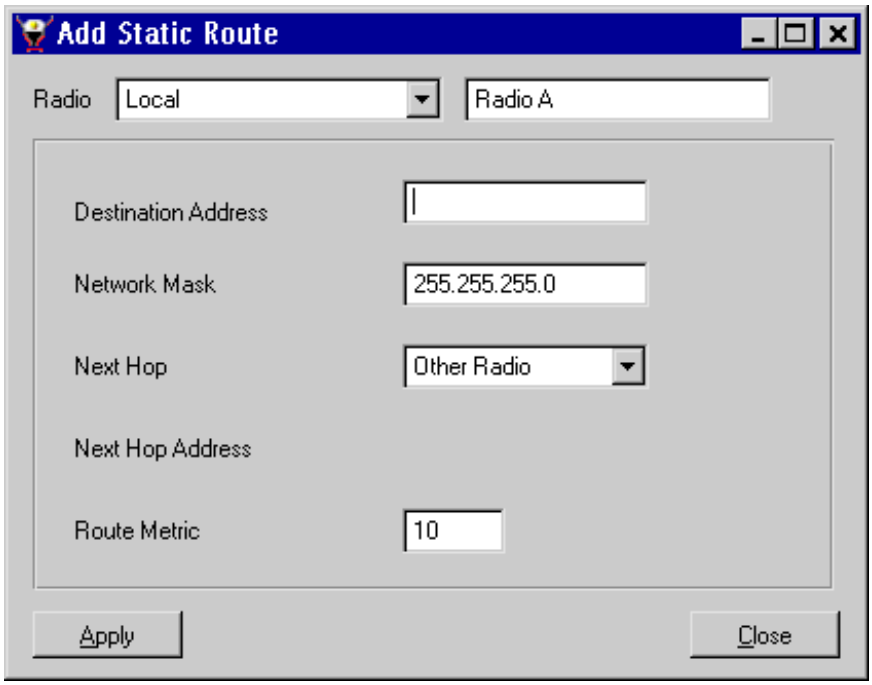
CLICK TO APPLY CHANGES. CHANGES TO IP ADDRESS TAKE EFFECT IMMEDIATELY AND DO NOT REQUIRE REBOOTING IDU.

Static Route Configuration

- *Define Static Routes*
- *Add or Delete*



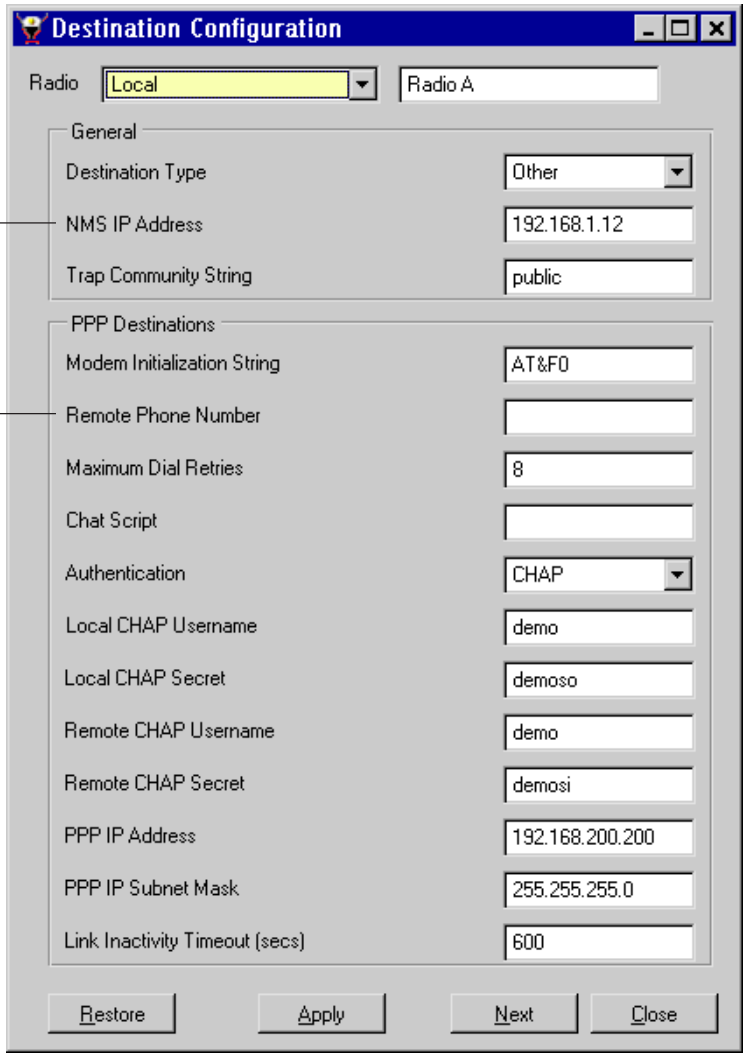
Add Static Route



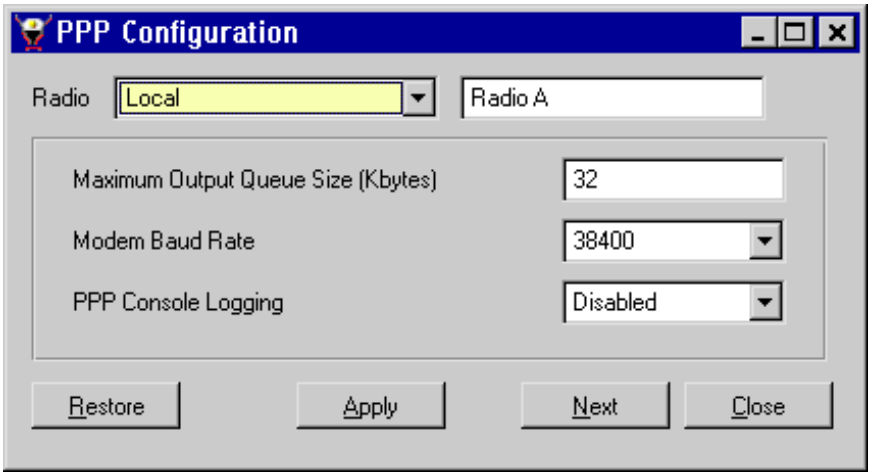
Destination Configuration

DEFINES IP ADDRESS OF NMS WHERE TRAPS ARE SENT.

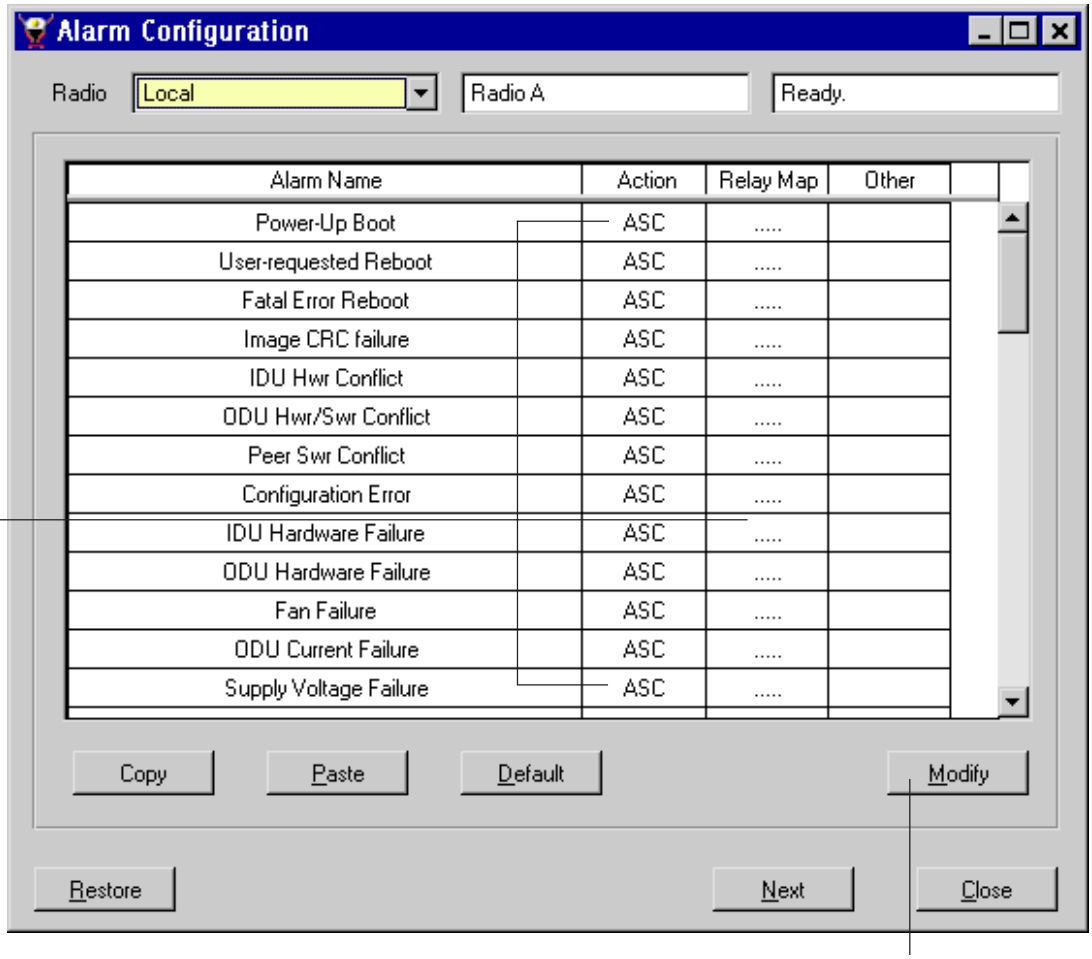
SET REMOTE MODEM DIAL-UP NUMBER



PPP Configuration



Alarm Configuration

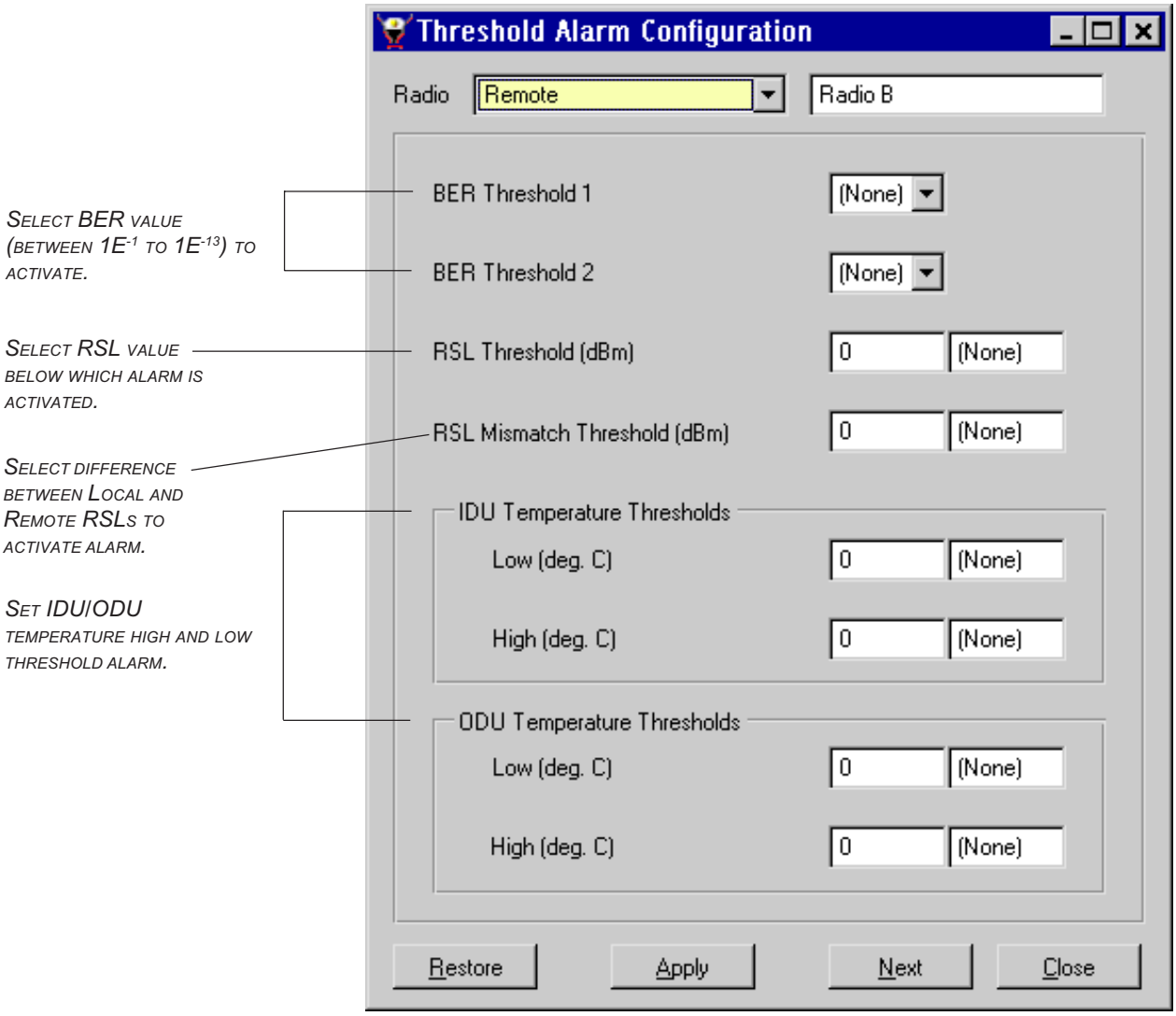


SET ALARMS FOR:
A = ACTIVE
S = SET TRAP
C = CLEAR TRAP

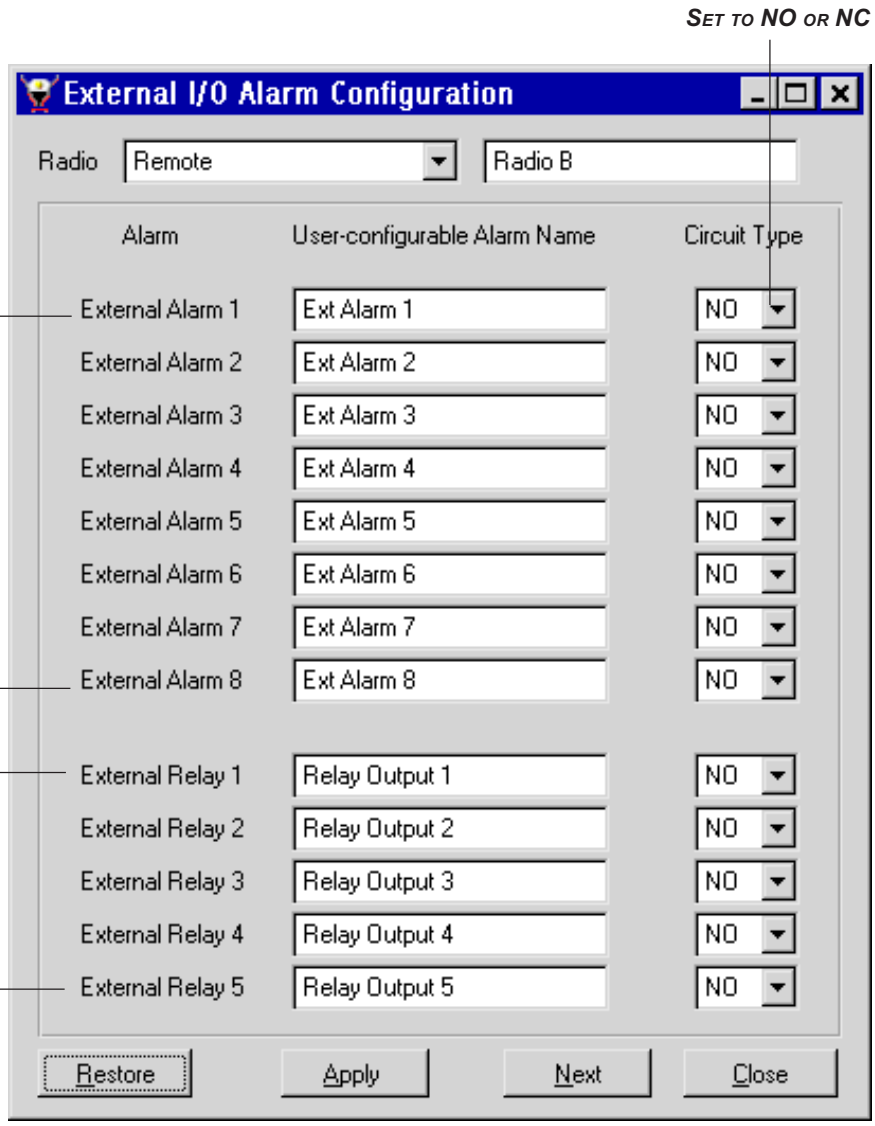
SELECT UP TO 5 OUTPUT RELAYS TO ACTIVATE ON GIVEN ALARM.

SELECT TO MODIFY SPECIFIC ALARM CONFIGURATION.

Threshold Alarm Configuration



External I/O Alarm Configuration



8 EXTERNAL INPUT ALARMS

- *ASSIGN ALARM NAME*
- *SET ALARM INPUT TO:*

  NO = NORMALLY OPEN
  NC = NORMALLY CLOSED

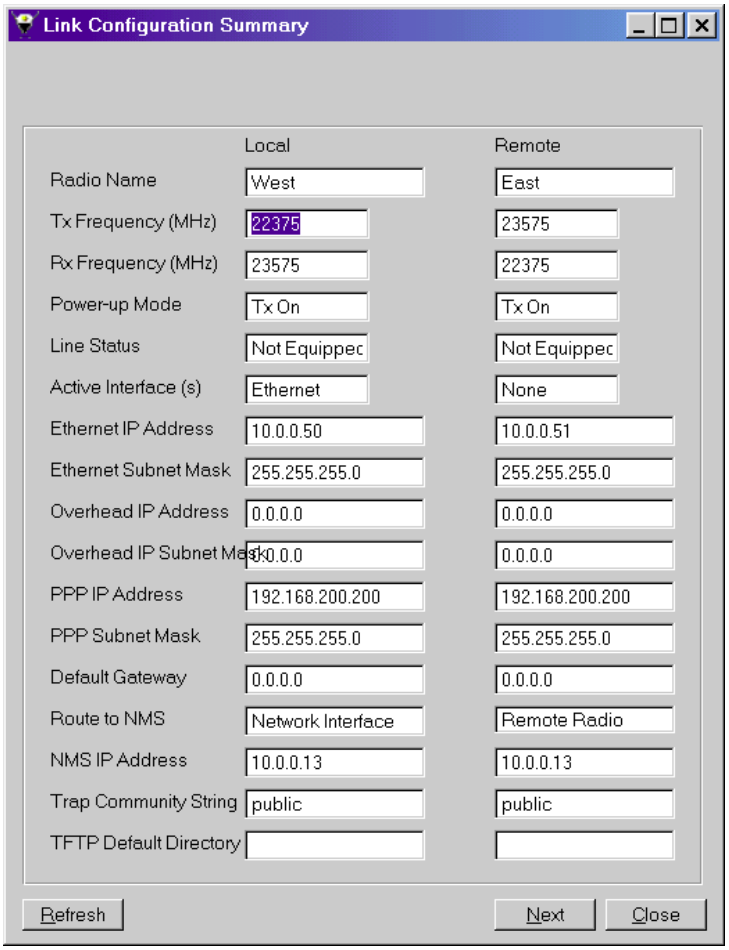
5 ASSIGNABLE ALARM RELAY OUTPUTS

- *ASSIGN RELAY OUTPUT NAME*
- *SET RELAY TYPE TO:*

  NO = NORMALLY OPEN
  NC = NORMALLY CLOSED

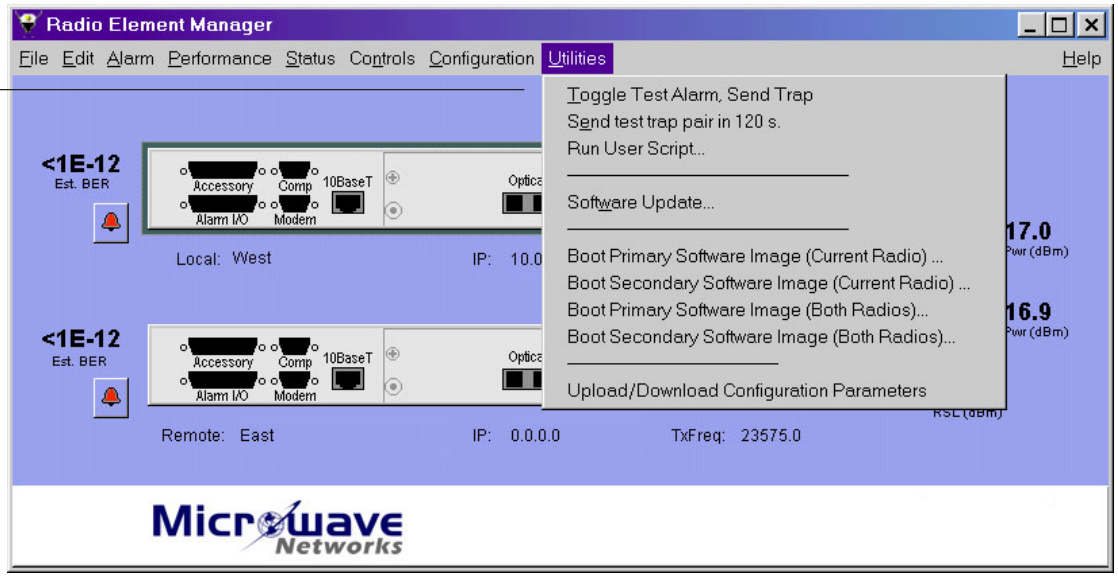
Link Configuration Summary

PROVIDES A SUMMARY OF MORE IMPORTANT CONFIGURATION SETTINGS.

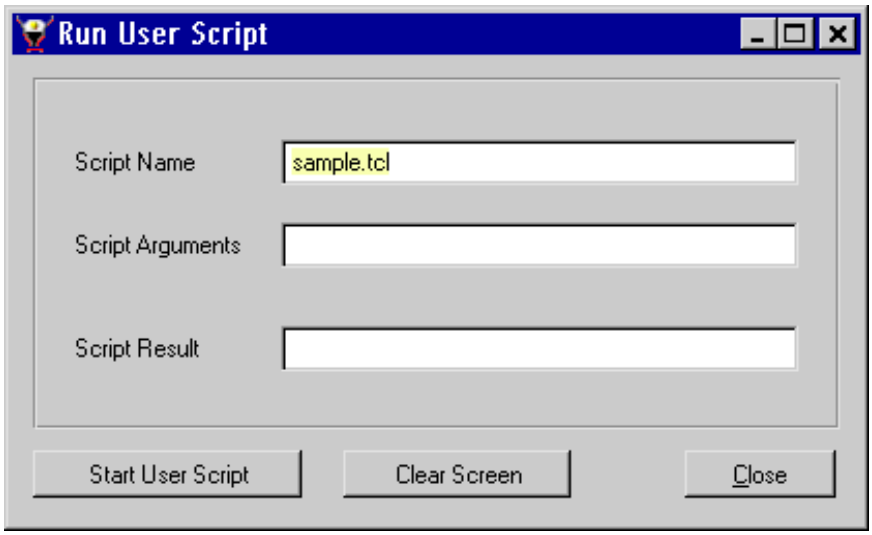


Utilities Menu

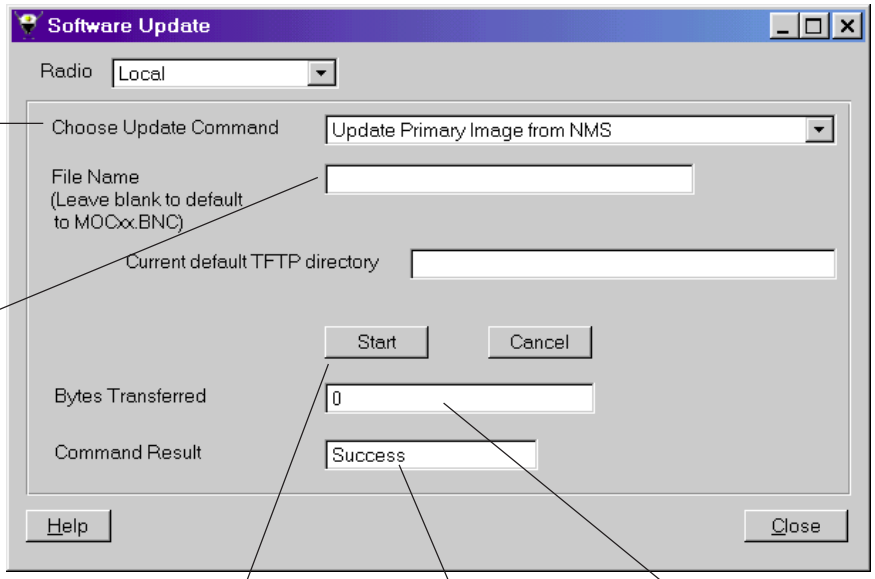
CLICK TO ACTIVATE TEST TRAP ALARM. CLICK AGAIN TO DEACTIVATE TEST TRAP ALARM.



Run User Script



Software Update



SELECT SOFTWARE UPDATE MODE

SOFTWARE UPDATE (OPERATING CODE) FOR BOTH PRIMARY AND SECONDARY.

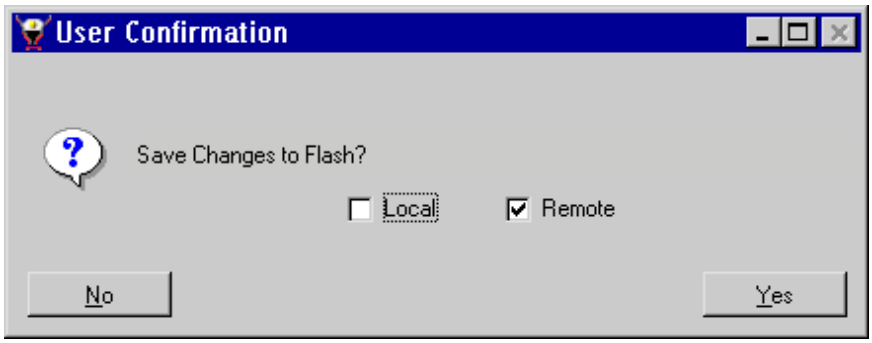
INSERT FILENAME OF NEW SOFTWARE CODE TO LOAD (MUST BE IN DEFAULT DIRECTORY OF TFTP SERVER).

CLICK TO START SOFTWARE UPDATE.

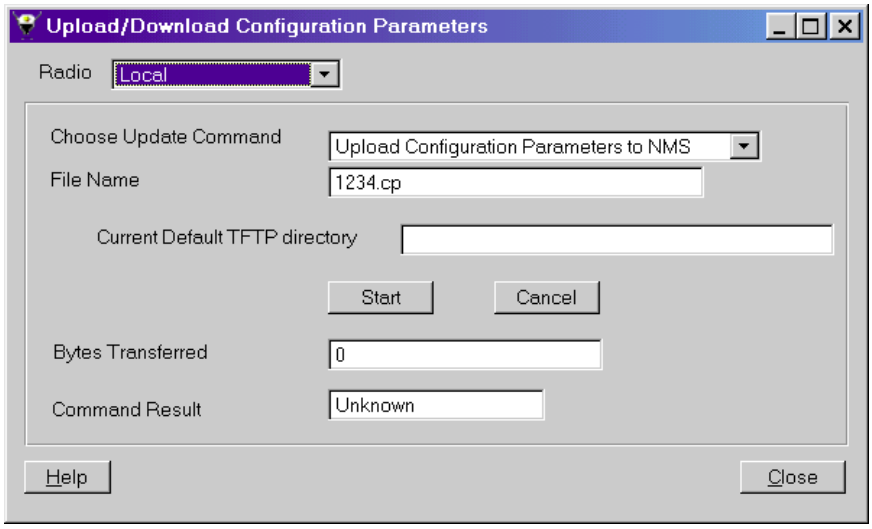
REPORTS PROGRESS OF UPDATE PROCEDURE. DISPLAYS "SUCESS" WHEN PROPERLY UPLOADED.

DISPLAYS STATUS OF BYTES TRANSFERRED DURING SOFTWARE UPDATE.

User Confirmation



Upload/Download Software Configuration Parameters



APPENDIX A - INSTALLATION & SITE SURVEY

Contents

Overview

To ensure the efficiency of an installation, a proper site survey should be conducted.

Before the start of an installation, an approved survey team should conduct a survey of the proposed sites. The team should be approved by the customer and may consist of either contracted surveyors or employees or both.

Equipment Checklist

The survey team will need:

- *Binoculars*
- *Spotting Scope*
- *GPS Navigation Device*
- *Site Survey Report Form*
- *Equipment Requisition Form*
- *Measure Tape, 100 feet*

Line of Sight (LOS)

In building construction terms, the beam width at 38GHz is relatively narrow. This reduces the clearance required between the direct path between sites A and B and buildings alongside that path. The required clearance from obstacles is called a Fresnel zone.

Fresnel zones are a series of concentric ellipsoid areas surrounding the straight line path between two antennas.

The first Fresnel zone is the area containing every point of which the distance from the transmitter to any reflection point on the area and on to the receiver is half a wavelength longer than the path of the direct signal.

The radius of the Fresnel zone is greatest at midpoint in the signal path. The required clearance of obstacles at this point is therefore higher than at any other point on the signal path.

The minimum required clearance is 0.6 of the first Fresnel zone.

Determining the LOS

The LOS should be clear and unimpeded for maximum efficiency in signal transmission and reception.

Non–metallic glass in windows may prove not to be an obstacle.

Determining Latitude and Longitude

Identification of the exact latitude and longitude of each location is required. This information is used in determining the distance between sites and the expected Receive Signal Level (RSL). In North America, the latitude and longitude must be reported to the FCC.

The measurements are performed using a Global Positioning System (GPS) Navigation Device, which is placed near the proposed location of the antenna. When the GPS device is activated, latitude and longitude readings transmitted from an overhead satellite will be recorded for at least 15 minutes.

Selecting Antenna Locations

The Site Survey team will determine the optimum location for the antenna. This should provide for ease of erecting and mounting the antenna as well as unimpeded LOS to the next site. Factors that need to be taken into account include:

- Loading weight for the roof
- Roof type (tar, cement, gravel, etc.)
- Proximity to the edge of the roof
- Local or Building ordinances prohibiting visibility of antennas
- Length of cable runs
- Grounding Connection Points
- Obstructions
- Accessibility

Grounding

Proper grounding of the antenna mounting provides protection from lightning and reduces the risk of electrical shock. The Site Survey Team will determine the source and connection points for the building–to–earth ground in the vicinity of the antenna. Efficient grounding of the antenna reduces electromagnetic interference to the operation of both the ODU and the IDU, and protects against electrical discharges.

Determining Antenna Mounting Type

The Site Survey Team will assess and report on any existing tower or antenna framework that may be usable.

In the case of a rooftop location, a standard non–penetrating mounting with an eight foot antenna post is standard. Non–penetrating mounts require concrete building blocks to prevent movement which might affect the alignment of the antennas.

The Site Survey team may determine that a wall–mounted antenna provides the optimum LOS.

The Site Survey Team will also identify the best place for the IDU and the rack or cabinet position. Factors that need to be considered include:

- **Accessibility**—For installation and maintenance purposes, the IDU should be readily accessible from both the front and the rear.
- **Environment**—The IDU is designed to operate in temperatures ranging from –5°C to +45° C, and in relative humidity of 95% non–condensing.
- **Cables**—The Site Survey Team will determine the path for the RG~8 coaxial cable(s) between the ODU and the IDU.

  In the case of a rooftop installation, the Site Survey Team will locate any available portal conduit to the roof. If none is available, the Site Survey Team will prepare a recommendation and include it in the report.

  The Site Survey Team will determine the proposed length of the RG-8 coaxial cable(s) between the ODU and the IDU. A further 10% of this measurement is required to allow for service loops and contingencies.
- **Power Supply**—The Site Survey Team will determine the location and availability of a power source. The Pinnacle radio is designed to operate with a DC power supply from –36 to –60 VDC or +24VDC±20% or 90 VAC to 240 VAC. A dedicated wall outlet is required.

  The Site Survey team reports on:
  - The current availability of an uninterrupted power source (UPS).
  - The regularity and frequency of interruptions to the power supply.

Pinnacle Site Survey Report

Requisition N°. _____ **Date** _____

Customer Name _____ Customer Reference _____
Customer Contact _____ Contact Title _____
Customer Address _____
City/State _____
Zipcode _____ Country _____
Telephone _____ Fax _____
E–mail _____

SITE DATA

Site Name _____
Address _____
City _____
State _____
Site Contact _____ Telephone _____
Path to (street address) _____
Distance between Paths _____ LOS ☐ Yes ☐ No
Union Personnel Required _____ ☐ Yes ☐ No
Property Management _____
Property Management Contact _____ Telephone _____
Building Engineer/Emergency after hours contact _____ Tel. N°. _____

TYPE OF STRUCTURE

Building _____ Guyed Tower _____ Self Supporting Structure _____
Total Height of Structure _____ Square Feet at Ground Level _____

GEODETIC DATA

Coordinates: Latitude DEG _____ MIN _____ SEC _____ N _____
Longitude DEG _____ MIN _____ SEC _____ W
Determined by: ☐ Topographical Map ☐ GPS ☐ Site Drawing
Ground Elevation (Ft. AMSL) _____ Antenna Center Line (Ft AGL) _____
Determined by: ☐ Topographical Map ☐ GPS ☐ Site Drawing

Pinnacle Site Survey Report

INDOOR LOCATION

IDU Location: _____ Floor No. _____ Room No. _____

Rack Space Provided? ☐ Yes ☐ No Size ☐ 19" ☐ 23"

Location on Rack _____ Height of Space _____

Space for New 19" Rack? ☐ Yes ☐ No

Demarc Location Floor No. _____ Room No. _____

Customer Required Interface _____

Cable Lengths: _____

_____

_____

Common Telco space available in building? ☐ Yes ☐ No

Indoor Telephone available? ☐ Yes ☐ No

Location for use by Contractor _____

POWER SUPPLY ☐ –48VDC ☐ 120VAC ☐ 240VAC

MOUNT

Type ☐ Wall ☐ Non–Penetrating Roof Other (Specify) _____

Height of Mast _____

Pressure Pad ☐ Yes ☐ No

ROOF

Is Roof Penetration required? ☐ Yes ☐ No

Roof Type: ☐ Gravel ☐ Rubber ☐ Cement Other (Specify) _____

Existing Conduit? ☐ Yes ☐ No Space Available? ☐ Yes ☐ No

New Conduit required? ☐ Yes ☐ No

GROUNDING WIRE/LIGHTNING PROTECTION

Is there existing Grounding Wire from roof? Yes ☐ No ☐

Length of Grounding wire required: _____

Is there existing Grounding Wire from rack? Yes ☐ No ☐

Length of Grounding wire required: _____

Prepared by: _____ Date Survey Completed: _____

Company: _____ Signed: _____ Tel. No.: _____

Drawings Attached: Specify location of mount on roof: _____

Specify location of mount on wall: _____

Cable run from antenna to IDU: _____

B APPENDIX B - Frequency Plans

Contents

Frequency Plans

13 GHz ETSI (ITU-R F.497)			T/R Spacing = 266 MHz - Chan BW = 28 MHz		
CH	**1A-Tx Freq**	**1A-Rx Freq**	**CH**	**1B-Tx Freq**	**1B-Rx Freq**
1	12,765.00	13,031.00	1	13,031.00	12,765.00
2	12,793.00	13,059.00	2	13,059.00	12,793.00
3	12,821.00	13,087.00	3	13,087.00	12,821.00
4	12,849.00	13,115.00	4	13,115.00	12,849.00
CH	**2A-Tx Freq**	**2A-Rx Freq**	**CH**	**2B-Tx Freq**	**2B-Rx Freq**
5	12,877.00	12,143.00	5	13,143.00	12,877.00
6	12,905.00	13,171.00	6	13,171.00	12,905.00
7	12,933.00	13,299.00	7	13,199.00	12,933.00
8	12,961.00	13,277.00	8	13,227.00	12,961.00

15 GHz ETSI (ITU-R F.636)			T/R Spacing = 490 MHz - Chan BW = 28 MHz - 14.4-15.35 GHz		
CH	**1A-Tx Freq**	**1A-Rx Freq**	**CH**	**1B-Tx Freq**	**1B-Rx Freq**
1	14,417.00	14,907.00	1	14,907.00	14,417.00
2	14,445.00	14,935.00	2	14,935.00	14,445.00
3	14,473.00	14,963.00	3	14,963.00	14,473.00
4	14,501.00	14,991.00	4	14,991.00	14,501.00
5	14,529.00	15,019.00	5	15,019.00	14,529.00
6	14,557.00	15,047.00	6	15,047.00	14,557.00
7	14,585.00	15,075.00	7	15,075.00	14,585.00
8	14,613.00	15,103.00	8	15,103.00	14,613.00
CH	**2A-Tx Freq**	**2A-Rx Freq**	**CH**	**2B-Tx Freq**	**2B-Rx Freq**
9	14,641.00	15,131.00	9	15,131.00	14,641.00
10	14,669.00	15,159.00	10	15,159.00	14,669.00
11	14,697.00	15,187.00	11	15,187.00	14,697.00
12	14,725.00	15,215.00	12	15,215.00	14,725.00
13	14,753.00	15,243.00	13	15,243.00	14,753.00
14	14,781.00	15,271.00	14	15,271.00	14,781.00
15	14,809.00	15,299.00	15	15,299.00	14,809.00
16	14,837.00	15,327.00	16	15,327.00	14,837.00

15 GHz ETSI (ITU-R F.636)			T/R Spacing = 728 MHz - Chan BW = 28 MHz - 14.4-15.35 GHz		
CH	**1A-Tx Freq**	**1A-Rx Freq**	**CH**	**1B-Tx Freq**	**1B-Rx Freq**
1	14,515.00	15,243.00	1	15,242.00	14,515.00
2	14,545.00	15,271.00	2	15,271.00	14,543.00
3	14,571.00	15,299.00	3	15,299.00	14,571.00
4	14,599.00	15,327.00	4	15,327.00	14,599.00

Frequency Plans

15 GHz ETSI (ITU-R F.636)			T/R Spacing = 420 MHz - Chan BW = 28 MHz - 14.5-15.35 GHz		
CH	**1A-Tx Freq**	**1A-Rx Freq**	**CH**	**1B-Tx Freq**	**1B-Rx Freq**
1	14,515.00	14,935.00	1	14,935.00	14,515.00
2	14,543.00	14,963.00	2	14,963.00	14,543.00
3	14,571.00	14,991.00	3	14,991.00	14,571.00
4	14,599.00	15,019.00	4	15,019.00	14,599.00
5	14,627.00	15,047.00	5	15,047.00	14,627.00
6	14,655.00	15,075.00	6	15,075.00	14,655.00
7	14,683.00	15,103.00	7	15,103.00	14,683.00
8	14,711.00	15,131.00	8	15,131.00	14,711.00
CH	**2A-Tx Freq**	**2A-Rx Freq**	**CH**	**2B-Tx Freq**	**2B-Rx Freq**
9	14,739.00	15,159.00	9	15,159.00	14,739.00
10	14,767.00	15,187.00	10	15,187.00	14,767.00
11	14,795.00	15,215.00	11	15,215.00	14,795.00
12	14,823.00	15,243.00	12	15,243.00	14,823.00
13	14,851.00	15,271.00	13	15,271.00	14,851.00
14	14,879.00	15,299.00	14	15,299.00	14,879.00
15	14,907.00	15,327.00	15	15,327.00	14,907.00

18 GHz FCC			T/R Spacing = 1560 MHz - Chan BW = 40 MHz		
CH	**1A-Tx Freq**	**1A-Rx Freq**	**CH**	**1B-Tx Freq**	**1B-Rx Freq**
1	17720.00	19280.00	1	19280.00	17720.00
2	17760.00	19320.00	2	19320.00	17760.00
3	17800.00	19360.00	3	19360.00	17800.00
4	17840.00	19400.00	4	19400.00	17840.00
5	17880.00	19440.00	5	19440.00	17880.00
6	17920.00	19480.00	6	19480.00	17920.00
7	17960.00	19520.00	7	19520.00	17960.00
8	18000.00	19560.00	8	19560.00	18000.00
9	18040.00	19600.00	9	19600.00	18040.00
10	18080.00	19640.00	10	19640.00	18080.00
11	18120.00	19680.00	11	19680.00	18120.00

Frequency Plans

18 GHz ETSI (ITU-R F.595-6)			T/R Spacing = 1010 MHz - Chan BW = 55 MHz		
CH	**1A-Tx Freq**	**1A-Rx Freq**	**CH**	**1B-Tx Freq**	**1B-Rx Freq**
1	17755.00	18765.00	1	18765.00	17755.00
2	17810.00	18820.00	2	18820.00	17810.00
3	17865.00	18875.00	3	18875.00	17865.00
4	17920.00	18930.00	4	18930.00	17920.00
5	17975.00	18985.00	5	18985.00	17975.00
6	18030.00	19040.00	6	19040.00	18030.00
7	18085.00	19095.00	7	19095.00	18085.00
8	18140.00	19150.00	8	19150.00	18140.00
9	18195.00	19205.00	9	19205.00	18195.00
CH	**2A-Tx Freq**	**2A-Rx Freq**	**CH**	**2B-Tx Freq**	**2B-Rx Freq**
10	18250.00	19260.00	10	19260.00	18250.00
11	18305.00	19315.00	11	19315.00	18305.00
12	18360.00	19370.00	12	19370.00	18360.00
13	18415.00	19425.00	13	19425.00	18415.00
14	18470.00	19480.00	14	19480.00	18470.00
15	18525.00	19535.00	15	19535.00	18525.00
16	18580.00	19590.00	16	19590.00	18580.00
17	18635.00	19645.00	17	19645.00	18635.00

18 GHz ETSI (ITU-R F.595-6)			T/R Spacing = 1010 MHz - Chan BW = 27.5 MHz		
CH	**3A-Tx Freq**	**3A-Rx Freq**	**CH**	**3B-Tx Freq**	**3B-Rx Freq**
1	17727.50	18737.50	1	18737.50	17727.50
2	17755.00	18765.00	2	18765.00	17755.00
3	17782.50	18792.50	3	18792.50	17782.50
4	17810.00	18820.00	4	18820.00	17810.00
5	17837.50	18847.50	5	18847.50	17837.50
6	17865.00	18875.00	6	18875.00	17865.00
7	17892.50	18902.50	7	18902.50	17892.50
8	17920.00	18930.00	8	18930.00	17920.00
9	17947.50	18957.50	9	18957.50	17947.50
10	17975.00	18985.00	10	18985.00	17975.00
11	18002.50	19012.50	11	19012.50	18002.50
12	18030.00	19040.00	12	19040.00	18030.00
13	18057.50	19067.50	13	19067.50	18057.50
14	18085.00	19095.00	14	19095.00	18085.00
15	18112.50	19122.50	15	19122.50	18112.50
16	18140.00	19150.00	16	19150.00	18140.00
17	18167.50	19177.50	17	19177.50	18167.50
18	18195.00	19205.00	18	19205.00	18195.00

Frequency Plans

18 GHz ETSI (ITU-R F.595-6)			T/R Spacing = 1010 MHz - Chan BW = 27.5 MHz		
CH	**4A-Tx Freq**	**4A-Rx Freq**	**CH**	**4B-Tx Freq**	**4B-Rx Freq**
19	18222.50	19232.50	19	19232.50	18222.50
20	18250.00	19260.00	20	19260.00	18250.00
21	18277.50	19287.50	21	19287.50	18277.50
22	18305.00	19315.00	22	19315.00	18305.00
23	18332.50	19342.50	23	19342.50	18332.50
24	18360.00	19370.00	24	19370.00	18360.00
25	18387.50	19397.50	25	19397.50	18387.50
26	18415.00	19425.00	26	19425.00	18415.00
27	18442.50	19452.50	27	19452.50	18442.50
28	18470.00	19480.00	28	19480.00	18470.00
29	18497.50	19507.50	29	19507.50	18497.50
30	18525.00	19535.00	30	19535.00	18525.00
31	18552.50	19562.50	31	19562.50	18552.50
32	18580.00	19590.00	32	19590.00	18580.00
33	18607.50	19617.50	33	19617.50	18607.50
34	18635.00	19645.00	34	19645.00	18635.00
35	18662.50	19672.50	35	19672.50	18662.50

Frequency Plans

23 GHz FCC			T/R Spacing = 1200 MHz - Chan BW = 50 MHz		
CH	**1A-Tx Freq**	**1A-Rx Freq**	**CH**	**1B-Tx Freq**	**1B-Rx Freq**
1	21225.00	22425.00	1	22425.00	21225.00
2	21275.00	22475.00	2	22475.00	21275.00
3	21325.00	22525.00	3	22525.00	21325.00
4	21375.00	22575.00	4	22575.00	21375.00
5	21425.00	22625.00	5	22625.00	21425.00
6	21475.00	22675.00	6	22675.00	21475.00
7	21525.00	22725.00	7	22725.00	21525.00
8	21575.00	22775.00	8	22775.00	21575.00
9	21625.00	22825.00	9	22825.00	21625.00
10	21675.00	22875.00	10	22875.00	21675.00
11	21725.00	22925.00	11	22925.00	21725.00
12	21775.00	22975.00	12	22975.00	21775.00
CH	**2A-Tx Freq**	**2A-Rx Freq**	**CH**	**2B-Tx Freq**	**2B-Rx Freq**
13	21825.00	23025.00	13	23025.00	21825.00
14	21875.00	23075.00	14	23075.00	21875.00
15	21925.00	23125.00	15	23125.00	21925.00
16	21975.00	23175.00	16	23175.00	21975.00
17	22025.00	23225.00	17	23225.00	22025.00
18	22075.00	23275.00	18	23275.00	22075.00
19	22125.00	23325.00	19	23325.00	22125.00
20	22175.00	23375.00	20	23375.00	22175.00
21	22225.00	23425.00	21	23425.00	22225.00
22	22275.00	23475.00	22	23475.00	22275.00
23	22325.00	23525.00	23	23525.00	22325.00
24	22375.00	23575.00	24	23575.00	22375.00

Frequency Plans

23 GHz ETSI			T/R Spacing = 1008 MHz - Chan BW = 56 MHz		
CH	1A-Tx Freq	1A-Rx Freq	CH	1B-Tx Freq	1B-Rx Freq
1	22078.00	23086.00	1	23086.00	22078.00
2	22134.00	23142.00	2	23142.00	22134.00
3	22190.00	23198.00	3	23198.00	22190.00
4	22246.00	23254.00	4	23254.00	22246.00
5	22302.00	23310.00	5	23310.00	22302.00
6	22358.00	23366.00	6	23366.00	22358.00
7	22414.00	23422.00	7	23422.00	22414.00
8	22470.00	23478.00	8	23478.00	22470.00
9	22526.00	23534.00	9	23534.00	22526.00

23 GHz ETSI			T/R Spacing = 1008 MHz - Chan BW = 28 MHz		
CH	2A-Tx Freq	2A-Rx Freq	CH	2B-Tx Freq	2B-Rx Freq
1	22022.00	23030.00	1	23030.00	22022.00
2	22050.00	23058.00	2	23058.00	22050.00
3	22078.00	23086.00	3	23086.00	22078.00
4	22106.00	23114.00	4	23114.00	22106.00
5	22134.00	23142.00	5	23142.00	22134.00
6	22162.00	23170.00	6	23170.00	22162.00
7	22190.00	23198.00	7	23198.00	22190.00
8	22218.00	23226.00	8	23226.00	22218.00
9	22246.00	23254.00	9	23254.00	22246.00
10	22274.00	23282.00	10	23282.00	22274.00
11	22302.00	23310.00	11	23310.00	22302.00
12	22330.00	23338.00	12	23338.00	22330.00
13	22358.00	23366.00	13	23366.00	22358.00
14	22386.00	23394.00	14	23394.00	22386.00
15	22414.00	23422.00	15	23422.00	22414.00
16	22442.00	23450.00	16	23450.00	22442.00
17	22470.00	23478.00	17	23478.00	22470.00
18	22498.00	23506.00	18	23506.00	22498.00
19	22526.00	23534.00	19	23534.00	22526.00
20	22554.00	23562.00	20	23562.00	22554.00

Frequency Plans

23 GHz ETSI			T/R Spacing = 1232 MHz - Chan BW = 28 MHz		
CH	**3A-Tx Freq**	**3A-Rx Freq**	**CH**	**3B-Tx Freq**	**3B-Rx Freq**
1	21238	22470	1	22470	21238
2	21266	22498	2	22498	21266
3	21294	22526	3	22526	21294
4	21322	22554	4	22554	21322
5	21350	22582	5	22582	21350
6	21378	22610	6	22610	21378
7	21406	22638	7	22638	21406
8	21434	22666	8	22666	21434
9	21462	22694	9	22694	21462
10	21490	22722	10	22722	21490
11	21518	22750	11	22750	21518
12	21546	22778	12	22778	21546
13	21574	22806	13	22806	21574
14	21602	22834	14	22834	21602
15	21630	22862	15	22862	21630
16	21658	22890	16	22890	21658
17	21686	22918	17	22918	21686
18	21714	22946	18	22946	21714
19	21742	22974	19	22974	21742
20	21770	23002	20	23002	21770
CH	**4A-Tx Freq**	**4A-Rx Freq**	**CH**	**4B-Tx Freq**	**4B-Rx Freq**
21	21798	23030	21	23030	21798
22	21826	23058	22	23058	21826
23	21854	23086	23	23086	21854
24	21882	23114	24	23114	21882
25	21910	23142	25	23142	21910
26	21938	23170	26	23170	21938
27	21966	23198	27	23198	21966
28	21994	23226	28	23226	21994
29	22022	23254	29	23254	22022
30	22050	23282	30	23282	22050
31	22078	23310	31	23310	22078
32	22106	23338	32	23338	22106
33	22134	23366	33	23366	22134
34	22162	23394	34	23394	22162
35	22190	23422	35	23422	22190
36	22218	23450	36	23450	22218
37	22246	23478	37	23478	22246
38	22274	23506	38	23506	22274
39	22302	23534	39	23534	22302
40	22330	23562	40	23562	22330

Frequency Plans

23 GHz ETSI			T/R Spacing = 1232 MHz - Chan BW = 56 MHz		
CH	**1A-Tx Freq**	**1A-Rx Freq**	**CH**	**1B-Tx Freq**	**1B-Rx Freq**
1	21252	22484	1	22484	21252
2	21308	22540	2	22540	21308
3	21364	22596	3	22596	21364
4	21420	22652	4	22652	21420
5	21476	22708	5	22708	21476
6	21532	22764	6	22764	21532
7	21588	22820	7	22820	21588
8	21644	22876	8	22876	21644
9	21700	22932	9	22932	21700
10	21756	22988	10	22988	21756
CH	**2A-Tx Freq**	**2A-Rx Freq**	**CH**	**2B-Tx Freq**	**2B-Rx Freq**
11	21812	23044	11	23044	21812
12	21868	23100	12	23100	21868
13	21924	23156	13	23156	21924
14	21980	23212	14	23212	21980
15	22036	23268	15	23268	22036
16	22092	23324	16	23324	22092
17	22148	23380	17	23380	22148
18	22204	23436	18	23436	22204
19	22260	23492	19	23492	22260
20	22316	23548	20	23548	22316

23 GHz ETSI (Used by the RA in the UK)			T/R Spacing = 1008 MHz - Chan BW = 56 MHz		
CH	**3A-Tx Freq**	**3A-Rx Freq**	**CH**	**3B-Tx Freq**	**3B-Rx Freq**
1	22036	23044	1	23044	22036
2	22092	23100	2	23100	22092
3	22148	23156	3	23156	22148
4	22204	23212	4	23212	22204
5	22260	23268	5	23268	22260
6	22316	23324	6	23324	22316
7	22372	23380	7	23380	22372
8	22428	23436	8	23436	22428
9	22484	23492	9	23492	22484
10	22540	23548	10	23548	22540

Frequency Plans

23 GHz ETSI			T/R Spacing = 1232 MHz - Chan BW = 28 MHz		
CH	**5A-Tx Freq**	**5A-Rx Freq**	**CH**	**5B-Tx Freq**	**5B-Rx Freq**
1	21241.5	22473.5	1	22473.5	21241.5
2	21269.5	22501.5	2	22501.5	21269.5
3	21297.5	22529.5	3	22529.5	21297.5
4	21325.5	22557.5	4	22557.5	21325.5
5	21353.5	22585.5	5	22585.5	21353.5
6	21381.5	22613.5	6	22613.5	21381.5
7	21409.5	22641.5	7	22641.5	21409.5
8	21437.5	22669.5	8	22669.5	21437.5
9	21465.5	22697.5	9	22697.5	21465.5
10	21493.5	22725.5	10	22725.5	21493.5
11	21521.5	22753.5	11	22753.5	21521.5
12	21549.5	22781.5	12	22781.5	21549.5
13	21577.5	22809.5	13	22809.5	21577.5
14	21605.5	22837.5	14	22837.5	21605.5
15	21633.5	22865.5	15	22865.5	21633.5
16	21661.5	22893.5	16	22893.5	21661.5
17	21689.5	22921.5	17	22921.5	21689.5
18	21717.5	22949.5	18	22949.5	21717.5
19	21745.5	22977.5	19	22977.5	21745.5
20	21773.5	23005.5	20	23005.5	21773.5
CH	**6A-Tx Freq**	**6A-Rx Freq**	**CH**	**6B-Tx Freq**	**6B-Rx Freq**
21	21801.5	23033.5	21	23033.5	21801.5
22	21829.5	23061.5	22	23061.5	21829.5
23	21857.5	23089.5	23	23089.5	21857.5
24	21885.5	23117.5	24	23117.5	21885.5
25	21913.5	23145.5	25	23145.5	21913.5
26	21941.5	23173.5	26	23173.5	21941.5
27	21969.5	23201.5	27	23201.5	21969.5
28	21997.5	23229.5	28	23229.5	21997.5
29	22025.5	23257.5	29	23257.5	22025.5
30	22053.5	23285.5	30	23285.5	22053.5
31	22081.5	23313.5	31	23313.5	22081.5
32	22109.5	23341.5	32	23341.5	22109.5
33	22137.5	23369.5	33	23369.5	22137.5
34	22165.5	23397.5	34	23397.5	22165.5
35	22193.5	23425.5	35	23425.5	22193.5
36	22221.5	23453.5	36	23453.5	22221.5
37	22249.5	23481.5	37	23481.5	22249.5
38	22277.5	23509.5	38	23509.5	22277.5
39	22305.5	23537.5	39	23537.5	22305.5
40	22333.5	23565.5	40	23565.5	22333.5

Frequency Plans

26 GHz ETSI			T/R Spacing = 1008 MHz - Chan BW = 56 MHz		
CH	**1A-Tx Freq**	**1A-Rx Freq**	**CH**	**1B-Tx Freq**	**1B-Rx Freq**
1	24577.00	25585.00	1	25585.00	24577.00
2	24633.00	25641.00	2	25641.00	24633.00
3	24689.00	25697.00	3	25697.00	24689.00
4	24745.00	25753.00	4	25753.00	24745.00
5	24801.00	25809.00	5	25809.00	24801.00
6	24857.00	25865.00	6	25865.00	24857.00
7	24913.00	25921.00	7	25921.00	24913.00
8	24969.00	25977.00	8	25977.00	24969.00
CH	**2A-Tx Freq**	**2A-Rx Freq**	**CH**	**2B-Tx Freq**	**2B-Rx Freq**
9	25025.00	26033.00	9	26033.00	25025.00
10	25081.00	26089.00	10	26089.00	25081.00
11	25137.00	26145.00	11	26145.00	25137.00
12	25193.00	26201.00	12	26201.00	25193.00
13	25249.00	26257.00	13	26257.00	25249.00
14	25305.00	26313.00	14	26313.00	25305.00
15	25361.00	26369.00	15	26369.00	25361.00
16	25417.00	26425.00	16	26425.00	25417.00

Frequency Plans

26 GHz ETSI			T/R Spacing = 1008 MHz - Chan BW = 28 MHz		
CH	**3A-Tx Freq**	**3A-Rx Freq**	**CH**	**3B-Tx Freq**	**3B-Rx Freq**
1	24563.00	25571.00	1	25571.00	24563.00
2	24591.00	25599.00	2	25599.00	24591.00
3	24619.00	25627.00	3	25627.00	24619.00
4	24647.00	25655.00	4	25655.00	24647.00
5	24675.00	25683.00	5	25683.00	24675.00
6	24703.00	25711.00	6	25711.00	24703.00
7	24731.00	25739.00	7	25739.00	24731.00
8	24759.00	25767.00	8	25767.00	24759.00
9	24787.00	25795.00	9	25795.00	24787.00
10	24815.00	25823.00	10	25823.00	24815.00
11	24843.00	25851.00	11	25851.00	24843.00
12	24871.00	25879.00	12	25879.00	24871.00
13	24899.00	25907.00	13	25907.00	24899.00
14	24927.00	25935.00	14	25935.00	24927.00
15	24955.00	25963.00	15	25963.00	24955.00
16	24983.00	25991.00	16	25991.00	24983.00
CH	**4A-Tx Freq**	**4A-Rx Freq**	**CH**	**4B-Tx Freq**	**4B-Rx Freq**
17	25011.00	26019.00	17	26019.00	25011.00
18	25039.00	26047.00	18	26047.00	25039.00
19	25067.00	26075.00	19	26075.00	25067.00
20	25095.00	26103.00	20	26103.00	25095.00
21	25123.00	26131.00	21	26131.00	25123.00
22	25151.00	26159.00	22	26159.00	25151.00
23	25179.00	26187.00	23	26187.00	25179.00
24	25207.00	26215.00	24	26215.00	25207.00
25	25235.00	26243.00	25	26243.00	25235.00
26	25263.00	26271.00	26	26271.00	25263.00
27	25291.00	26299.00	27	26299.00	25291.00
28	25319.00	26327.00	28	26327.00	25319.00
29	25347.00	26355.00	29	26355.00	25347.00
30	25375.00	26383.00	30	26383.00	25375.00
31	25403.00	26411.00	31	26411.00	25403.00
32	25431.00	26439.00	32	26439.00	25431.00

Frequency Plans

38 GHz FCC			T/R Spacing = 700 MHz - Chan BW = 50 MHz		
CH	**1A-Tx Freq**	**1A-Rx Freq**	**CH**	**1B-Tx Freq**	**1B-Rx Freq**
1	38625.00	39325.00	1	39325.00	38625.00
2	38675.00	39375.00	2	39375.00	38675.00
3	38725.00	39425.00	3	39425.00	38725.00
4	38775.00	39475.00	4	39475.00	38775.00
5	38825.00	39525.00	5	39525.00	38825.00
6	38875.00	39575.00	6	39575.00	38875.00
7	38925.00	39625.00	7	39625.00	38925.00
CH	**2A-Tx Freq**	**2A-Rx Freq**	**CH**	**2B-Tx Freq**	**2B-Rx Freq**
8	38975.00	39675.00	8	39675.00	38975.00
9	39025.00	39725.00	9	39725.00	39025.00
10	39075.00	39775.00	10	39775.00	39075.00
11	39125.00	39825.00	11	39825.00	39125.00
12	39175.00	39875.00	12	39875.00	39175.00
13	39225.00	39925.00	13	39925.00	39225.00
14	39275.00	39975.00	14	39975.00	39275.00

38 GHz ETSI			T/R Spacing = 1260 MHz - Chan BW = 56 MHz		
CH	**1A-Tx Freq**	**1A-Rx Freq**	**CH**	**1B-Tx Freq**	**1B-Rx Freq**
1	37086.00	38346.00	1	38346.00	37086.00
2	37142.00	38402.00	2	38402.00	37142.00
3	37198.00	38458.00	3	38458.00	37198.00
4	37254.00	38514.00	4	38514.00	37254.00
5	37310.00	38570.00	5	38570.00	37310.00
6	37366.00	38626.00	6	38626.00	37366.00
7	37422.00	38682.00	7	38682.00	37422.00
8	37478.00	38738.00	8	38738.00	37478.00
9	37534.00	38794.00	9	38794.00	37534.00
10	37590.00	38850.00	10	38850.00	37590.00
CH	**2A-Tx Freq**	**2A-Rx Freq**	**CH**	**2B-Tx Freq**	**2B-Rx Freq**
11	37646.00	38906.00	11	38906.00	37646.00
12	37702.00	38962.00	12	38962.00	37702.00
13	37758.00	39018.00	13	39018.00	37758.00
14	37814.00	39074.00	14	39074.00	37814.00
15	37870.00	39130.00	15	39130.00	37870.00
16	37926.00	39186.00	16	39186.00	37926.00
17	37982.00	39242.00	17	39242.00	37982.00
18	38038.00	39298.00	18	39298.00	38038.00
19	38094.00	39354.00	19	39354.00	38094.00
20	38150.00	39410.00	20	39410.00	38150.00

Frequency Plans

38 GHz ETSI			T/R Spacing = 1260 MHz - Chan BW = 28 MHz		
CH	**3A-Tx Freq**	**3A-Rx Freq**	**CH**	**3B-Tx Freq**	**3B-Rx Freq**
1	37072.00	38332.00	1	38332.00	37072.00
2	37100.00	38360.00	2	38360.00	37100.00
3	37128.00	38388.00	3	38388.00	37128.00
4	37156.00	38416.00	4	38416.00	37156.00
5	37184.00	38444.00	5	38444.00	37184.00
6	37212.00	38472.00	6	38472.00	37212.00
7	37240.00	38500.00	7	38500.00	37240.00
8	37268.00	38528.00	8	38528.00	37268.00
9	37296.00	38556.00	9	38556.00	37296.00
10	37324.00	38584.00	10	38584.00	37324.00
11	37352.00	38612.00	11	38612.00	37352.00
12	37380.00	38640.00	12	38640.00	37380.00
13	37408.00	38668.00	13	38668.00	37408.00
14	37436.00	38696.00	14	38696.00	37436.00
15	37464.00	38724.00	15	38724.00	37464.00
16	37492.00	38752.00	16	38752.00	37492.00
17	37520.00	38780.00	17	38780.00	37520.00
18	37548.00	38808.00	18	38808.00	37548.00
19	37576.00	38836.00	19	38836.00	37576.00
20	37604.00	38864.00	20	38864.00	37604.00
CH	**4A-Tx Freq**	**4A-Rx Freq**	**CH**	**4B-Tx Freq**	**4B-Rx Freq**
21	37632.00	38892.00	21	38892.00	37632.00
22	37660.00	38920.00	22	38920.00	37660.00
23	37688.00	38948.00	23	38948.00	37688.00
24	37716.00	38976.00	24	38976.00	37716.00
25	37744.00	39004.00	25	39004.00	37744.00
26	37772.00	39032.00	26	39032.00	37772.00
27	37800.00	39060.00	27	39060.00	37800.00
28	37828.00	39088.00	28	39088.00	37828.00
29	37856.00	39116.00	29	39116.00	37856.00
30	37884.00	39144.00	30	39144.00	37884.00
31	37912.00	39172.00	31	39172.00	37912.00
32	37940.00	39200.00	32	39200.00	37940.00
33	37968.00	39228.00	33	39228.00	37968.00
34	37996.00	39256.00	34	39256.00	37996.00
35	38024.00	39284.00	35	39284.00	38024.00
36	38052.00	39312.00	36	39312.00	38052.00
37	38080.00	39340.00	37	39340.00	38080.00
38	38108.00	39368.00	38	39368.00	38108.00
39	38136.00	39396.00	39	39396.00	38136.00
40	38164.00	39424.00	40	39424.00	38164.00

C APPENDIX C - Alarm Descriptions

Contents

Alarm Descriptions

Startup/Config Failures	
Alarm	**Probable Cause**
Power-Up Boot	• Operational software rebooted due to radio power-up.
User-Requested Reboot	• Operational software rebooted due to user request.
Fatal Error Reboot	• Operational software rebooted because of fatal software error. The trap parameter contains an error code that identifies the particular fatal error.
Image CRC Failure	• CRC comparison failed on primary or secondary operational software image in flash (trap parameter is 1 if primary is bad, 2 if secondary is bad.)
IDU Hwr Conflict	• There is an incompatibility between the current operational software version and the IDU hardware or firmware. The link may still be capable of operation, but if it fails to acquire sync, this incompatibility is the likely cause.
ODU Hwr/Swr Conflict	• The IDU is not compatible for use with the ODU. Consult sales representative for technical assistance.
Peer Swr Conflict	• The software code version is different between the local IDU and remote IDU. The link may still be capable of operation, but if it fails to acquire sync, this incompatibility is the likely cause.
Configuration Error	• Link cannot go online because of configuration error. For example, configured frequency incompatible with ODU.

Hardware Failures	
Alarm	**Probable Cause**
IDU Hardware Failure	• Software has detected a definite, specific IDU hardware failure. Specific reason in given trap parameter.
ODU Hardware Failure	• Software has detected a definite, specific ODU hardware failure. Specific reason in given trap parameter.
Fan Failure	• One or more fans have failed. The number of fans that have failed is in the trap parameter.
ODU Current Failure	• Current to ODU is too high or low. Might be a cable failure or an ODU failure.
Supply Voltage Failure	• Supply voltage to IDU is too low.

Alarm Descriptions (cont.)

Link Rx/Tx Failures	
Alarm	**Probable Cause**
Tx Failure	• Radio's transmitter is not transmitting properly. Specific reason in trap parameter.
Tx Mute	• Radio's transmitter muted by user.
Rx Failure	• Radio's receiver is not receiving properly. The specific reason is indicated by the trap parameter.
FE Rx Failure	• The receiver on the far end (FE) radio (this radio's peer radio) is not receiving properly.
Link Disabled	• The user has commanded the transmitter to be "off".
Maintenance Mode	• The user put link into a maintenance mode that interrupts user traffic. This includes enabling the integral BER Test, and also any line loopbacks (which have their own alarms).
Receive Protection Switch	• In a protected link, a receiver failure has led to a protection switch (a switch from the side's primary receiver to its secondary receiver). The specific type of failure is indicated by the trap parameter.
Transmit Protection Switch	• In a protected link, a transmitter failure has led to a protection switch (a switch from the side's primary transmitter to its secondary transmitter). The specific type of failure is indicated by the trap parameter.

Performance Thresholds - All thresholds are configured in the Alarm Configuration Table Menu or GUI	
Alarm	**Probable Cause**
BER Threshold 1	• The estimated BER has fallen to or below the configured threshold. The alarm is not reset until the BER rises to 2 orders of magnitude above the threshold.
BER Threshold 2	• Same as previous alarm, but uses a second separate threshold. One can be an early warning alarm, second can indicate a serious problem.
RSL Threshold	• The RSL has fallen below the configured threshold. The alarm is not reset until the RSL rises to 5 dB above the threshold.

Alarm Descriptions (cont.)

Performance Thresholds (cont.)	
Alarm	**Probable Cause**
RSL Mismatch Threshold	• The difference between the two radio RSLs has risen above the configured threshold. The alarm is not reset until the difference falls to 5 dB below the threshold.
IDU Temperature Threshold	• IDU temperature is either greater than the high threshold or less than the low threshold. The alarm is not reset until the temperature returns to 5 degrees WITHIN the relevant threshold.
ODU Temperature Threshold	• ODU Temperature threshold alarm, otherwise just like preceding one.

Alarm Names	
Alarm Failures	**Remarks**
ODU Telemetry Failure	• IDU cannot communicate with the ODU.
Peer Comm Failure	• IDU is unable to communicate with one of more of the other radios in the link.
NM Comm Failure	• Ethernet Link Fail (loss of connection to hub) or PPP redials are exhausted.
Login Alarm	• Someone has logged into serial or Telnet craft terminal interface. (Like all alarms, this can be disabled. The factory default for this alarm is for it to be disabled.)
Test Alarm	• Alarm that user can set/clear from the craft terminal interface. Used when testing trap delivery.
Misc Major Failure	• Specifics in trap parameter.
Misc Minor Failure	• Specifics in trap parameter.

Alarm Descriptions (cont.)

Alarm Names	
Line Failures	**Remarks**
Line Los	• Loss Of Signal detected on receiver of Line that is configured as being equipped. (One separate alarm for each line, if multiple lines.)
Wayside A LOS	• Loss of Signal detected on wayside channel A if configured as equipped.
Line Unexp Signal	• Unexpected Signal: signal detected on receiver of line that is configured as being unequipped.
Wayside A Unexp Signal	• Unexpected Signal: signal detected on Wayside Channel A that is configured as being unequipped.
Line Loopback	• Line has one loopback active.
Wayside A Loopback	• Wayside Channel A has a loopback control active.
Wayside A AIS	• Wayside Channel A has detected AIS on its input from the user.
Line LOF	• Loss of frame on Line input from user. Only used on systems equipped with SOH framing.
Radio Link SOH LOF	• Loss of frame of SOH over Radio Link. Only used on system equipped with SOH framing.
External Alarms/Relays	**Remarks**
External Alarm Input 1-8	• Configurable external Alarm input in abnormal state (either closed or open). One alarm per external input.
Relay Summaries 1-5	• Configurable relay is in abnormal state (either closed or open) due to one or more of the alarms mapped to it being set. One alarm per relay, can be disabled.
Link Failure Summary	• Summary Alarm, if link is not passing data properly in both directions. The highest level indicates that there is a major failure.
IDU Summary	• Failure detected (hard hardware failure or internal loss of signal continuity) that is localized to IDU; suggests that replacement is warranted.
ODU Summary	• Failure detected (hardware failure or internal loss of signal continuity) that is localized to ODU; suggests that replacement is warranted.
Remote Radio Summary	• Link is up, but there is an alarm on remote radio. Tied to "Remote" LED.

D APPENDIX D - Updating IDU Software

Contents

Updating IDU Software in a Single IDU

Software updates for Pinnacle radios can be easily performed using TFTP. You may use any TFTP server. A

9-Pin D cable between the IDU Computer Port and a PC, plus an Ethernet connection to the IDU will be required before the following procedure can be implemented. If the IDU and NMS IP addresses are set as described below, the 9-pin D cable is not required.

1. Check and record your PC's IP address and subnet mask. This can be obtained in Windows by clicking on **Start/Control Panel/Network/ Configuration/TCP/IP-Interface/Properties.** If no address is assigned, enter the following: 192.168.1.1 for an IP address and 255.255.255.0 for the mask. Reboot the PC.
2. After an address is set for the PC, the same must be done for the radio. If the Network Manager has not assigned an IP address for the Radio, one must be assigned. Assume one was not assigned and choose 192.168.1.50.

Note: These IP addresses are samples. Other IP addresses can be used as long as the NMS and IDU are set to the same subnet or there is a proper static route from the NMS to the IDU.

---

3. In the menu, go to Configure/Network Management and configure as:
   a. Active Interface(s) Ethernet
   b. Default Gateway 0.0.0.0
   c. Route to NMS None
   d. NMS IP Address 192.168.1.1 Your PC's address
4. In the menu, go to Configure/Ethernet and configure as follows:
   a. Ethernet IP Address 192.168.1.50 *radio's IP Address*
   b. Ethernet IP Subnet Mask 255.255.255.0 *same as on your PC*
5. Ping from the radio. Go to Utilities/Send a Ping to the NMS. An answer should be received.

   Example:

   Command: C:\Windows>Ping 10.162.1.31

   Reply: Pinging 10.162.1.31 with 32 bytes of data:

   Reply from 10.162.31: bytes = 32 time = 5ms TTL = 225
6. Start the TFTP server on the PC. Point it to the directory where the BNC File you desire to upload is stored. This is done by selecting "file" & "set root" on the TFTP window.
7. From the radio menu, choose Utilities/Software Update/Update

Updating IDU Software in a Single IDU

Secondary from NMS. Input the filename. Wait for "Success" to display.

Example:

```
Software Update
(? for help)
_____________________________________________________

1. Update Primary  Image from NMS
2. Update Secondary Image from NMS
3. Update Secondary Image from Peer Radio's Secondary
4. Update Primary  Image from This Radio's Secondary
   _____________________________________________________

(local, online, (latched alarm))> 2
Enter name of image file to download (ESC to cancel): 1220.bnc
Update Secondary Image from NMS (file:1220.bnc): Confirm (Y/N) [N]:y
TFTP Get of '1220.bnc' starting...
Press any key to cancel transfer.
TFTP Get completed successfully, 384675 bytes received.
Image CRC verified.
Programming flash...
Image programmed into secondary slot.
```

8. Reboot the IDU, using the newly loaded software in the secondary slot, by choosing Utilities/Reboot/Boot Secondary Software Image.
9. Check to make sure that the radio works properly with the new software. It is best to test it in its link, confirming that the link acquires, and that RSL and BER are normal. Note that there should be no new alarms, other than the "Peer Software Conflict" alarm that will show up if the two IDUs have different software versions.
10. If step 9 is successful, copy the software from Secondary to Primary. Go to Utilities/Software Update/Update Primary from this Radios Secondary.
11. Reboot the radio and verify good CRC under Status/Inventory/Boot Status (t,4,2).
12. Update the remote radio at the other end of the link in one of two ways:
    a. Use the Ethernet interface on the IDU and a TFTP server from a PC as described above.
    b. Using the Utilities menu at the local site, select Remote and update software on secondary from peer's secondary. Check CRC for success, reboot and check for major alarms. Then move secondary code into primary position using utilities menu.

Updating IDU Software with REM

Software update can be done using Radio Element Manager in place of the craft terminal menus (assuming that IP addressing is set up enough that REM can access the radio.) . Use the Configuration/Network Management screen and the Utilities/Software Update screen.

Updating Software in Installed, Operating Links

The preceding examples illustrate updating software in an isolated IDU. Software can be updated in networks of installed, operating links, as well,
using the following general procedure:

1. It is assumed that at least one IDU in each link will have an IP address and IP connectivity through a management network back to the central NMS host.
2. The NMS host will have a TFTP server.
3. Before a whole network of radio links are updated, it is recommended that the software update be tested on a single link first.
4. The operator will connect over the management network to each link in turn, using telnet (to access craft terminal menus) or using the Radio Element Manager application.
5. The secondary image slot on each radio in the link should be updated first. This can be done in two ways:

   a. Update the secondary image slot of the radio(s) that have direct IP connectivity, and then update the other radios' secondary image slots by copying from the already-updated radios using the following command: Update Secondary Image from Peer Radio's Secondary (the peer radio is the one across the link) or, in the case of protected (4-IDU) links: Update Secondary Image from Peer Radio's Secondary (the peer radio is the one across the link) or update Secondary Image from Twin Radio's Secondary (the twin radio is the second radio on the same side of the link).

   b. Update Secondary Image from NMS on each radio, This will work on non IP-connected radios as long as the "Route to NMS" parameter in the Configuration/Network Management screen is set to: "Other Radio (OR)" on those radios.

6. Once the secondary slots are updated on all radios (this can be done at any time, since it does not disturb normal radio operations), a time should be chosen when network traffic is minimal, and the new software can be tested. To test a link, the operator should use the following

   Utilities/Reboot menu item:

   - Boot Secondary Software Image (Both Radios) or,
     for a protected link:
   - Boot Secondary Software Image (All Radios)
     If there is any problem, the operator can reboot to the original primary images (the primary image always is booted after a power-up boot).

7. Once the link is shown to work with the new software, it should be copied into the primary slots using the

   - Update Primary Image from This Radio's Secondary menu command.

E APPENDIX E - PPP Connectivity

Contents

PPP Connectivity via Dial-Up Networking

To set up PPP Connectivity from a PC running Windows Dial-Up Networking, to a radio, the following hardware is required:

- Hayes-compatible modem that will support 28.8 Kbps or greater
- DB9 (Female) to DB25 (Male) standard off-the-shelf modem cable
- Analog phone line
- PC with Windows Dial-Up Networking and a modem installed.

Radio Configuration

1. Connect the RS-232 port of the computer to the RS-232 port on the IDU using the modem cable. No special configuration of the modem is required. The radio software will reset the modem and then reconfigure it dynamically without changing its flash configuration. After a minute, the radio should have reconfigured the modem and the auto-answer indicator (AA) should be lit.

The following configuration must be set up for PPP operation:

Network Management Configuration
(? for help)

1. Active Interface(s):	**PPP**

The following (factory default) PPP configuration can be set up as follows:

PPP Configuration
(? for help)

1. Maximum Output Queue Size (K bytes):	**32**
2. Modem Baud Rate:	**38400**
3. Modem Initialization String:	**AT&F0**
4. Remote Phone Number:	
5. Maximum Dial Retries:	**8**
6. Chat Script:	
7. Authentication:	**CHAP**
8. Local CHAP Username:	**demo**
9. Local CHAP Secret:	**demoso**
10. Remote CHAP Username:	**demo**
11. Remote CHAP Secret:	**demosi**
12. PPP IP Address:	**192.168.200.200**
13. PPP IP Subnet Mask:	**255.255.255.0**
14. Link Inactivity Timeout (secs):	**60**
15. PPP Console Logging:	**Disable**

PC Configuration

Procedure may vary on different Windows™ version.

1. From My Computer double-click DialUp Networking.
2. Double-Click Make New Connection. Type a name for the new connection (i.e., OC-3 Link).
3. Select the modem used for dial-up (the installed modem should appear). Click Next.
4. Enter the area code, phone number and country code of the analog line that will be installed to the radio and click Finish.
5. At this point, an icon with the chosen name in Step 2 (example, OC-3 Link) should appear in the DUN folder. Right-click this icon.
6. Choose Properties and at the bottom of the General screen, click Configure.
7. Set max speed to 38400 and click the Connection tab.
8. Configuration should be 8-N-1.
9. Click Advanced and check boxes for Flow Control and Hardware. Also, if you need to wait for a dial-tone (due to telephone options), go to Extra Settings and type s6=6.
10. Click OK twice and then click Server Types tab.
11. Make sure PPP is selected as the type of Dial Up Server. Also make sure that Log onto Network and Enable Software Compression are checked and that only TCP/IP is selected.
12. Click TCP/IP Settings and then click on Specify an IP Address.
13. Enter the PPP IP address of your PC. This should be in the same subnet as the IP address of the radio. For example, if the radio is 192.168.200.200, and it subnet mask is 255.255.255.0, then the PC IP address should be 192.168.200.n, where n is greater than 0, less than 255, and not equal to 200. 192.168.200.1 is a good choice.
14. Click on Specify Name Server Addresses and leave it set to all zeroes. This is to inhibit any name server requests. Make sure the last two checkboxes are checked.
15. Click OK twice to go back to the Dial-Up Networking folder, which now contains a new connection icon.
16. Double click this new connection icon.
17. Enter the radio's local CHAP username (demo) in the Username field, and the radio's local CHAP secret (demoso) in the Password field. Then

PPP Connectivity via Dial-Up Networking (cont.)

click Connect.

18. Once connected, go to the MS-DOS prompt and type "telnet" (or run C:\WINDOWS\TELNET.EXE using any other method you choose, like a desktop of start-menu shortcut).
19. Once the telnet prompt comes up, click Remote Connection and type in the PPP IP address from the radio configuration.
20. Remember that your connection will only last without inactivity for as long as you have set the Link Activity Timeout in the radio's PPP Configuration menu.
21. When you are done, log out from the telnet session, right-click on the Connection icon and choose Disconnect.
22. To connect again, resume at step 16 (double click on the new connection icon). You will not have to enter a username or password: they will be saved.

Bi-directional Demand-Dialed PPP Connectivity

Windows Dial-Up Networking is capable of calling out, but not receiving incoming calls. A more complete form of PPP connectivity uses a ""Remote Access Server" or PPP-capable router to act as a bridge between an IP network and a PPP-configured radio. In this case, any time that the an IP packet needs to cross from the network to the radio or from the radio to the network, the originating side (the router or the radio) will dial the other side and set up a connection. This is called demand dialing. The demand dialing is automatic and transparent. A timeout can be configured that will drop the connection after a suitable period with no traffic.

Bidirectional Demand-Dialed PPP Connectivity is required in cases where radios need to deliver SNMP traps to a central NMS host over a PPP link.

Configuring the radio for this kind of connectivity is similar to dial-up networking. The principle difference is that a remote phone number needs to be configured in the "Remote Phone Number" parameter in the PPP Configuration menu.

The best way to get bidirectional demand-dialed PPP connectivity (or, indeed, any PPP connectivity) working is to have the radio (or a sample radio) and the router or DUN PC in the same room, and use two outside phone lines that can dial each other. This way, when one initiates a call in one direction, one can observe the results on the called system.

Note that if the craft terminal is logged out, it will display simple PPP progress messages. More detailed logging is available by setting the "PPP Console Logging" parameter to "Enable".

F APPENDIX F - Protected Link

Contents

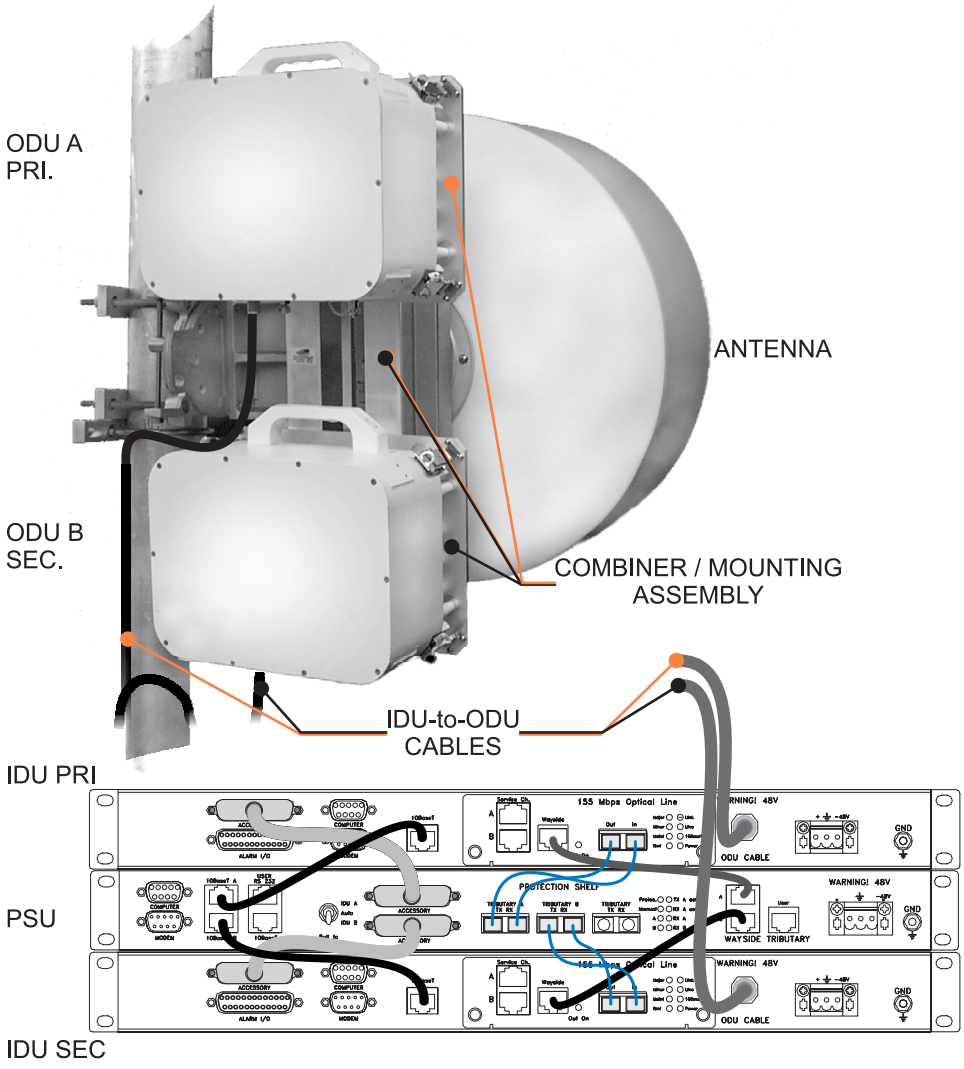
Description

The typical Pinnacle protection scheme is a 1:1 monitored hot-standby (MHSB) radio. In the hot-standby radio a complete secondary terminal maintains traffic in the event of path fades, equipment failure, or maintenance.

A protection switch unit (PSU) switches transmit or receive traffic between the active and standby equipment. Transmit and receiver paths switch independantly, but switching is non-reverting, that is, standby equipment stays active after its alarms clear. Figure 1 shows a typical hot-standby radio with a single antenna.

The Pinnacle radio also has a serial data protection scheme for STM-1/OC3 radios where payload data connects through a customer's add-drop multiplexer. In this configuration redundant IDUs connect together at the serial ports. Internal logic sets the active unit and passes alarm data through the payload.

Figure 1. Typical Pinnacle Hot-Standby Protected Terminal; Single Antenna



Description (cont.)

The following tables list the components of the Pinnacle hot-standby radio.

Hot-Standby Terminal; 1 Antenna

Item	P/N	Qty
ODU	PinRF1-xxNx-xxxx	2
Mounting Kit	See following tables	1
IDU	8209269-xx	2
LIM	8209266 /267 /268 -xx	2
PSU	See following tables	1
Connector kit	8708236-01	2

HSB ODU Mounting Kit; 1 Antenna

Frequency	P/N
13GHz	8708237-00
15GHz	8708238-00
18GHz	8708239-00
23GHz	8708240-00
26GHz	8708241-00
38GHz	8708242-00

Protection Switch Unit

Type	P/N
MM, SC, T1/E1	8209284-01
100BT + E3/DS3	8209284-02
SM, SC, T1/E1	8209284-03

Protection switch units include cable and connector kits that the following tables list (see figures on the following pages).

HSB IDU Cable Kit, 8708243-00, OC3/STM1

Cable Assembly	Port	P\N	Qty.
2xDB25M, Shielded, 24"	Accessory	8108706-00	2
Fiber Type: SC-SC	Tributary	8108707-00	2
PSU-IDU RJ45, 4-TP, Shielded, 25"	10BT & WS	8108705-00	4

HSB IDU Cable Kit, 8708243-01, 100BaseT + E3/DS3

Cable Assembly	Port	P/N	Qty.
2xDB25M, shielded, 24"	Accessory	8108706-00	2
BNC (M) - BNC (M), 9.5"	Tributary	8108021-18	4
8P, RJ45, straight (1-1), 13", CAT5E	10BT to IDU	8108717-00	2
8P, RJ45, X-over (1-8), 13", CAT5E	100BT & 10BT to HUB	8108719-00	4

HSB Connector Kit, 8708236-01

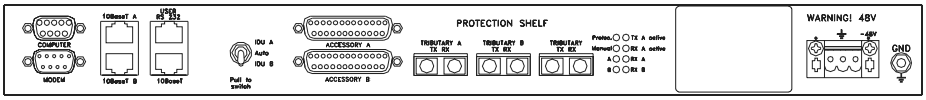
Type	Equivalent	P/N	Qty.
DB9P, Cable, Solder	AMP 747904-2	3070037-00	1
DB9S, Cable, Solder Cup	AMP 747905-2	3070037-01	1
DB25P, Cable, Solder Cup	AMP 747912-2	3070037-03	2
Power Plug, 3P, Term, .2 SP	Phoenix 1757022	3024080-03	1

Description (cont.)

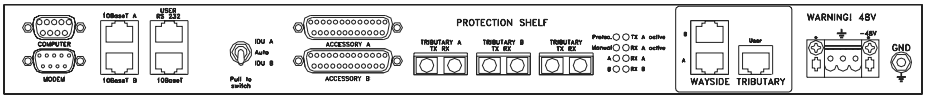
Figures in other sections show the IDU and ODU. The following figures show components unique to protected configurations.

Figure 2. Hot-Standby Protection Switch Units; PSU

OPTICAL VERSION WITHOUT WAYSIDE (P/N 8209284-00)



OPTICAL VERSION WITH WAYSIDE (P/N 8209284-01)



100BASE-T, E3, DS3 VERSION (P/N 8209284-02)

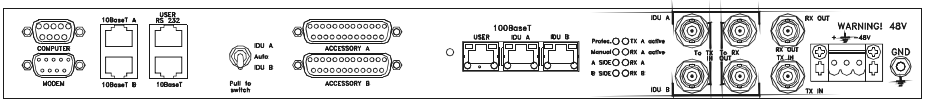
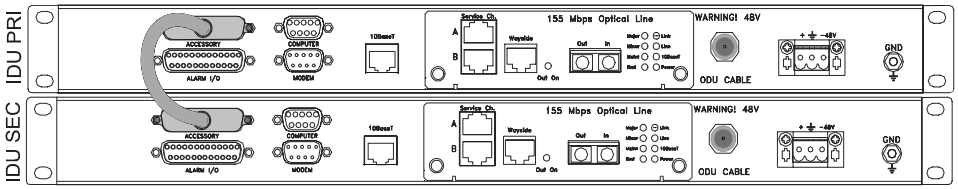
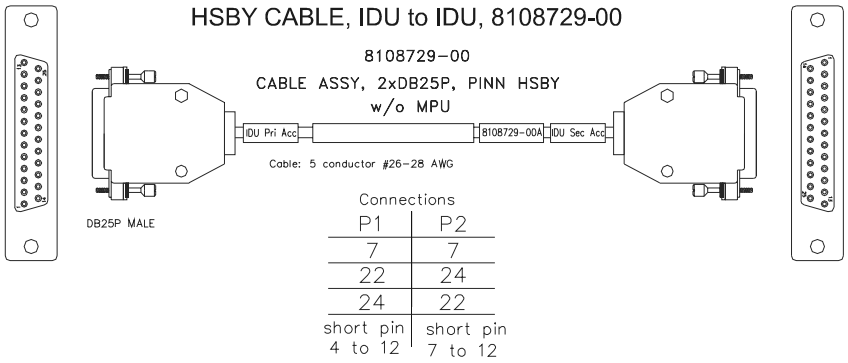


Figure 3. External Switching Serial Data Protection; No PSU



External switching, serial data protection mode lets customers protect payload using their own add-drop multiplexers. The Protection Switch unit is not used. A special cable assembly, Figure 4, connects the accessory ports of the IDUs. IDU logic selects active path.

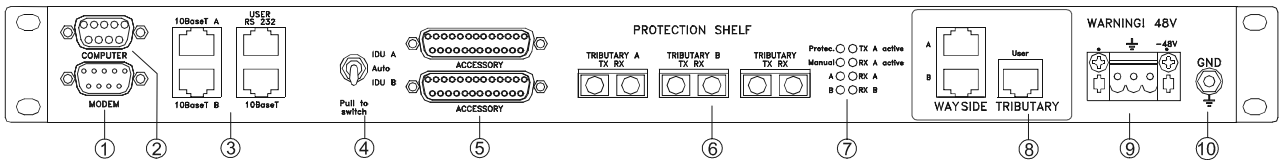
Figure 4. Serial Data Protection Cable



Description (cont.)

The Protected Switch Unit (PSU) connects two IDUs in a 1+1 protected terminal and interfaces customer signals. The following describes PSU ports and features.

Figure 5. Protection Switch Unit Features



PSU Features

Item	Label	Type	Description
2	Modem	DB9P	*Not available on the 1+1 hot-standby configuration.*
2	Computer	DN9S	RS232 serial connection. *Not used on the PSU*
3	10BaseT	RJ45	10Mbps Ethernet connections to network management. USER: use cross-over cable to connect to a hub or straight-through cable to attach to PC (opposite the IDU connection). A/B use a straight-through cable to connect to the IDU .
4	IDU/Auto	Switch	Manual switchover. Toggle switch normally in the AUTO position. Typically used during maintenance and troubleshooting.
5	Accessory	DB25	RS232 acynchronous data channel, eight external alarm/status inputs, five isolated relay outputs, 1+1 protection signaling to the switching shelf.
6	Tributary	varies	Payload connection. MM or SM optical, electrical, or Ethernet and E3/DS3.
7	A/B/Man	LED	Status indicators. See indicator table below.
8	Wayside Trib	RJ48	Uses RJ45 8-pin connector. RJ48 refers to pinning protocol for T1/E1 digital servicing.
9	Power	Terminal	DC power input for +, -, and ground on three wire plug-in terminal block.
10	GND	Post	Ground post.

PSU Indicators

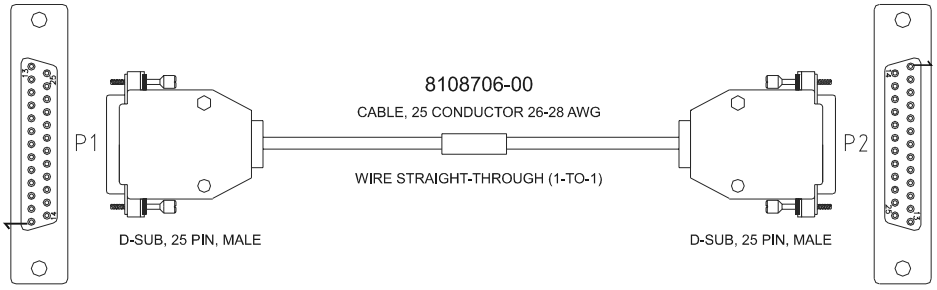
Red LED		Green LED	
Protec.	Protected link failure. One side of the terminal in alarm condition.	TX A active	Primary transmit path is active. Transmit / receive paths switch independently.
Manual	Toggle switch set of A or B not AUTO	RX A active	Primary receive path is active. Transmit / receive paths switch independently.
A	Primary (A) IDU receive failure	RX A	Primary (A) IDU receive path is working.
B	Secondary (B) IDU receive failure	RX B	Primary (A) IDU receive path is working.

Description (cont.)

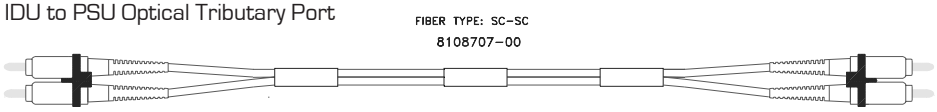
Cabling the IDU to PSU requires the following cable assemblies. Tables on the following pages list port pinning to allow cabling as needed.

Figure 6. HSB Cable Assemblies

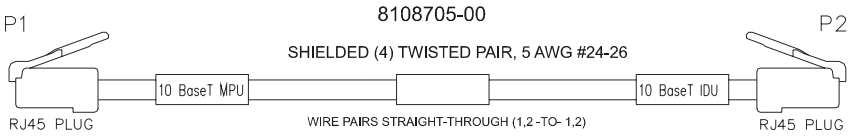
IDU Accessory to PSU Accessory Port



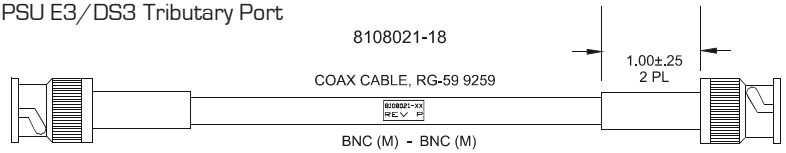
IDU to PSU Optical Tributary Port



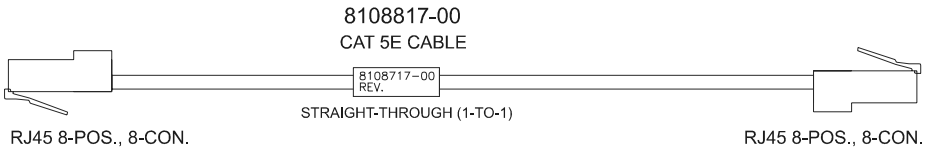
IDU to PSU 10BT & Wayside Ports



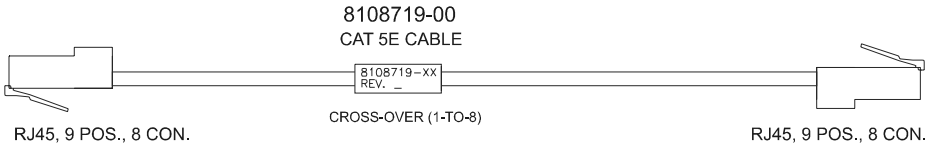
IDU to PSU E3/DS3 Tributary Port



IDU to PSU 10BaseT Port



IDU to PSU 100BaseT & 10BT to Hub



Description (cont.)

The following tables list the PSU port pins.

Power

Terminal	Description
+	Positive voltage from primary supply
Ground	Earth ground
-48 VDC	Negative voltage from primary supply

Accessory A&B

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	VCC	6	IN 3	11	OUT 1	16	GND	21	GND
2	RX	7	GND	12	IN 0	17	GND	22	PPP IN
3	TX	8	NC	13	OUT 0	18	OUT 3	23	GND
4	PWR	9	OUT 2	14	GND	19	GND	24	PPP OUT
5	+12PV*	10	IN 1	15	GND	20	IN 2	25	GND

* not connected on B side

10BaseT A, B, & User

Pin	Signal	Pin	Signal
1	RX (in) + (P)	5	GND
2	RX (in) – (N)	6	TX (out) – (N)
3	TX (out) + (P)	7	GND
4	GND	8	GND

Computer - DB9 female

Pin	Signal
1	RTS
2	TX (S_OUT)
3	RX (S_IN)
4	NC
5	GND
6	DTR
7	DCD
8	NC
9	NC

MODEM – DB9 Male

Pin	Signal
1	DCD
2	RXD (S_IN)
3	TXD (S_OUT)
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9	RI

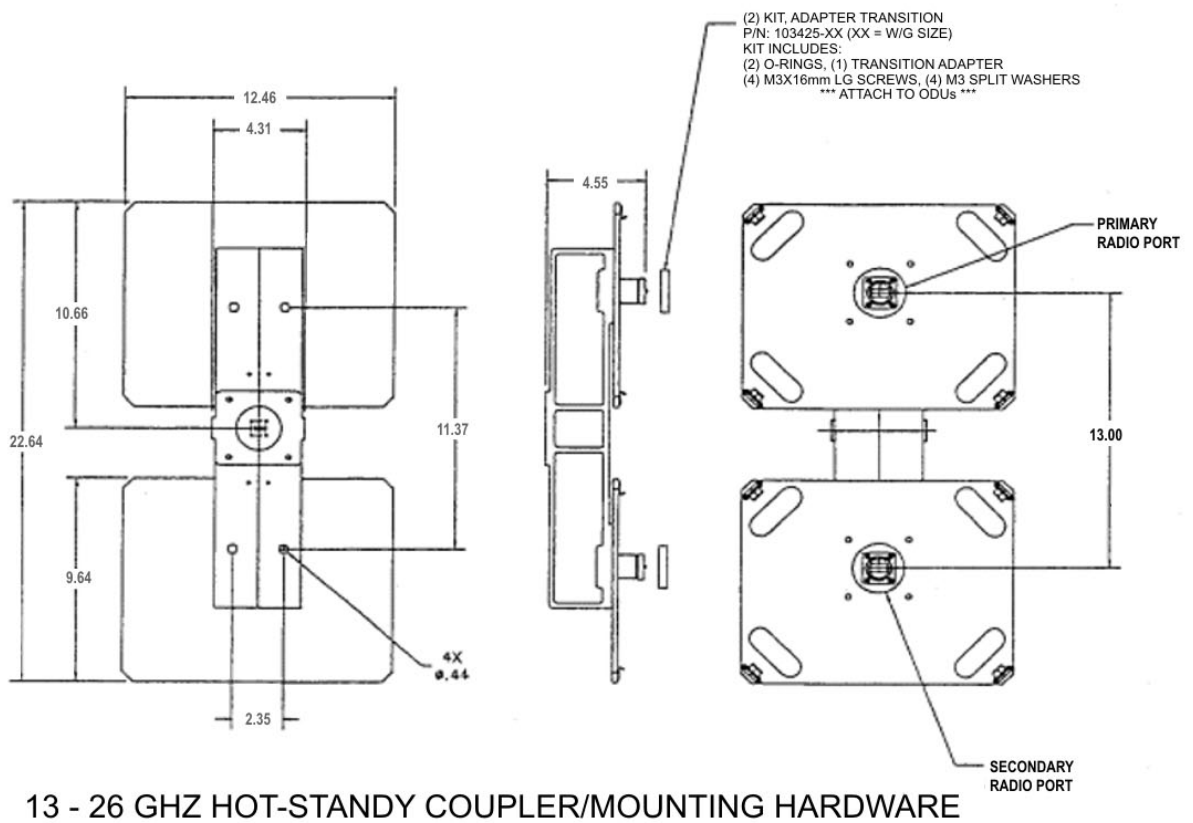
Optional Wayside Ch. A, B, & User - RJ45

Pin	Signal
1	RX –
2	RX +
3	NC
4	TX +
5	TX –
6	NC
7	NC
8	NC

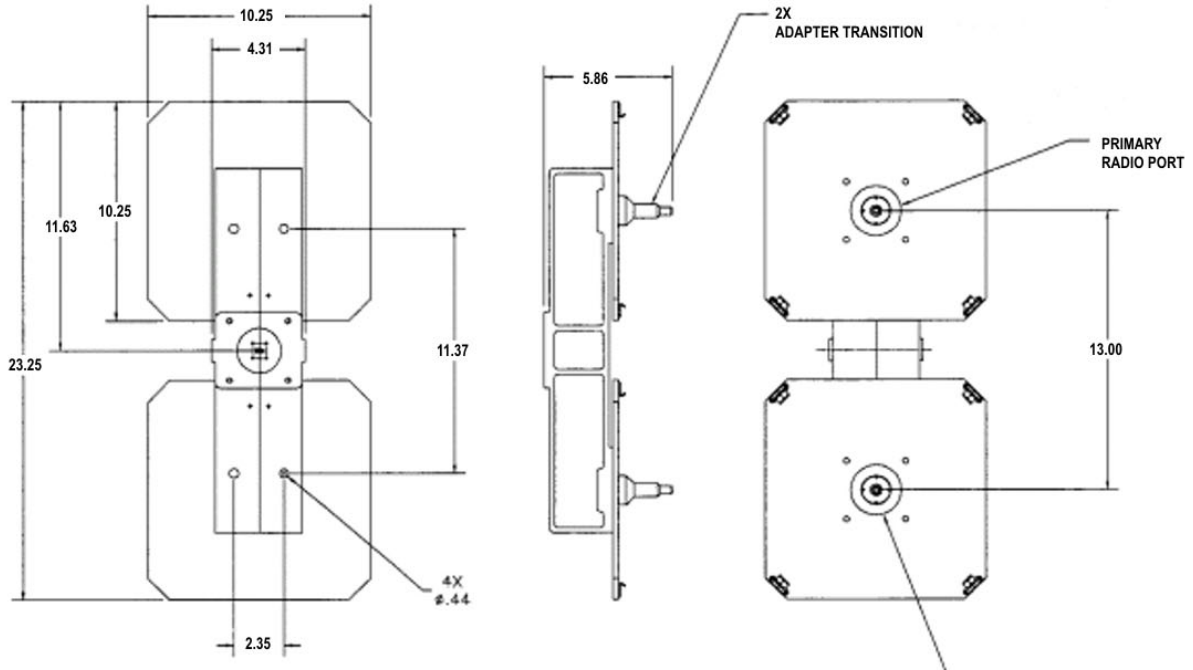
Description (cont.)

ODU hot-standby coupler and mounting hardware includes a common assembly for the 13- to 26-GHz ODUs and one for 38-GHz units.

Figure 7. HSB ODU Coupler/Mounting Assemblies



13 - 26 GHZ HOT-STANDY COUPLER/MOUNTING HARDWARE



38 GHZ HOT-STANDBY COUPLER/MOUNTING HARDWARE

Protected Operation

155 Mbps data (OC3 or STM-1) interfaces the radio at the protection switch unit front panel. The protection unit splits the data to supply two 155Mb IDUs. Each IDU receives and processes the transmit payload for output to associated ODUs. Boths main and standby ODUs operate at the same radio frequencies. The protection switch sets transmit mute on one of the ODUs so only the active path transmits signals over the link.

In the radio receive direction, both ODU receivers output signals to associated IDUs. IDUs process the signal to its original payload at 155 Mbps, and output the signals to the protection unit. The protection unit outputs one of the payload signals to its front panel port based on a receive path switch logic.

The two ODUs are each connected to a separate antenna or, optionally, to a single antenna through a 6-dB coupler where the main path is routed through the direct coupler arm and the standby path is routed through the 6-dB coupled path.

Switching logic favors the main path, but switching does not revert to the main path once alarms clear. Traffic stays on the standby path until the logic receives a manual switch request, or an alarm triggers a switch request when the main radio does not have alarms. The standby radio stays active to avoid another outage just for radio switching. When there is an alarm on both receivers (such as rain fade), built-in delays trigger the system to switch back to the main path and the standby path to attenuate.

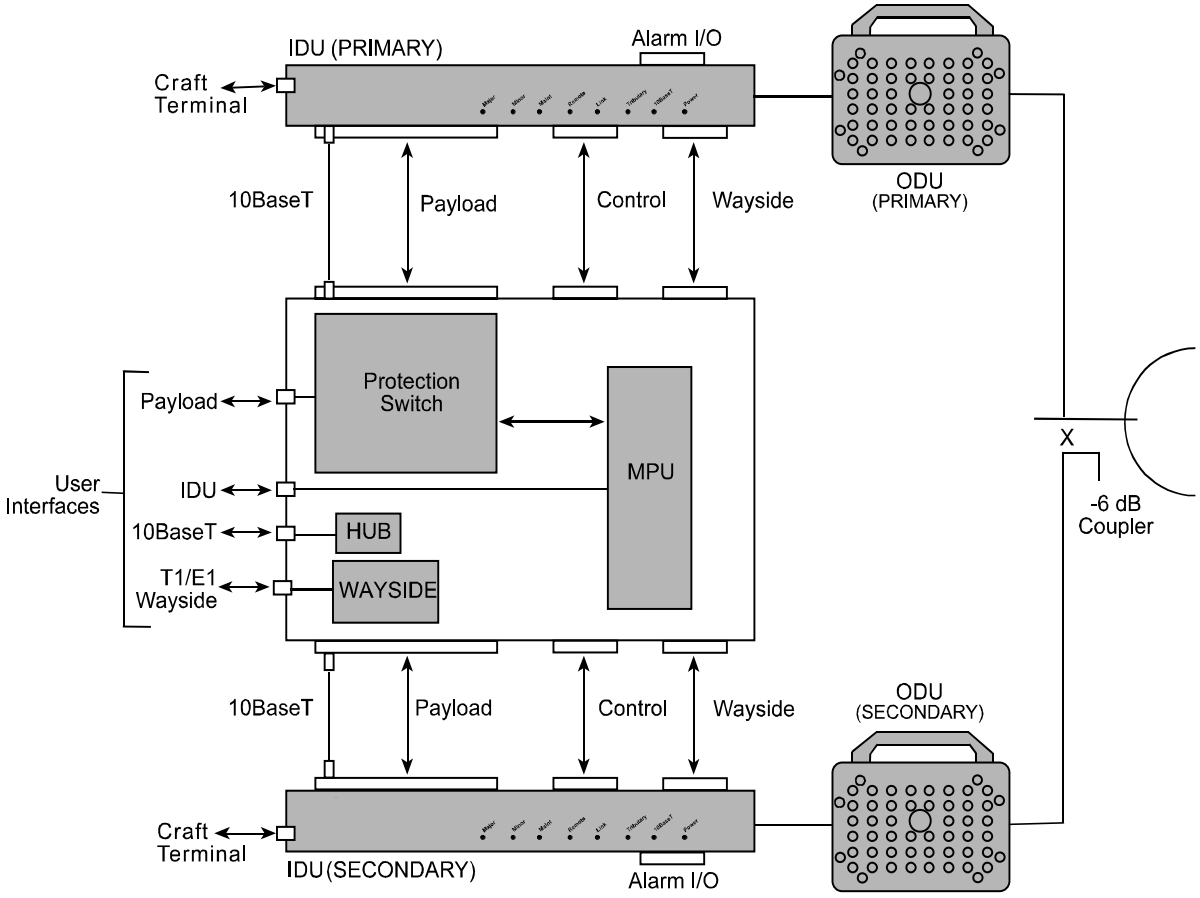
Protection switching is niether hitless nor errorless. Downtime is held to a minimum since transmit and receive paths switch independently. A transmit switch typically takes 0.8 seconds, and a receive switch typically takes 200 miliseconds.

Protection units are 1RU high. Current versions of the OC3/STM1 protection switch have optional wayside tributary protection. Protection units include an integral 10BaseT hub to connect the radio management application.

Installation Note:

Radio sub-bands must be compatible for the required frequency range of the application. For a protected link, two (x2) 1A radios must be matched with two (x2) 1B radios (or two 2A radios with two 2B, etc.).

Figure 8. Hot-Standby Protected Terminal; Single Antenna



Payload = SONET/SDH

Installing the Protected Configuration

Antennas for protected applications have a heavier RF unit mounting bracket on back as Figure 9 shows. This bracket accepts a hot-standby mounting assembly with integral coupler.

Note: Section 3 shows non-protected (NP) antennas and RF unit mounting plates.

The protected ODU assemblies – antenna, RF units, mounting hardware with coupler – come with 1-, 1.5-, and 2-foot (30-, 45-, 60-cm) antennas. Antennas 3' (90cm) and larger require an offset pole-mounted with flexible waveguide to a rectangular antenna interface.

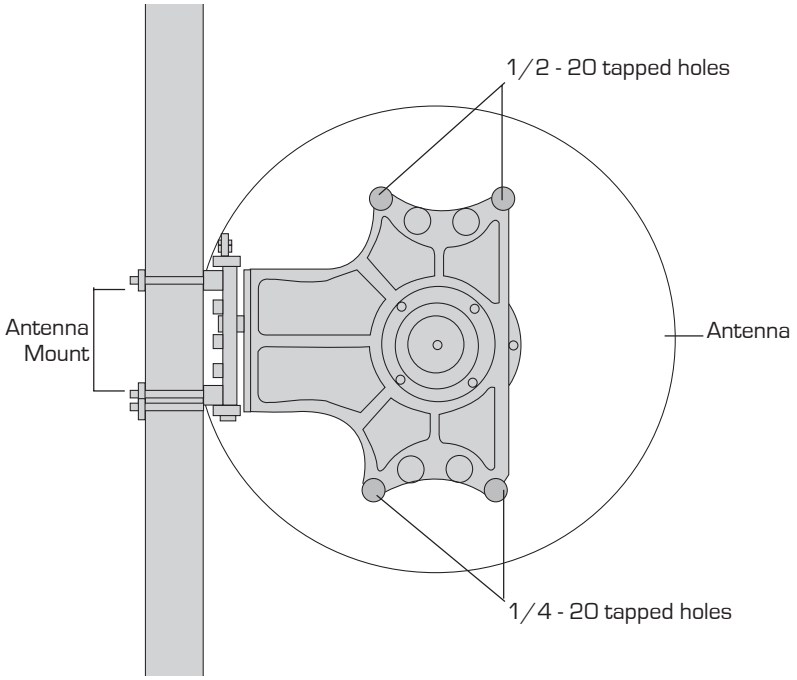
Use the following tools and materials to install a protected link:

- 9/16- and 1/2-inch socket or wrench
- 3/32 x 5 inch alan wrench
- digital voltmeter (DVM) with BNC to banana leads
- hexagonal crimp tool (.108 inch, 2.7mm & .475 inch, 12.1mm)
- butyl or weatherproof tape
- tie wraps
- #2 x 150mm philips screw driver
- elbow adapter, Type-N, right angle

Install Protected ODU 13 to 26 GHz

1. Install the desired antenna as Section 3 describes. The RF unit mounting plate will not be on the back of the antenna. Instead, the antenna has a heavy-duty mounting bracket as Figure 9 shows.

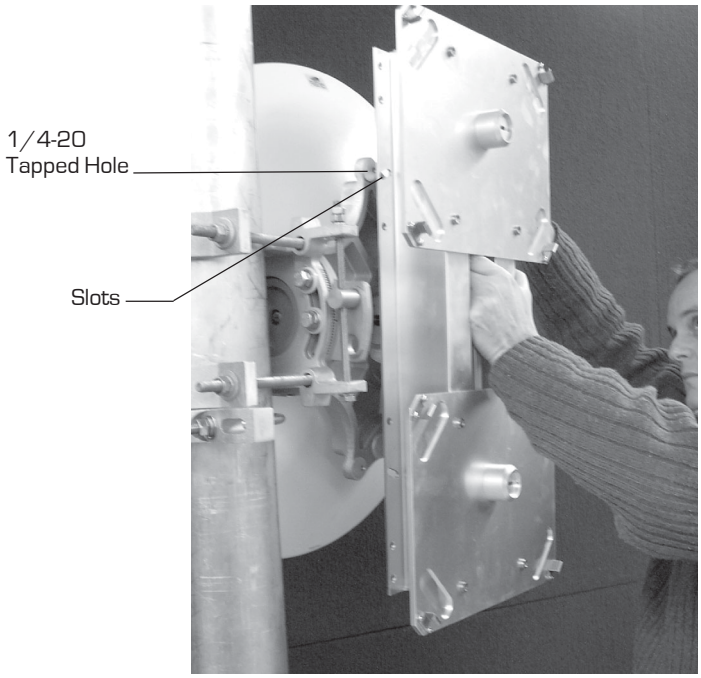
Figure 9. Hot-Standby ODU Mounting Bracket



Install Protected ODU (cont.)

2. Secure the ODU coupler/mounting assembly to the antenna bracket. Align four 1/4-20 tapped holes on the antenna bracket with four slots on the coupler. Use the allen wrench to secure the coupler with four 1/4-20 screws, lock washers and flat washers.

Figure 10. Install ODU Coupler/Mounting Assembly



3. On 13-26 GHz units attach an adapter to the two RF units. The adapter mates the RF units to the hot-standby ODU coupler unlike the transition assembly for non-protected units described in Section 3.

   Adapter and associated hardware comes in kits for 13- to 15-GHz units, which use WR62 waveguide, and 18- to 26-GHz units, which use WR42 waveguide.

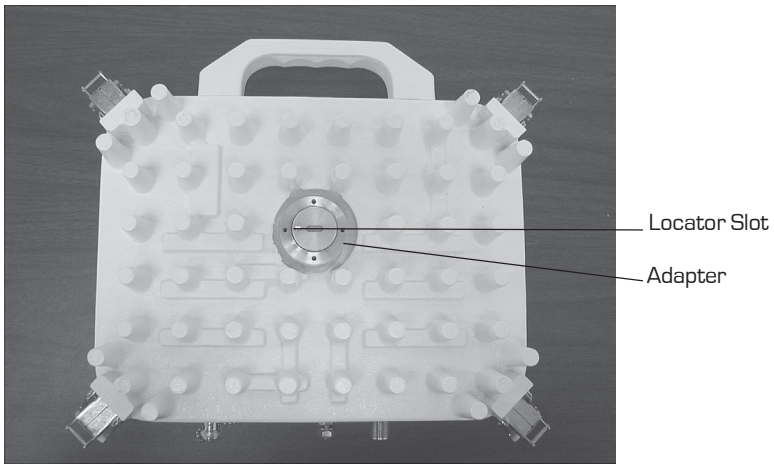
Hot-Standby RF Adapter Kit - P/N 103425-xx*	
O-rings	2
Transition adapter	1
M3x16mm LG screws	4
M3 split washers	4

*xx = W/G size

   Attach the adapter to the RF unit using four supplied screws. Position the adapter as Figure 11 shows with a locator slot in the upper left position with the RF unit handle upward.

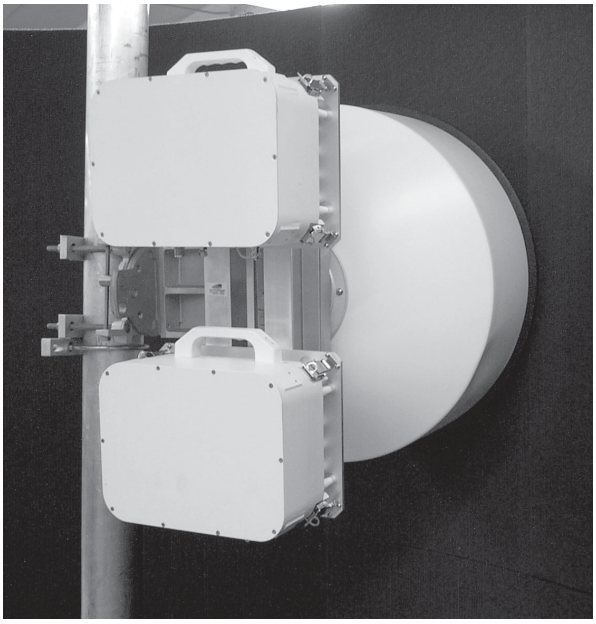
Install Protected ODU (cont.)

Figure 11. RF Unit with Hot-Standby Coupling Adapter Installed



4. Attach the RF units with adapter to the coupler assembly. Align RF units to the center feed on the coupler. Carefully push the assemblies together. Orient the RF unit handle up. Latch the RF units to the coupler using the four chassis clamps. Figure 12 shows the completed assembly.

Figure 12. 13-26 GHz Protected ODU Assembly



5. The above procedure will provide vertical polarization for the antenna. A horizontally polarized coupler/mounting assembly is available for special order. Contact MNI.

Install Protected ODU 38 GHz

1. Install the desired antenna (Section 3). A heavy duty mounting bracket is used for hot-standby ODU applications.
2. Install the protection combiner assembly on to the antenna assembly as previously described. Attach the coupler to the antenna assembly bracket using four 1/4-20 tapped holes on the antenna bracket. Align the four holes on the bracket with the four slots on the coupler and secure with the four 1/4-20 screws, lock washers, and flat washers.
3. Tighten the coupler/mounting assembly to the antenna using the right angle allen wrench.
4. Attach two RF units directly to the coupler. Align the RF units to the center feed attachment point and push the two parts together with the handle at the top. Latch the units to the coupler with the four chassis clamps. The completed assembly should like Figure 13.

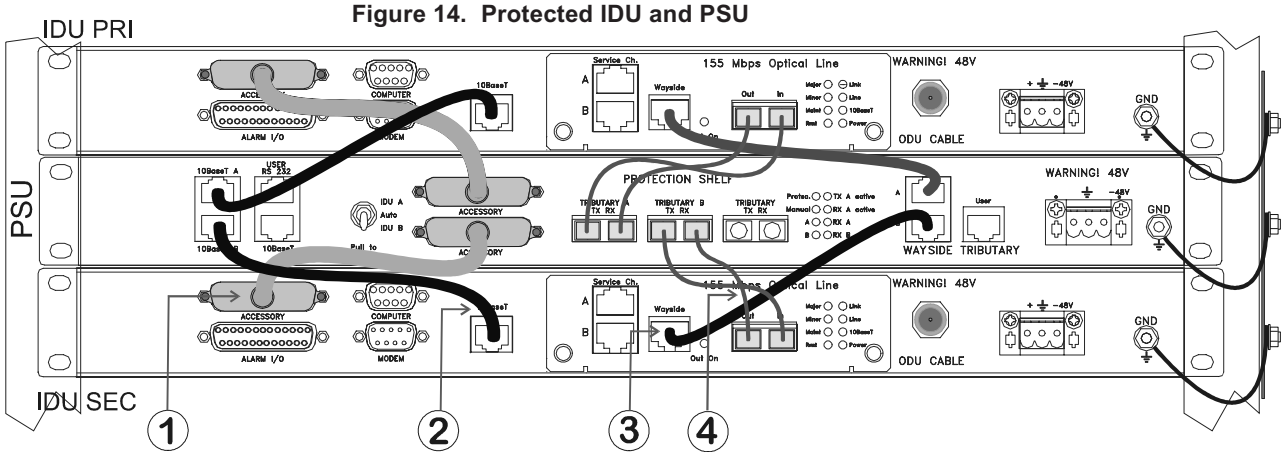
Figure 13. 38-GHz Protected ODU

5. This procedure works for vertical antenna polarization. For horizontal polarization order the associated horistantally poled coupler from MNI.

Install Protection Switch (PSU) Mount the Protection Switch Unit (PSU) in the equipment rack or cabinet between the primary and secondary IDU as Figure 14 shows. The PSU takes one RU of space.

Hot-standby cables connect user data and radio management data from the PSU to both primary and secondary IDUs. Call outs in Figure 14 refer to the cables in the table below.

Figure 14. Protected IDU and PSU



HSB IDU Cables for OC3/STM1 Radio

Item	Cable Assembly	Port	P\N	Qty.
1	DB25M, Shielded, 24"	Accessory	8108706-00	2
2 & 3	RJ45, 4-TP, Shielded, 25"	10BT & WS	8108705-00	4
4	Fiber Type: SC-SC	Tributary	8108707-00	2

Figure 6 on page F-6 shows each of the hot-standby cables. Connect cables between IDU and PSU as Figure 14 shows.

The PSU, like the IDU, has a grounding screw (NC8) to attach the unit to a reliable ground bus. Connect the PSU ground securely to a rack ground bus.

Cable the power terminal to the primary supply as described for the IDU in Section 2, IDU Installation, on page 2-7.

Interface payload at the PSU tributary connector, and 10BaseT radio management data at the PSU 10BaseT RJ connector.

Note: The computer and modem connectors are not used for hot-standby configurations, and so are not used on the PSU.

Install Serial Data Protection

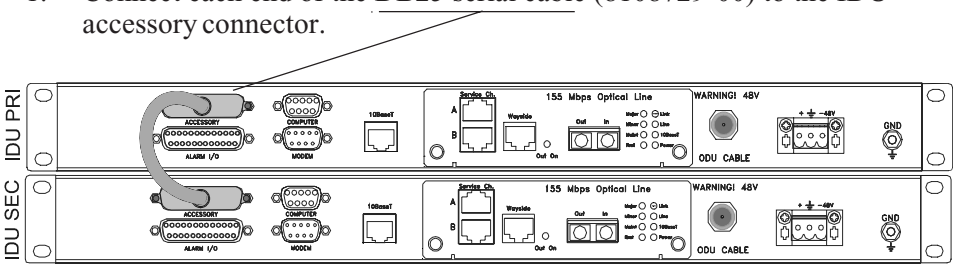
Serial data protection using an add-drop mux is another way to implement hot-standby on a Pinnacle radio. This configuration does not use the Protection Switch unit (PSU).

IDU logic sets the active and standby units.

Connect payload (fiber cables) directly to the IDU LIM (line interface module). The customer-supplied external MUX switches the payload data.

To configure the serial data protected radio:

1. Connect each end of the DB25 serial cable (8108729-00) to the IDU accessory connector.



2. Configure each radios using the radio management application.

   From the top menu select 6 – Configuration menu

   Select 1 – Link menu.

   From the link menu select 7 – Link Protected Configuration menu

   Go to 1. Link Protection Type. Select protected and another menu opens.

   Go to 2. Link Protection Method and select 4 – External Switching-Serial Connected

3. Reboot all radios after configuration.
4. Finally, connect your payload data lines to the LIMs.

Protected Configuration

Configure a protected radio using the Installation Reminders sequence, craft terminal menus, or Radio Element Manager.

Menu commands unique to the Protected Link configuration and operation follow.

Menu Commands

The following commands on a protected radio system can be used to navigate through the meus. Enter ? to get this list.

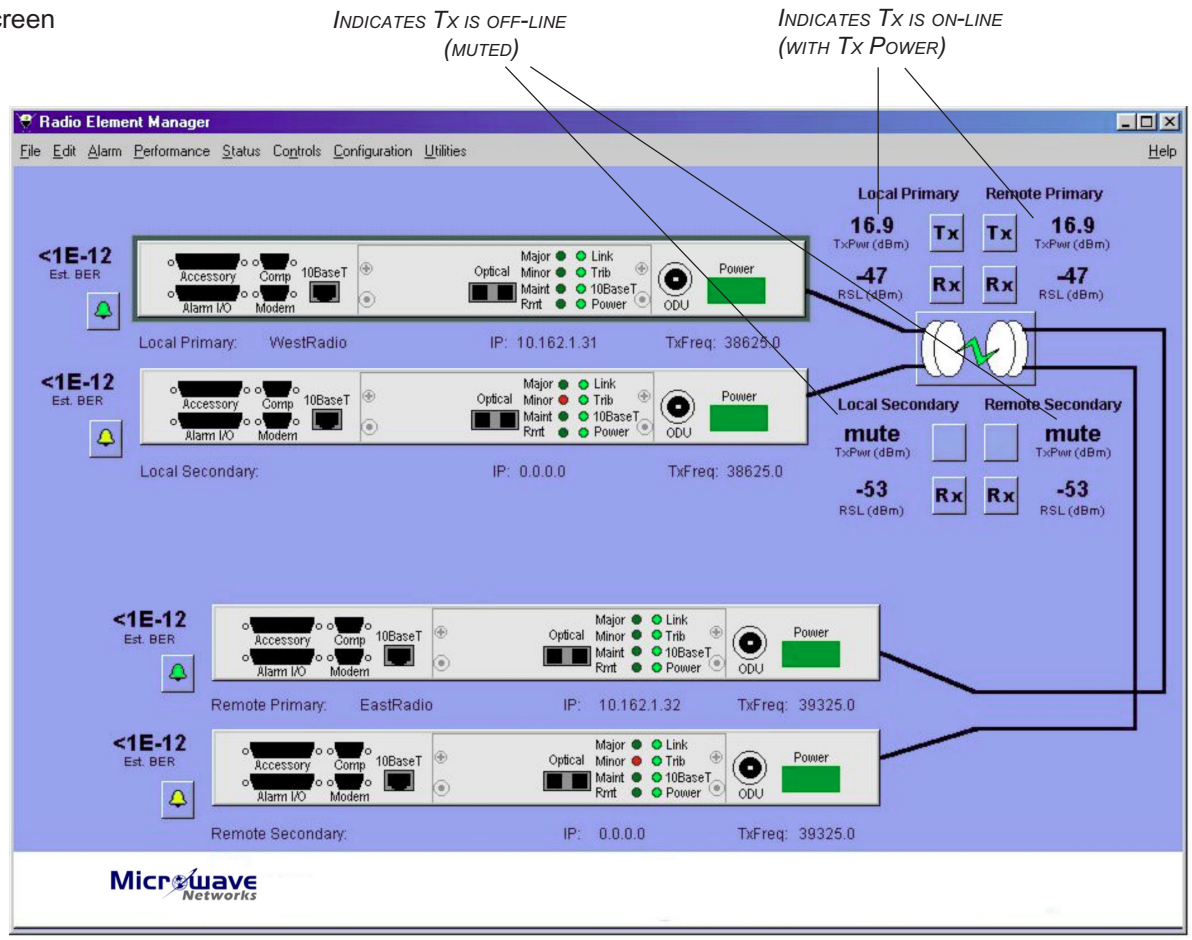
```
H or ?  Help:          Show this help.
Enter:  Again:         Redisplay the current menu.
Esc:    Previous:      Go to previous (parent) menu.
T:      Top:           Go to Top menu.
R:      Remote:        Switch to remote radio.
L:      Local:         Switch to local radio.
S:      Save:          Save Current Configuration Parameters.
U:      Update:        Continuously update this menu.
E:      Exit:          Log off.
A:      Primary:       Focus commands on PRIMARY radio.
B:       Secondary:    Focus commands on SECONDARY radio.
GA:     Alarms:        Go to Alarms menu
GP:     Performance:   Go to Performance menu
GB:     BERT:          Go to Integral BERT menu
Press any key to return to the current menu
```

Comand t

Top Menu
(? for help)

0. Protected Link Status/Performance ...
1. Alarms ...
2. Performance ...
3. Performance History ->
4. Status/Inventory ->
5. Controls ->
6. Configuration ->
7. Utilities ->
8. Log Off

Main GUI Screen



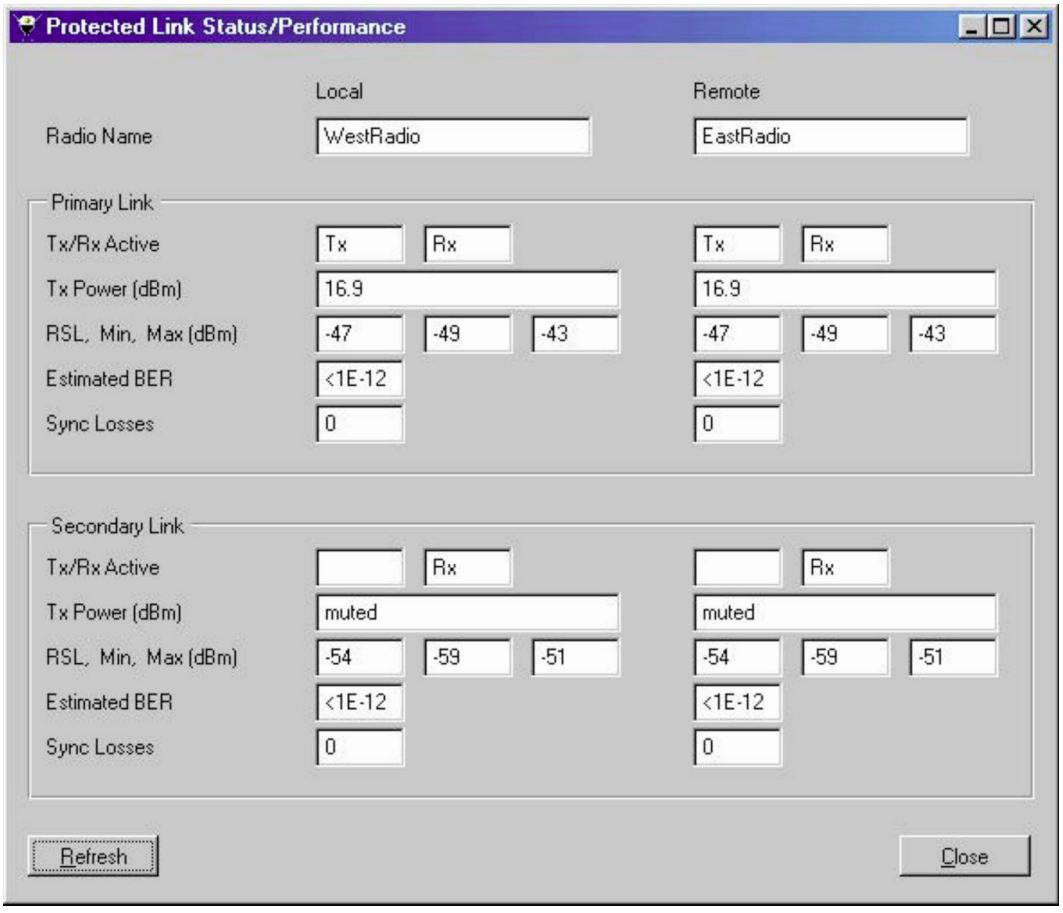
t,0

*P*rotected Link Status/ Performance

Shows Tx and Rx primaries are on-line and both standby receivers are active with 6 to 7 dB less RSL than primaries.

Protected Link Status/Performance
(? for help)

	Local: WestRadio	Remote: EastRadio
Primary		
Tx/Rx Active:	Tx Rx	Tx Rx
Tx Power (dBm):	16.9	16.9
RSL (dBm) (Mn/Mx):	-47 (-48/-46)	-47 (-48/-45)
Estimated BER:	<1E-12	<1E-12
Sync Losses:	0	0
Line Status:	Online	Online
Secondary		
Tx/Rx Active:	-- --	-- --
Tx Power (dBm):	(muted)	(muted)
RSL (dBm) (Mn/Mx):	-54 (-59/-53)	-54 (-59/-51)
Estimated BER:	<1E-12	<1E-12
Sync Losses:	0	0
Line Status:	Online	Online



t,5

Protected Link Status/ Performance

```
Controls
 (? for help)
_____________________________________________________
1. Tx Mute
2. Intergral BERT...
3. Radio Loopback...
4. Continuous Wave...
5. Line / Wayside / Service Channel Loopback / Controls...
6. Protection Switching...
_____________________________________________________
(Local, online)>6
```

t,5,6

Protection Switching

Notation "Tx" and "Rx" shows actual equipment on-line.

Commands 1 thru 4 toggle on-line status of transmit and receive paths at local and remote ends.

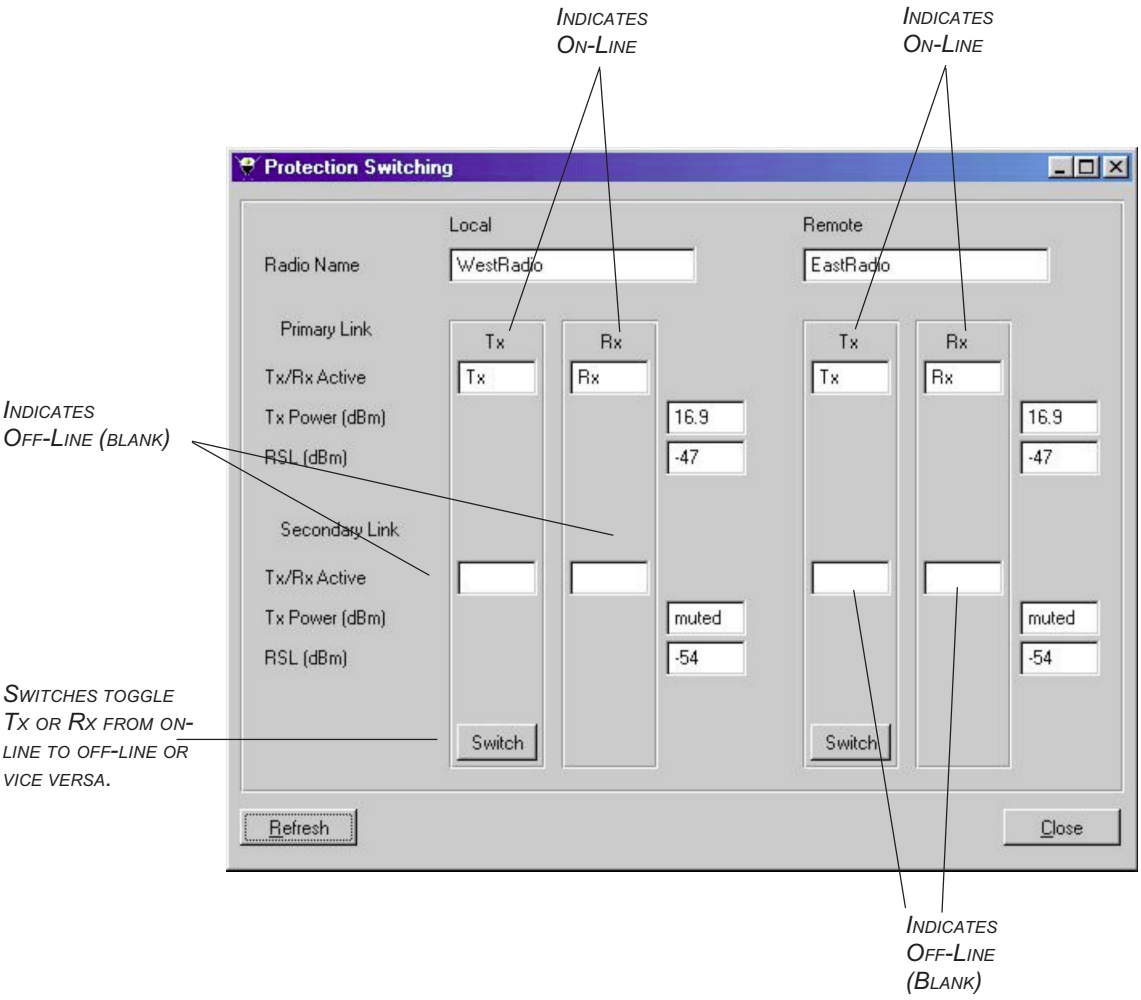
```
Protection Switching
(? for help)
                                Local: WestRadio    Remote: EastRadio
_____________________________________________________________________
  Primary
    Tx/Rx Active:               Tx  Rx              Tx  Rx
    Tx Power (dBm):             16.9                16.9
    RSL (dbm) (Mn/Mx):          -47  (-48/-46)      -47  (-48/-45)
  Secondary
    Tx/Rx Active:               --  --              --  --
    Tx Power (dBm):             (muted)             (muted)
    RSL (dbm) (Mn/Mx):          -54  (-59/-53)      -54  (-59/-51)
                                  ^    ^              ^    ^
1.Switch Local Tx ————————————— +
2.Switch Local Rx ——————————————+
3.Switch Remote Tx———————————————————————————————— +
4.Switch Remote Rx ——————————————————————————————————+
_____________________________________________________________________
```

t,5,6,1

Switch Local Tx from Primary to Secondary

```
Protection Switching
(? for help)
                                Local: WestRadio    Remote: EastRadio
_____________________________________________________________________
  Primary
    Tx/Rx Active:               --  Rx              Tx  Rx
    Tx Power (dBm):             (muted)             16.9
    RSL (dBm) (Mn/Mx):          -47  (-48/-46)      -54  (-54/-45)
  Secondary
    Tx/Rx Active:               Tx  --              --  --
    Tx Power (dBm):             16.9                (muted)
    RSL (dBm) (Mn/Mx):          -54  (-59/-53)      -60  (-60/-51)
                                  ^    ^              ^    ^
1. Switch Local Tx ————————————— +
2. Switch Local Rx ——————————————+
3.Switch Remote Tx ——————————————————————————————— +
4.Switch Remote Rx ——————————————————————————————————+
_____________________________________________________________________
```

Protection Switching



t,6,1

Link Configuration

Status within parentheses gives current conditions of protected/unprotected mode, radio currently selected, and link protection method.

```
Link Configuration
 (? for help)
-------------------------------------------------------------
1. Tx Frequency (MHz):                          38625.0
2. Rx Frequency (MHz):                          39325.0
3. Manual Tx Power (if ATPC disabled)(dBm):     17.0
   Equivalent Attenuation (dB):                 0
4. Power-up Mode:                               TxOn
5. ATPC (Automatic Transmit Power Control):     Disable
6. Far End Target ATPC RSL (dBm):               -55
7. ATPC Maximum Tx Power (dBm):                 17.0
   Equivalent Attenuation (dB):                 0
8. Link Protection Configuration (Protected, Primary, Serial)->
-------------------------------------------------------------
```

t,6,1,5

ATPC (Automatic Transmit Power Control)

Enables Automatic Transmit Power Control. If ATPC is on, radio's transmit power will change to maintain the specified Target ATPC RSL on the far radio. ATPC can be completely disabled, enabled in one direction, or enabled in both directions. In a protected link, one will usually want to enable ATPC on the secondary if one enables it on the primary.

A protetcted link has four transmitters (two transmitters on each side, one of which is active at any given time). ATPC can be enabled on either side independently. Also, on either side, ATPC can be enabled on the primary only, on the primary and the secondary, or even on the secondary only.

An Active transmitter with ATPC enabled will always attempt to adjust its Tx Power so as to keep the remote primary receiver's RSL at the transmitter's ATPC target RSL. The secondary receiver's RSL will be about 6 dB lower than the ATPC target, because of the combining coupler attenuation.

An active transmitter with ATPC disabled will set its Tx Power to the configured manual value.

The decision about whether to enable ATPC on one side or another or both is a link-engineering decision.

t,6,1,6

Target ATPC RSL (dBm)

Far End Target ATPC RSL that the local radio will attempt to maaintain by adjusting its own transmit power level.

In Protected Link Operation the same RSL target should be set for both primary and secondary from the same side. Note that only the active radio will support the wanted target level, and the non-active radio will have 6dB less for secondary and more for primary.

t,6,1,8

Link Protection Configuration

Selects parameters for protection mode.

```
Link Protection Configuration
 (? for help)
-------------------------------------------------------------
1.Link Protection Type      Protected
2.Link Protection Method    External switching, Serial connected
3.Link Protection Details...
-------------------------------------------------------------
```

t,6,1,8,1

Link Protection Type

Selects protected or unprotected mode.

```
Link Protection Type
_____________________________________________________
1. Unprotected              <—— Current value
2. Protected
_____________________________________________________
Enter Link Protection Type >2
Note: A reboot is required for this change to take effect.
```

t,6,1,8,1,2

Configure as Protected Mode

```
Link Protection Type
_____________________________________________________
1. Unprotected
2. Protected                <—— Current value
_____________________________________________________
```

t,6,1,8, 2

Link Protection Method

```
Link Protection Type
_____________________________________________________
1.  Unprotected
 2. MPU
 3. MPU, External switching
 4. External switching, Serial-connected        <—— Current value
_____________________________________________________
```

This parameter specifies how the primary and secondary radios interconnect to each other and to the PSU.

Unprotected: Value that this parameter has on unprotected links.

NOTE: MPU is an early acronym for the protection switch unit; now PSU.

PSU(MPU): Primary and secondary interfaces connect to the PSU, which switches both the incoming data traffic (to Tx radio path) and outgoing data traffic (from Rx radio path) data. The PSU presents a single interface to the customer premise equipment (CPE), just as an unprotected link would. The PSU also provides a communications/control path between the primary and secondary IDUs, and some shared logic to allow manual override and switching from the PSU, etc.

PSU (MPU), External Switching: Primary and secondary interfaces connect directly to interfaces on customer premise equipment (CPE). The CPE provides identical incoming data traffic (to Tx radio path) data to both radio's transmitters (unless there is a failure). The protected link logic sets the active transmitter, thus which of the identical data streams to transmit. The two radios provide two identical outgoing data traffic (from Rx radio path) data streams to the CPE, and the CPE decides the stream to use based on its criteria.

The PSU continues to provide a communications/control path between the primary and secondary IDU, and some shared logic to allow manual override and switching.

External Switching, Serial-Connected: Like the previous choice, no PSU is installed, and a serial cable connects to customer multiplexer (see Page F-4).

t,6,1,8, 3

Link Protection Details

```
Link Protection Details
(? for help)
_____________________________________________________
 1.  Protection Switch on LOF                 Disable
2..  Mute Tx on LOS/LOF                       Disable
_____________________________________________________
```

Protection Switch on LOF: A line LOS (loss of signal) on the active Tx will always cause a switch to the other Tx if that Tx has good data coming into its line. With the LOF switch selection enabled, a line LOF (loss of frame), which is usually ignored, causes a switch similar to an LOS switch.

Mute Tx on LOS/LOF: Each end of a 1+1 protected link has two transmitters, but only one transmits at a time, even when both radios have good line (payload) input, or when only one radio has a good line (payload) input, or when neither radio has good line input.

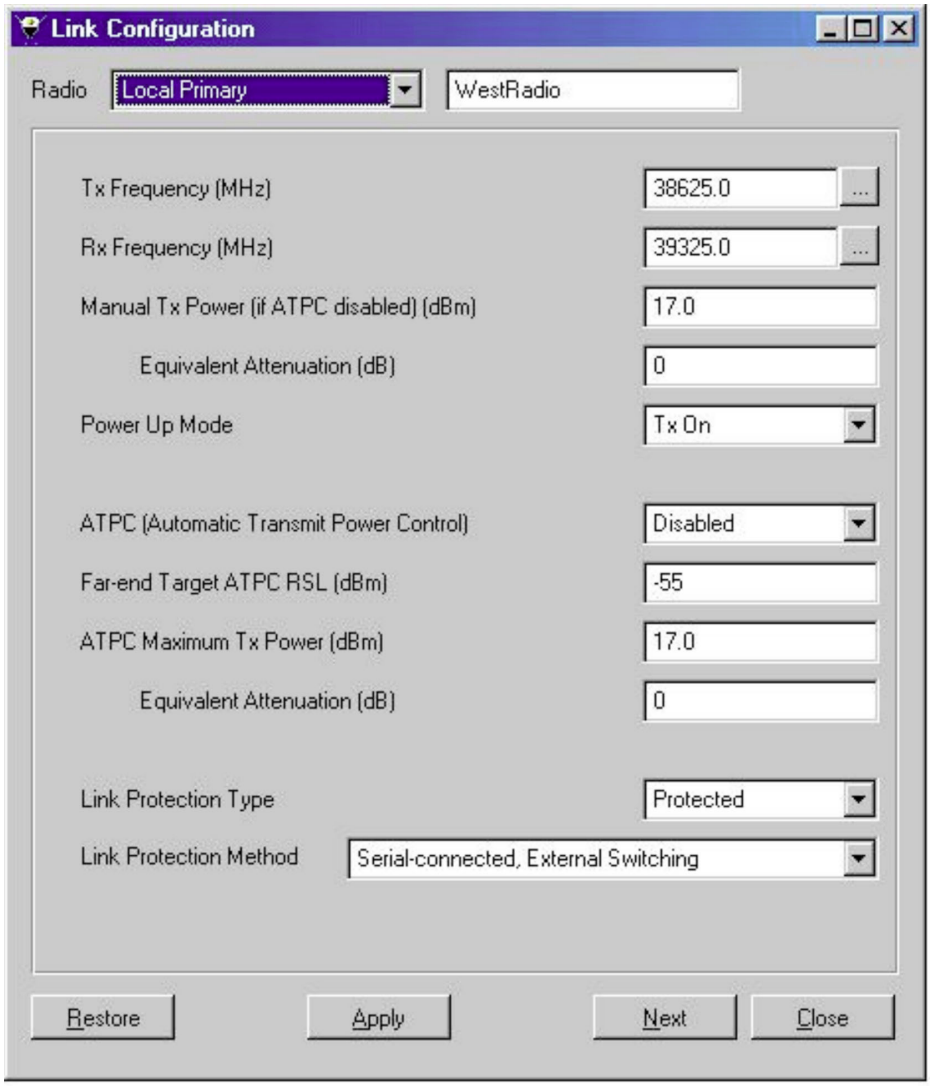
With MuteTx on LOS/LOF enabled, when both radios have LOS at the same time, or LOF with the LOF switch selection (1) enabled, NONE of the transmitters on that side transmits.

In hot-standby protected configurations - when both radios have LOS, but LOS to the twin (unmuted) radio has a delay of more than 100 ms, the twin radio continues to transmit - without data frames - to the far end. This function keeps the link alive, and lets you access and control radios at the far end of the link.

In serial-data protected configurations (PSU-less) - the function described above, continued transmit on LOS delay to the twin radio, does not work. The link goes mute.

This parameter also has no effect on non-protected links. Also note that PSU line ports support LOF, not LOS.

NOTE: Reboot the radio to load protection changes.



A protected link has four transmitters (two transmitters on each side, one of which is active at any given time.) ATPC can be enabled on either side independently. Also, on either side, ATPC can be enabled on the primary only, on the primary and the secondary, or even on the secondary only.

An active transmitter with ATPC enabled will always attempt to adjust its Tx Power so as to keep the remote primary receiver's RSL at the transmitters ATPC target RSL. (The secondary receiver's RSL will be about 6 dB lower than the ATPC target, because of the coupler attenuation.)

An active transmitter with ATPC disabled will set its TxPower to the configured manual value.

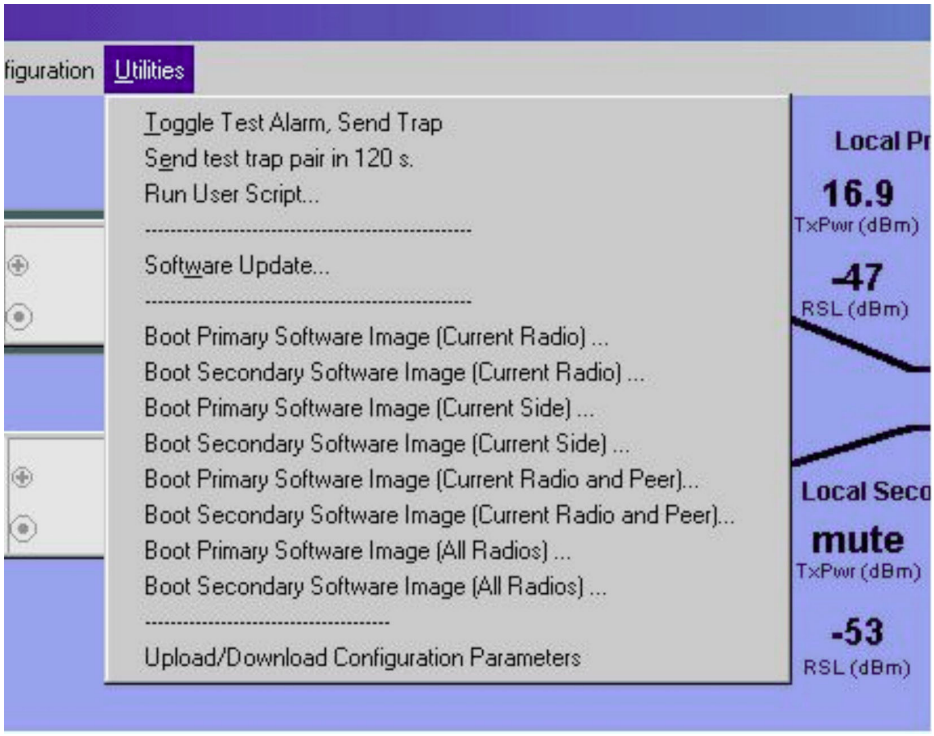
t,7

Utilities

```
Utilities
  (? for help)
  ──────────────────────────────────────────────
  1. Send a ping to the NMS
  2. Toggle test alarm, send trap
  3. Send test alarm trap set/clear pair in 120 seconds
  4. Close Current PPP Session
  5. Software Update ->
  6. Reboot ->
  7. Boot Status...
  8. Upload/Download Configuration Parameters ->
  9. Restore Configuration to Factory Settings, Restart
 10.Calculate Estimated RSL Value ->
  ──────────────────────────────────────────────
```

Radio Element Manager (GUI) Screen

Pull-down utilities menu gives selection to send test, update software or reboot system.



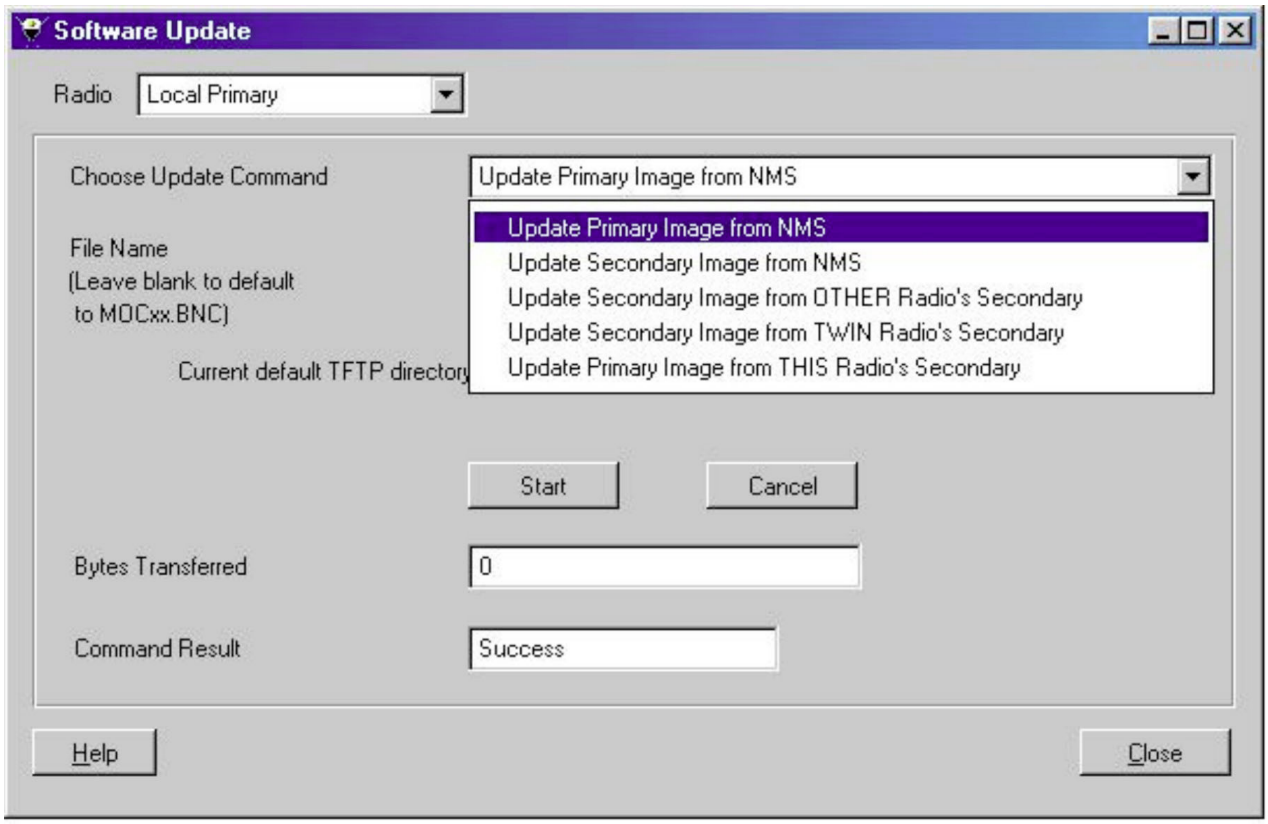
t,7,5

Software Update

"Peer" is equivalent radio at other end of link. "Twin" is second radio at same terminal end.

```
Software Update
 (? for help)
_____________________________________________________

1.Update Primary Image from NMS
2.Update Secondary Image from NMS
3.Update Secondary Image from Peer Radio's Secondary
4.Update Secondary Image from Twin Radio's Secondary
5.Update Primary Image from This Radio's Secondary
6.Update ODU SW code from NMS
7.Update FPGA/LUT data from NMS
_____________________________________________________
```

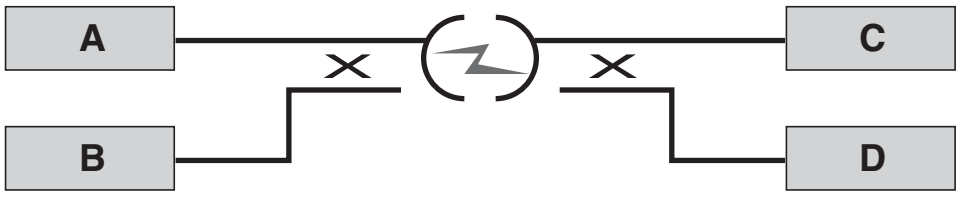


t,7,6

Reboot

The "Boots Radio" column is only true if the currently focused radio is A.

Reboot (? for help)	Boots	Radio
1. Boot Primary	Software Image (Current Radio)	A
2. Boot Secondary	Software Image (Current Radio)	A
3. Boot Primary	Software Image (Current Side)	A&B
4. Boot Secondary	Software Image (Current Side)	A&B
5. Boot Primary	Software Image (Current Radio and Peer)	A&C
6. Boot Secondary	Software Image (Current Radio and Peer)	A&C
7. Boot Primary	Software Image (All Radios)	A, B, C & D
8. Boot Secondary	Software Image (All Radios)	A, B, C & D



Local Terminal *Remote Terminal*

Definitions:

Primary Software Image ..... Main software image

Secondary Software Image ..... Backup software image

Current Radio ..... Radio that is selected:

a-local (Local Primary) "A"
B-local (Local Secondary) "B"
a-REMOTE (Remote Primary) "C"
B-REMOTE (Remote Secondary) "D"

Current Side ..... Both radios at selected side ("Local" or "Remote") as shown in prompt

Current Radio Peer ..... Radio that is selected ("A" or "B") and equivalent radio at other end of link

All Radios ..... All four radios

Configuring PPP Access to Protected Links

Protected links use the serial port (that PPP ordinarily uses) to communicate between the two IDUs on a side. If you need to access a protected link using PPP, you can do so by accessing the IDUs from the PSU (MPU). The PSU has PPP capability and can act as a PPP-to-Ethernet router.

To set up a protected link to allow one or more IDUs to be accessed via PPP through the PSU complete the following steps.

1. Ensure IDUs on the are both connected (via Ethernet 10 BaseT cables) to the PSU (A to A/ B to B).
2. Connect the PSU (MPU) Modem port (lower DB-9) to an external modem capable of 28.8 baud or more.
3. Connect the modem to a phone line as directed by modem instructions.
4. Power all equipment.
5. Connect the PSU Computer port (upper DB-9) to a PC with a serial cable. Use HyperTerminal or standard terminal emulator with the connection speed of 9600 baud. Apply the following configuration to the PSU (MPU). Save changes by typing “s” at and confirm at a prompt.

```
Network Management Configuration
  (? for help)
-------------------------------------------------------------
1. Active Interface(s):          PPP & Ethernet
2. Default Gateway:              0.0.0.0
3. Route to NMS:                 None (Disables traps)
4. NMS IP Address:               <does not matter>
5. Trap Community String:        <does not matter>
-------------------------------------------------------------
```

```
PPP Configuration
 (? for help)
-------------------------------------------------------------
 1. Maximum Output Queue Size    (K bytes): 32
 2. Modem Baud Rate:             38400
 3. Modem Initialization String: AT&F0
 4. Remote Phone Number:
 5. Maximum Dial Retries:        8
 6. Chat Script:
 7. Authentication:              CHAP
 8. Local CHAP Username:          demo
 9. Local CHAP Secret:           demoso
10. Remote CHAP Username:        demo
11. Remote CHAP Secret:          demosi
12. PPP IP Address:              192.168.200.200
13. PPP IP Subnet Mask:          255.255.255.0
14. Link Inactivity Timeout (secs): 60
15. PPP Console Logging:         Disable
-------------------------------------------------------------
```

Configuring PPP Access to Protected Links (cont.)

```
Ethernet Configuration
 (? for help)
 ──────────────────────────────────────────────────────
 1. Ethernet IP Address:       172.16.1.1  (See note #1 below)
 2. Ethernet IP Subnet Mask:   255.255.255.0
 ──────────────────────────────────────────────────────
```

Note #1: The Ethernet IP address above is for example only.

This address is a private unused IP address as defined by RFC 1597 and can be used if the protection equipment is not connected to an Ethernet network.

Important: *All Ethernet IP addresses on the PSU and any radio connected to it by Ethernet need to be in the same subnet, and that subnet needs to be different from the subnet of the radio and PC PPP.*

6. Apply the following configuration to the IDU you want to access and save it by typing “s” at the prompt.

```
Network Management Configuration
 (? for help)
 ──────────────────────────────────────────────────────
 1. Active Interface(s):       Ethernet
 2. Default Gateway:           172.16.1.1  (See note #2 below)
 3. Route to NMS:              None (Disables traps)
 4. NMS IP Address:            <does not matter>
 5. Trap Community String:     <does not matter>
 ──────────────────────────────────────────────────────
```

```
Ethernet Configuration
 (? for help)
 ──────────────────────────────────────────────────────
 1. Ethernet IP Address:       172.16.1.2  (See note #2 below)
 2. Ethernet IP Subnet Mask:   255.255.255.0
 ──────────────────────────────────────────────────────
```

Note #2: As described in Note #1 above, the 172.16.1.1 and 172.16.1.2 IP addresses are suggested private unused IP addresses.

Use real IP addresses for your Ethernet network if applicable.

Configuring PPP Access to Protected Links (cont.)

7. If you want to access the other IDU, simply configure it as the first one, but using 172.16.1.3 (not 172.16.1.2, see Note #2) as the Ethernet address. If, in a laboratory situation, you want to access the two primary IDUs at both ends of a link (near- and far ends), connect the two 10BaseT lines on the PSU to the two desired IDUs (instead of the PSU primary and secondary).
8. Confirm that the Auto Answer light (AA) on the modem is lit, and that the IDU 10BaseT LED lights.
9. Configure Dial-Up-Networking (DUN) on the connected PC according to Appendix E of this manual. After you establish DUN, access the radios using 172.16.1.2 and 172.16.1.3 (or your real IP addresses as notes 1 and 2 explain) using Telnet or the Pinnacle – Radio Element Manager. Do not use 192.168.200.200, the PSU IP address.
10. On the PC, the TCP/IP protocol suite knows that addresses like 172.16.1.2 are not local, so sends packets addressed to the PC's default gateway, which will be the active PPP port.

G APPENDIX G - Technical Information SDH/SONET

Contents

SDH/SONET Framing

Within the SDH or SONET frame, there are standard Section Overhead (SOH) bytes that can be used to help control and monitor a radio link or pass information convenient to the user. The bytes are located at locations within the SOH as defined by international standards so that the signal payload is not affected. The SOH is a part of the basic STM-1 or OC-3 signal (155 Mbit/s) and does not require additional overhead in addition to the 155 Mbit/s. Since the information described below is imbedded within the standard STM-1 or OC-3 signal, it will not be lost when transported over a cable, fiber or other wireless medium.

Access to the SOH is provided with an optional field interchangeable plug-in interface module within the IDU that contains an SOH framer/deframer. The following capabilities are included as part of the SOH:

1. Regenerator section termination - Byte B1 is monitored for bit errors and updates a table of performance statistics as defined by ITU-T G.826 recommendations. At a radio terminal, two G.826 tables are updated: data coming from the other end of radio link and data coming from the SDH/SONET line. In many SDH/SONET networks, this monitoring of the quality of each section in a line that may pass through several mediums (cable, fiber, radio, mux) is important in determining where a potential problem exists.
2. Two 64 kbps service channels – Provides an external V.11/V.28 connection for two user service channels that are contra-directional synchronized with the SONET/SDH network clock. Uses the E1 and F1 bytes within the SOH. The two channels are terminated via two RJ45 connectors but can also be passed thru under software control. One of the two service channels can be connected to an optional voice order wire drop. Either one of the two channels can be used as an external customer circuit with a throughput of 64 kbps over the radio link.
3. Wayside channel – Unused and media dependent bytes are used to carry an E1 or T1 channel that is synchronized to the SDH/SONET frame. The Tx and Rx data ports are available on two BNC coaxial connectors for unbalanced circuits or an RJ45 connector for a balanced circuit. The wayside channel meets ITU-T G.703 interface requirements and is typically used in applications such as a PABX interconnect between the two ends of the radio link or a means to carry network management or other data not directly related to the radio system.
4. Future capabilities – Not offered with initial interface modules but future applications include access to DCC bytes for network management and I/O for synchronous timing clock.
5. Untouched SOH bytes – All other SOH bytes not described above are passed thru without being processed.

SDH/SONET Framing (cont.)

All SOH functions can be bypassed or made transparent via software configuration if desired. In addition, the following functions can selectively be bypassed: B1 byte regenerator, wayside channel, service channels and circuit identifier.

A table is given below showing the location of all bytes used for the SOH functions within the radio terminal:

STM1 - SOH
(from ITU-T Recommendation G.708)

	0	1	2	0	1	2	0	1	2
0	A1	A1	A1	A2	A2	A2	C1	X	X
1	B1	M/WS	M/WS	E1	M/WS	*/WS	F1	X/WS	X/WS
2	D1	M/WS	M/WS	D2	M/WS	*/WS	D3	*/WS	*/WS
	Administrative unit pointers								
4	B2	B2	B2	K1	*/WS	*/WS	K2	*/WS	*/WS
5	D4	*/WS	*/WS	D5	*/WS	*/WS	D6	*/WS	*/WS
6	D7	*/WS	*/WS	D8	*/WS	*/WS	D9	*/WS	*/WS
7	D10	*/WS	*/WS	D11	*/WS	*/WS	D12	*/WS	*/WS
8	S1	Z1	Z1	Z2	Z2	M1	E2	X	X

* ..... Reserved for future

X ..... Bytes reserved for national use

M ..... Media-dependent bytes

..... WS Wayside channel used bytes

..... C1 Circuit identifier (J0)

..... E1/F1 64 kb service channels bytes