MDS Intrepid
MDS Intrepid Ultra

User Manual

Broadband Wireless Transceivers

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Information to User

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Quick Start Guide

Installation of an Intrepid Series Radio should be carried out only by an experienced technician.

1. Equipment Required

The following is a list of the equipment and materials required to install Intrepid hardware.

- Tools and materials:
  - Crimping tool for RJ-45 (if the ODU-IDU cable is without connectors)
  - Spanner/wrench 13 mm (0.5 in)
  - Drill (for wall mounting only)
  - Cable ties
  - Sealing material
- Cables and connectors:
  - ODU grounding cable 12 AWG
  - IDU grounding cable 18 AWG
  - ODU-IDU cable (outdoor class, CAT-5e, 4 twisted pairs, 24 AWG).

2. Installation Sequence

Install the Intrepid system according to the following the steps:

1. Survey the site
2. Mount the ODUs
3. Mount the external antennas (if used)
4. Mount the lightning protection devices (if used)
5. Perform outdoor connections
6. Mount the IDUs
7. Perform indoor connections
8. Align the ODUs/antennas.

3. Installing the Intrepid Radio Units

Mounting the ODUs

❋ **To mount the ODU on a pole or a wall:**

1. Ensure that the ODU is properly grounded.
2. Mount the ODU onto the pole or wall. Ensure that the unit is oriented so that the cable connectors are at the bottom. **(If they are on top, water may penetrate into the unit causing damage.)**

Notes

- *Do not tighten the ODU to its mounting brackets until the alignment process of the antenna is complete.*
- *Ensure that there are no direct obstructions in front of the ODU or interference from man-made obstacles.*

Mounting an External Antenna

❋ **To mount an external antenna:**

1. To mount an external antenna ensures that the antenna is properly grounded and then mounts the antenna onto the pole.
2. Follow the mounting instructions supplied with the antenna.

Performing Outdoor Connections

❋ **To complete the outdoor connections:**

1. Connect the ground cable to the ODU chassis as marked on the ODU.
2. Connect the antenna cable(s) to the ODU.
3. Connect the lightning protection device to the ODU.
4. Attach the ODU-IDU cable to the ODU RJ-45 connector.
5. Screw in the cable glands to ensure hermetic sealing of the ODU.
6. Secure the cables to the pole, mast or brackets using UV-rated cable ties.

Mounting and IDU

❋ **To mount an IDU:**

1. If the rack already holds other equipment, ensure that it is properly grounded.

Warning

Do not proceed with installation into a "live" rack unless it is properly grounded.

2. Attach the rack mounting brackets to the IDU.
3. Bolt the IDU into an empty slot in the rack, ensuring that it sits securely.

4. Ground the IDU to the rack using grounding lug I. The IDU should be left permanently grounded.

Note *Instead of using the rack mounting brackets, the IDU may be rail mounted using the four screw holes on each of its sides.*

Connecting the ODU to the IDU

❋ **To connect the ODU to the IDU:**

1. Route the cable from the ODU to the IDU, secure the cable along its path
2. Connect the cable to the ODU RJ-45 connector on the IDU.

Connecting User Equipment to the IDU

❋ **To connect user equipment to the IDU:**

- Connect user switch/router or any other compatible device to the IDU panel RJ-45 ports designated LAN.

Aligning ODUs

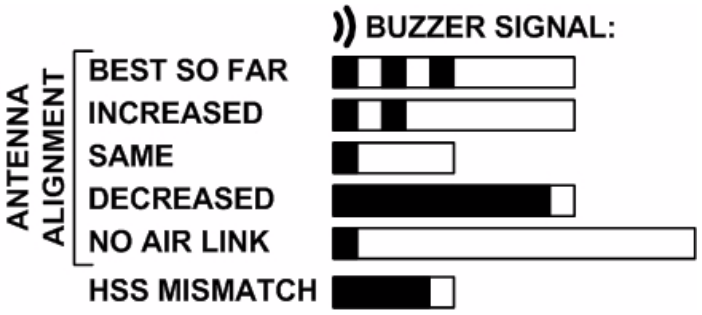
❋ **To align ODUs with integrated antennas or external bipolar antennas:**

1. For external dual-polarized antennas: Using a coax cable with N-Type connectors, connect the vertical polarization connector of the antenna to the ANT 1 connector of the ODU.
2. For external dual-polarized antennas: Using a coax cable with N-Type connectors, connect the horizontal polarization connector of the antenna to the ANT 2 connector of the ODU.
3. Ensure that power is connected to the IDUs at both sites.
4. Ensure normal operation of the IDUs by the LED indications on the front panel.
5. Provided that site A detects the signal from site B, the ODU starts beeping 20 seconds after power up, and continues beeping until the ODUs are aligned, and the installation is complete.
6. In the following steps, “antenna” refers both to an external antenna and an integrated antenna.
7. Direct the antenna of site B in the direction of site A. This is simplified if a previous site survey has been completed and azimuths are known.

Warning

When aligning the antennas, do not stand in front of a live antenna.

8. Make a horizontal sweep of 180 degrees with the site A antenna so that the strongest signal from site B can be detected.
9. Slowly turn the site A antenna back towards the position of site B, listening to the tone until the best signal is reached. See the following figure for audible signal variations.



Note

- *Three beeps and a pause is 'best signal so far'.*
- *Two beeps and a pause is 'signal quality increased'.*
- *One beep and pause is 'no change in signal'.*
- *Long beep and short pause is 'signal quality decreased'.*
- *One beep and a long pause is 'no air link'.*
- *Any other signal does not relate to antenna alignment.*

10. Secure the site A antenna to the pole/wall.
11. Repeat steps 4 to 8 for site B.

Chapter 1
Introduction

1.1 Overview

Intrepid and Intrepid Ultra offer throughput capacity of 25Mbps Full Duplex / 50Mbps aggregate and 100 Mbps Full Duplex / 200Mbps aggregate for cost-effective point-to-point broadband wireless transmission device. It transmits native Ethernet and TDM traffic (TDMoIP) over a variety of bands, and is suitable for licensed and unlicensed deployment.

Product Options

Wireless Link Capacity

Intrepid PtP Systems are available with the following wireless link capacities:

- 25Mbps Full Duplex / 50Mbps aggregate
- 100 Mbps Full Duplex / 200Mbps aggregate

Frequencies

MDS Intrepid Products operates in different frequency ranges, with versions for FCC, ETSI and other regulations.

Table 1-1. Supported Frequencies, Regulations and Channel Bandwidths

Band	Occupied Frequency Range [GHz]	Compliance	Channel Bandwidth		
			10 MHz	20 MHz	40 MHz
FCC/IC 2.4	2.402–2.472	FCC 47CFR, Part 15, Subpart C and IC RSS-210	Yes	Yes	No
FCC/IC 4.9	4.940–4.990	FCC 47CFR, Part 90, Subpart Y and IC RSS-111	Yes	Yes	No
FCC/IC 5.3	5.260–5.340	FCC 47CFR, Part 15, Subpart E and IC RSS-210	Yes(*)	Yes	Yes(*)
FCC 5.4	5.480–5.715	FCC 47CFR, Part 15, Subpart E	Yes(*)	Yes	Yes(*)
IC 5.4	5.480–5.590 5.660–5.715	IC RSS-210	Yes	Yes	Yes
FCC/IC 5.8	5.725-5.850	FCC 47CFR, Part 15, Subpart C and IC RSS-210	Yes	Yes	Yes
ETSI 5.3	5.160–5.340	ETSI EN 301 893	Yes	Yes	No
ETSI 5.4	5.480–5.715	ETSI EN 301 893	Yes	Yes	Yes

Band	Occupied Frequency Range [GHz]	Compliance	Channel Bandwidth		
			10 MHz	20 MHz	40 MHz
ETSI 5.8	5.735–5.865	ETSI EN 302 502	Yes	Yes	No
WPC India 5.8	5.825–5.875	GSR-38	Yes	Yes	Yes
MII China 5.8	5.730–5.845	MII China	Yes	Yes	Yes

Note

For FCC 5.4 and FCC/IC 5.3 bands: To comply with FCC regulations do not select channel bandwidths of 10 and 40 MHz.

Features

Wireless Link

Intrepid Series Radios delivers up to 100 Mbps air rate for Ethernet and E1/T1 traffic. The system supports a variety of spectrum bands.

Capacity

The two Intrepid Series models with different Ethernet or aggregate throughputs are available:

Intrepid Ultra

- Max 100 Mbps FD / 200 Mbps Aggregate,
- Ethernet and up to 16 E1/T1 ports

Intrepid

- Max 25 Mbps FD / 200 Mbps Aggregate
- Ethernet and up 8 E1/T1s ports

Transmission Technologies

Using the following technologies, the Intrepid Series air interface is designed to ensure nonstop, high quality transmission, even under interference and harsh conditions

- Automatic Adaptive Rate (AAR) is a mechanism that dynamically adapts the air interface rate by changing both the signal modulation and coding.
- Automatic Channel Selection (ACS) chooses the best channel by monitoring the available radio channels and dynamically selecting a channel which is best suited for transmission at any given time.
- Automatic Repeat Request (ARQ) is a mechanism for error control during data transmission. When the receiver detects an error in the received information, it automatically requests the transmitter to resend the information. This process is repeated until the transmission is error free or the error continues beyond a predetermined number of maximum transmissions. Intrepid Series ARQ mechanism is optimized for time-critical traffic.

- Forward Error Correction (FEC) with very low overhead and algorithms specifically designed for the varying conditions of license-exempt frequency bands, ensuring fast, robust and error-free communications.

LAN Interface

Intrepid Series IDUs includes two 10/100BaseT ports and one SFP-based Fast Ethernet port with autonegotiation and VLAN support. Traffic handling is provided by a MAC-level self-learning bridge. Single port PoE units are also available for Ethernet-only systems.

Physical Configurations

An outdoor unit (ODU), an optional external antenna and an indoor unit (IDU) with redundant DC power supplies. The outdoor unit is suitable for mast or wall installation.

Superior Spectral Efficiency

Built on advanced MIMO and OFDM technologies, the Intrepid Series system provides a high-capacity link at the 10, 20 MHz channel bandwidths for Intrepid and 10, 20 , 40 MHz bandwidths for Intrepid Ultra.

These channels support high robustness of the air interface under interference and harsh conditions. In countries where applicable, narrow channel bandwidth reduces the cost of the spectrum license.

Security

AES 128-bit integrated advanced encryption support provides enhanced air interface security for carriers and private networks. It ensures user data protection with one of the most sophisticated commercially available combined encryption and authentication techniques, CCM/AES. This technique combines message authentication (preventing anti-spoofing and replay protection) with commercial encryption, and complies with the IEEE 802.11i (phase iii) security recommendations.

CCM/AES uses a symmetric 128-bit encryption key (EK), and a nonce, and provides both message encryption and authenticating signature. The nonce mechanism enables the receiver to remember already received genuine messages and reject all replayed messages.

Adaptive Modulation

Intrepid Series adaptively changes the modulation according to air conditions, targeting maximum rate while maintaining link stability. The rate drops temporarily after encountering interference, then automatically returns to the highest possible rate.

Quality of Service

When the link quality is out of limits, Intrepid Series automatically searches for a clear channel within a pre-selected list of frequencies.

Short Time-to-Service

Because Intrepid Series operates in license-exempt frequencies, it can be deployed in record time, eliminating the costs and delays involved in leasing lines or trenching fiber.

Ethernet Ring

Ethernet rings are used to protect data against link and node failures. The rings ensure high availability of Ethernet services for critical applications.

VLAN Management

VLAN management allows the separation of user traffic from NMS traffic. The user decides if such a separation is required. Both the headquarters and remote sites are configured with VLAN management.

Ethernet QoS

VLAN- or Diffserv-based traffic prioritization technique is used for forwarding user Ethernet traffic into four weighted queues. The queues handle traffic with different service demands (real-time, near real-time, controlled loaf and best effort).

Monitored Hot Standby (MHS)

The Monitored Hot Standby (MHS) protects up to sixteen E1/T1 services with Intrepid Ultra and up to four E1/T1 services with Intrepid . It is designed to provide high reliability high-capacity point-to-point links. The MHS is:

- Designed to provide redundancy and high reliability for carrier class operators
- Optimized for high capacity links operating in license-free bands
- A comprehensive solution providing protection against both equipment failure and loss of air interface, by simple connectivity between a primary link and a secondary link
- Able to use a different band for maximum protection to the air interface

The main features of the MHS are:

- Fully automatic switchover from the primary to the secondary link in less than than 50 ms
- Automatic restoration to primary link as soon as it becomes available

MHS supports TDM services; Ethernet services are carried by both links independently.

Hub Site Synchronization

When several Intrepid Series units are collocated at a common hub site interference may occur from one unit to another. The ODU units are supplied with special hardware for the collocation of up to eight units.

Using a method called Hub Site Synchronization (HSS) an external cable is connected to all collocated Intrepid Series units , this cable carries pulses sent to each ODU, which synchronize their transmission with each other.

Diversity

Intrepid Series links using dual bipolar antennas may be configured to transmit the same data through both radios. This feature provides added data transmission inegrity under harsh conditions.

Management

A single SNMP-based network management application (Airmux Manager) is used to control multiple Intrepid Series radions as a unified network.

VLAN management allows the separation of user traffic from NMS traffic. The user decides if such a separation is required. Both the headquarters and remote sites are configured with VLAN management.

Factory settings can be restored at any time for each ODU.

Information on links and management can be collected and analyzed via a single action.

Spectrum View displays a visual representation of spectrum avail-ability during the link installation. It is an RF survey tool supporting the link installation prior to service activation. Use Spectrum View to choose the operating channel.

1.2 Physical Description

An Intrepid Series system may consist of an Outdoor Unit (ODU) and an Indoor Unit or an outdoor PoE housed in a weather-proof enclosure.

Figure 1-1. Intrepid Series IDU and ODUs

Outdoor Unit (ODU)

The ODU is the radio transceiver of the Intrepid Series system. It supports two radios for MIMO operation. The ODU may be mounted on a pole or a wall, and connects to the IDU or PoE device using a Cat.5e cable.

ODUs are available as:

- **Integrated Antenna ODU**. This ODU has an integrated 370 mm (1.2ft) flat panel antenna. The ODU contains both the radio and the antenna as a single unit housed in a weatherproof case.
- **Connectorized ODU**. This ODU has 2 × N-type connectors for connecting an external antenna.

Note

The external antenna choices are:

- ***Single Dual-Polarized antenna***
- *Optional - Two Single-Polarized antennas*
- *Optional – Single Single-Polarized antenna – Reduces Throughput by 50%*

Indoor Units (IDUs)

The IDUs have the service ports and provide aggregation of these services towards the ODU that transports them over the air. The IDUs also provide power to the ODU.

Figure 1-1 shows typical Intrepid Series indoor IDU-E and ODU.

8.5" IDU provide up to two Ethernet ports and up to two E1/T1 interfaces.

Power Over Ethernet (PoE) Devices

The basic PoE device provides Ethernet service only, with power for the ODU. The PoE device is extremely compact, having one Ethernet port, one ODU port and a standard 3-pin male AC power socket.

Figure 1-2. Basic PoE Device

Figure 1-3. Outdoor (Ruggedized) DC PoE Device

Antennas

An antenna is the radiating and receiving element from which the radio signal, in the form of RF power, is radiated to its surroundings and vice versa. The antenna gain and transmitting power may be limited by country regulations.

Intrepid Series may be operated with an integrated antenna that is part of the ODU unit, or with external antennas connected to the ODU via N-type connectors. All cables and connections must be connected correctly to reduce RF losses. The required antenna impedance is 50Ω.

The 5.x GHz Integrated Antenna ODU is provided with 370 mm (1.2ft) flat panel antenna, with a gain of 23dBi (5.x GHz) / 19 dBi (4.9 GHz) and 8° beam width. The 2.x GHz Integrated Antenna ODU is provided with 370 mm (1.2ft) flat panel antenna, with a gain of 16 dBi and 16° beam width. The radio and the antenna are housed in a weatherproof case as a single unit.

Figure 1-4. ODU with Integrated Flat Panel Antenna

External antennas are available for the Intrepid Series radios, varying in operating frequencies, form factor, size and gain, dual or single polarization.

The flat panel antennas shown below can be used either as an integrated or external antenna.

Figure 1-5. External Antennas for Use with Intrepid Series

GSU

The GPS-based synchronization unit (GSU) is designed to handle inter-site interferences under large-scale deployment scenarios.

The GSU is an outdoor unit consisting of a standard wireless link enclosure, a GPS antenna and a PoE device.

The GSU is connected to the HSS unit using a standard HSS cable. It synchronizes the transmission timing of multiple hub sites to the same clock source thus eliminating mutual interference.

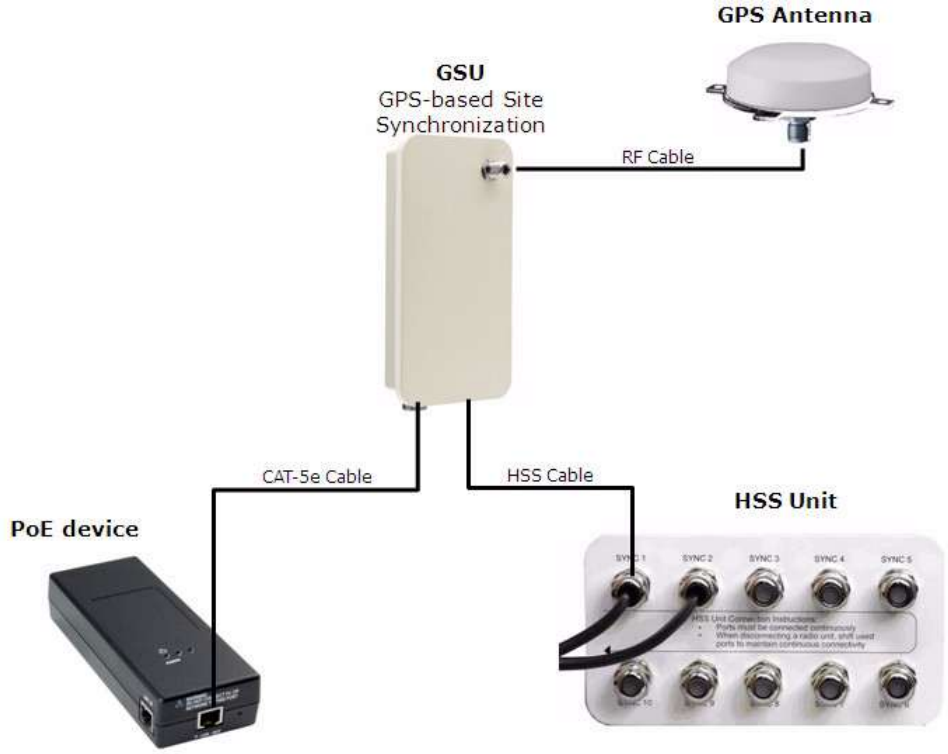


Figure 1-6. General GSU Configuration

1.3 Functional Description

Intrepid Series system comprises of the following units:

- **Outdoor Unit (ODU)**: An enclosed aluminum frame with a front sealed plastic cover, containing an integrated transceiver with an antenna, RF module, modem and standard interfaces. The ODU stores all the configuration parameters of the Intrepid Series system. *Figure 1-7* shows the ODU block diagram.
- **Indoor Unit (IDU)**: The interface unit between the ODU and the user. It converts 100–240 VAC to -48 VDC, and sends it on to the ODU. The IDU does not store any configuration data. Therefore, there is no need for additional configuration of the Intrepid Series system when replacing an IDU.
- **Outdoor PoE (O-PoE):** An enclosed aluminum frame with a front sealed aluminum cover, containing a 110–220 VAC to 48 VDC switching power supply and an interface interconnecting an un-powered Ethernet infrastructure to ODU.

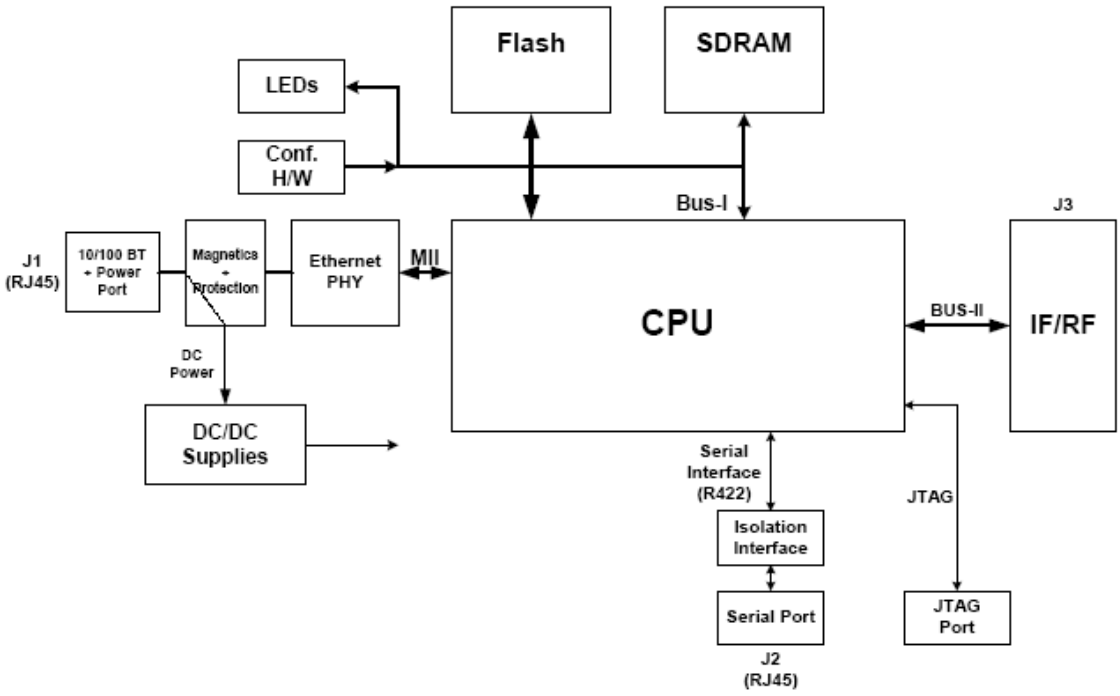


Figure 1-7. ODU Block Diagram

1.4 Technical Specifications

Radio

Frequency Bands (GHz)	See *Table 1-1*
Throughput	100 Mbps FD / 200Mbps Agg. - Ethernet and up to 16 E1/T1 25 Mbps FD / 50 Mbps Aggf. - Ethernet and up 8 E1/T1
Channel Bandwidth	10, 20 MHz channel bandwidths for Intrepid 10, 20 , 40 MHz bandwidths for Intrepid Ultra.
Duplex Technique	TDD
Modulation	2×2 MIMO-OFDM (BPSK, QPSK, 16 QAM, 64 QAM), see *Table 1-2*
Transmit Power	See *Table 1-2*
Sensitivity	See *Table 1-2* (measured at BER <10E-11, 20 MHz)
Error Correction	FEC, k = 1/2, 2/3, 3/4, 5/6, see *Table 1-2*
Encryption	AES 128
Regulation	FCC/IC: FCC 47CFR, Part 15, Subpart C, FCC 47CFR, Part 15, Subpart E FCC 47CFR, Part 90, Subpart Y RSS-111 IC RSS-210 ETSI: ETSI EN 302 502 ETSI EN 301 893 WPC India: GSR-38 China: MII

Antennas	*Characteristics*	*Table 1-3*
	Polarization Type	Dual
TDM Interface	*Number of Ports*	IDU – 2 IDU-E – 0, 4, 8 or 16
	Type	E1/T1, configurable
	Framing	Unframed (transparent)
	Timing	Independent timing per port, Tx and Rx
	Connector	RJ-45
	Standards Compliance	ITU-T G.703, G.826
	Line Code	HDB3 (E1) B8ZS/AMI (T1)
	Latency	Configurable 5–20 ms
	Impedance	E1: 120Ω, balanced, T1: 100Ω, balanced
	Jitter and Wander	According to ITU-T G.823, G.824
LAN Interface	*Number of Ports*	IDU – 2 IDU-E – 3
	Type	2 ports – 10/100BaseT 1 port – Fast Ethernet SFP
	Framing/Coding	IEEE 802.3u
	Bridging	Self-learning, up to 2048 MAC addresses
	Traffic Handling	MAC layer bridging, self-learning
	Latency	3 msec (typical)
	Line Impedance	100Ω (10/100BaseT)
	VLAN Support	Yes
	Connector	RJ-45 (10/100BaseT) LC (SFP-based)

Management	*Application*	PulseNet
	Protocol	SNMP, Telnet
Indicators	*PWR (green)*	Power status (IDU only)
	IDU (green)	IDU-E status
	ODU (green/red)	ODU-to-IDU link status
	AIR I/F (green/red)	Link status
	SVC (green/red)	E1/T1 signal status
	HSS	HSS status
	STBY	Standby mode status
Alarm Connector	*Connector*	DB-25 female
	Electrical Characteristics	Dry contact, 30V/2A Max input current, 0.01A at 0.5W (R=5K)
Power	*DC*	-20 to -60 VDC (24 VDC or 48 VDC nominal) via AC/DC converter
	Power Consumption	35W max (ODU with IDU)
	Connector	3-pin terminal block
Physical	*ODU (with integrated antenna)*	Height: 371 mm (14.8 in) Width: 371 mm (14.8 in) Depth: 9 mm (3.6 in) Weight 3.5 kg (7 lb)
	IDU	Height: 45 mm (1.7 in) Width: 436 mm (17.2 in) Depth: 210 mm (8.3 in) Weight 1.5 kg (3.3 lb)
Environment	*Temperature*	ODU: -35°C to +60°C (-31°F to +140°F) IDU: 0°C to +50°C (32°F to +122°F)
	Humidity	ODU: Up to 100% non-condensing, IP67 IDU: Up to 90%, non-condensing

Table 1-2. Radio Link Characteristics

Modulation	Rate		FEC	Max Tx Power		Sensitivity
	Single A**n**tenna [Mbps]	Dual Antenna [Mbps]	[k =]	4.8–6 GHz [dBm]	2.4 GHz	[dBm]
BPSK	6.5	13	1/2	25	26	-88
QPSK	13	26	1/2			-86
	19.5	39	3/4			-83
16 QAM	26	52	1/2	24	25	-81
	39	78	3/4	21	24	-77
64 QAM	52	104	2/3	19	24	-72
	58.5	117	3/4	18	21	-70
	65	130	5/6		20	-67

Table 1-3. Antenna Options

Antenna Type	Frequency [GHz]	Gain [dBi]	Beam [degrees]	Dimensions [mm]	[inch]	Weight [kg]	[lb]	Connector
Integrated								
Flat panel	4.9x–5.875	19 (4.9x GHz) 23 (5.x GHz)	9	371×371×40	14×14×1.5	2.5	5.5	2 × N-type
Flat panel	2.40	16	16	371×371×40	14×14×1.5	2.5	5.5	2 × N-type
External								
Flat panel	2.40–2.70	19	16	371×371×40	14×14×1.5	2.5	5.5	2 × N-type
Flat panel	4.40–5.10	22.8	10	371×371×40	14×14×1.5	2.5	5.5	2 × N-type
Flat panel	4.90–5.80	20.5 (4.90–5.00 GHz) 22 (5.00–5.80 GHz)	8	371×371×40	14×14×1.5	2.5	5.5	2 × N-type
Flat panel	4.90–6.06	22.5 (5.15–5.25 GHz) 23 (5.25–5.875 GHz) 21.5 (5.875–6.00 GHz)	9	371×371×40	14×14×1.5	2.5	5.5	2 × N-type
Flat panel	5.7–6.06	23 (5.70–5.875 GHz) 21.5 (5.875–6.06 GHz)	9	371×371×40	14×14×1.5	2.5	5.5	2 × N-type
Dish	4.90–6.06	28 (low band) 28.5 (mid band) 30 (high band)	5.6	Diam. 600	Diam. 23.6	7.0	15.4	2 × N-type

Note

The range of the system depends on the system configuration. For further information, contact the GE MDS partner nearest you or one of GE MDS offices worldwide.

Chapter 2

Installation and Setup

This section describes the installation, alignment, and setup procedures for an Intrepid Series Radio system.

After installing the hardware and establishing a link, refer to *Chapter 3* for operation instructions and *Chapter 4* for configuration instructions.

In case a problem is encountered, refer to *Chapter 5* for test and diagnostic instructions.

Warning

Internal settings, adjustment, maintenance, and repairs may be performed only by a skilled technician who is aware of the hazards involved.

Always observe standard safety precautions during installation, operation, and maintenance of this product.

Note

Before installing the product, review Handling Energized Products at the beginning of the manual.

2.1 Safety Practices

Warning

Outdoor units and antennas should be installed ONLY by experienced installation professionals who are familiar with local building and safety codes and, wherever applicable, are licensed by the appropriate government regulatory authorities. Failure to do so may expose the end user or the service provider to legal and financial liabilities. GE MDSand its resellers or distributors are not liable for injury, damage or violation of regulations associated with the installation of outdoor units or antennas.

Preventing Overexposure to RF Energy

To protect against overexposure to RF energy, install the ODUs so as to provide and maintain minimal separation distances from all persons.

When the system is operational, avoid standing directly in front of the antenna. Strong RF fields are present when the transmitter is on. The ODU must not be deployed in a location where it is possible for people to stand or walk inadvertently in front of the antenna.

Warning

Do not activate indoors an ODU with an integrated or external antenna. To test an active radio link inside the building, use an attenuated RF cable (at least 40 dB) for the ODU connection.

Table 2-1. Safety Distances for Intrepid Series Radio FCC and IC Products

Frequency Band [GHz]	FCC ID	IC ID	Antenna Gain [dBi]	Min. Safety Distance [cm]
5.8	Q3KRW2058	5100A-RW2054	28	223
5.8	Q3KRW2058	5100A-RW2054	24	141
5.3/5.4	Q3KRW2054	5100A-RW2054	23.5 / 28	20
4.9	Q3KRW2049	5100A-RW2054	28	225
4.9	Q3KRW2049	5100A-RW2054	21	113
2.4	Q3KRW2024	5100A-RW2054	19	39
2.4	Q3KRW2024I	5100A-RW2024I	17.5	40

Table 2-2. Safety Distances for Intrepid Series Radio ETSI Products

Frequency Band [GHz]	Antenna Gain [dBi]	Min. Safety Distance [cm]
5.8	24 / 28	16
5.4	23.5 / 28	9
5.3	23.5 / 28	4
2.4	19 / 17.5	3

Grounding

All GE MDSproducts should be grounded during operation. In addition:

- The **ODU** should be earthed by a wire with diameter of at least **12 AWG.**

  The Intrepid Series Radio ODU must be properly grounded to protect against lightning. It is the user's responsibility to install the equipment in accordance with Section 810 of the National Electric Code, ANSI/NFPA No.70-1984 or Section 54 of the Canadian Electrical Code. These codes describe correct installation procedures for grounding the outdoor unit, mast, lead-in wire and discharge unit. It also lays down the size of grounding conductors and connection requirements for grounding electrodes.

  The Intrepid Series Radio ODU must be grounded to a protective earth as described in *Appendix D* and in accordance with the local electrical regulations.

- The earth lug on the IDUE should be connected to the protective earth at all times, by a wire with a diameter of **18 AWG** or wider. Rack-mounted equipment should be mounted only in earthed racks and cabinets.
- Always make the ground connection first and disconnect it last
- Never connect telecommunication cables to ungrounded equipment
- Ensure that all other cables are disconnected before disconnecting the ground.

More detailed grounding guidelines are supplied in *Appendix D*.

Protection against Lightning

The use of lightning protection is dependent on regulatory and end user requirements. All outdoor units are designed with surge limiting circuits to minimize the risk of damage due to lightning strikes. GE MDS recommends the use of additional surge arrestor devices to protect the equipment from nearby lightning strikes.

See *Appendix D* for detailed installation instructions of lightning protection devices.

- It is recommended that installation of the outdoor unit be contracted to a professional installer.
- Before working on equipment connected to power lines or telecommunication lines, you should remove jewelry or any other metallic object that may come into contact with energized parts.
- Use extreme care when installing antennas near power lines.
- Use extreme care when working at heights.
- When using an AC power source for Intrepid Series Radio always use the AC power adapter supplied by GE MDS.
- Use the right tools. In addition to standard tools required for any kind of ODU or antenna installation, Intrepid Series Radio requires additional specific tools detailed in the *Additional Equipment Required* section below.

2.2 Site Requirements and Prerequisites

For the IDU units, allow at least 90 cm (36 in) of frontal clearance for operating and maintenance. Allow at least 10 cm (4 in) clearance at the rear of the unit for signal lines and interface cables.

The ambient operating temperature should be –35° to 60°C (–31° to 140°F) (ODU), or 0° to 50°C (32° to 122°F) (IDU) at a relative humidity of up to 100% (ODU) or 90% (IDU), non-condensing.

2.3 Package Contents

The Intrepid Series Radio packages include the following items:

- ODU package containing:
  - One ODU, see *Figure 2-1*, *Figure 2-2*
  - An ODU mounting kit
  - Label showing the MAC address and the alternative community string. The label is self-adhesive. You should keep this label safe.
  - Cable glands (to be used with the ODU-IDU cable).

Figure 2-1. Connectorized ODU, Front and Rear Views

Figure 2-2. Integrated ODU, Front and Rear Views

- IDU package containing:
  - IDUE
  - 19-inch rack mounting kit
  - Two DC power plugs for power cables.

  Or
- External antenna (if ordered)
  - Antenna
  - RF cable 1m (3 ft) long; two cables supplied with bipolar antennas, single cable supplied with monopolar antennas
  - Mounting kit.

2.4 Additional Equipment Required

The following is a list of the equipment and materials required to install Intrepid Series Radio hardware.

- Tools and materials:
  - Crimping tool for RJ-45 (if the ODU-IDU cable is without connectors)
  - Spanner/wrench 13 mm (0.5 in)
  - Drill (for wall mounting only)
  - Cable ties
  - Sealing material
- Cables and connectors:
  - ODU grounding cable 12 AWG
  - IDU grounding cable 18 AWG
  - ODU-IDU cable (outdoor class, CAT-5e, 4 twisted pairs, 24 AWG)
  - Ethernet cross cable (PoE-based links).

2.5 Installation Sequence

Install the Intrepid Series Radio system according to the following the steps:

1. Survey the site
2. Mount the ODUs, see *Appendix B*
3. Mount the external antennas (if used), see *Appendix B*
4. Mount the lightning protection devices (if used), see *Appendix D*
5. Perform outdoor connections, see *Outdoor Connections*
6. Mount the IDUs, see *Mounting the IDUs*.
7. Perform indoor connections, *Connecting the ODU to the IDU*.
8. Align the ODUs/antennas, page

Figure 2-3 illustrates a typical installation of Intrepid Series Radio with an external antenna.

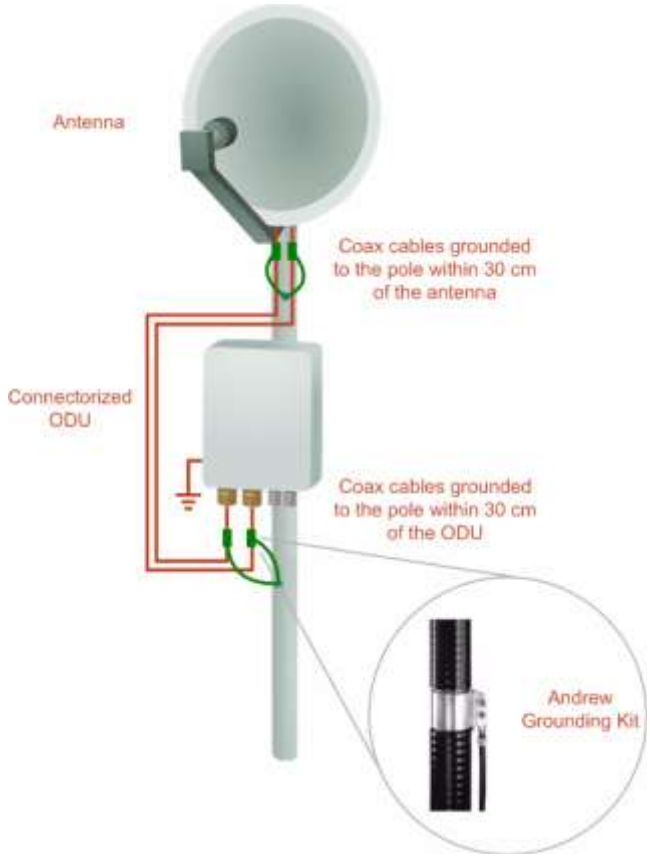


Figure 2-3. Typical Installation Diagram (with External Antenna)

2.6 Surveying the Site

This section explains how to survey the site intended for Intrepid Series Radio installation.

Planning the Link Site

Link site planning consists of a set of surveys, which must be carried out before any equipment is brought to the site. If for some reason, the outcome of any of these surveys is negative, site re-location will need to be considered.

A site survey consists of three stages:

- Preliminary survey – The proposed link is analyzed **in the office** using a topographic map.
- Physical survey – The locations of the Intrepid Series Radio indoor and outdoor equipment are determined **on-site**.
- Radio Frequency (RF) survey – It is recommended that the installation area be scanned with a spectrum analyzer, to identify RF interference so as to determine a clear channel for Intrepid Series Radio installation (**on-site**).

Site Survey

Intrepid Series Radio wireless links must be planned before installation. The designated installation site must be appraised to determine that the wireless system is able to operate efficiently and provide connectivity without signal degradation.

Intrepid Series Radio offers a wide operating frequency range. A free frequency channel must be determined within the operating range, for optimum performance.

Recommended equipment:

- Stage 1 (preliminary survey)
  - Topological map of the area
  - Urban map of the area
  - Compass
- Stage 2 (physical survey)
  - 100 meter tape measure
  - Ohmmeter, to check ground connection
  - Binoculars
  - Map
  - Digital camera
  - Paper, pencil, and a clipboard
  - GPS device (optional)
  - Compass (optional)
- Stage 3 (RF survey)
  - Spectrum analyzer with Max Hold function and screen capture facility that can store multiple images, for documentation purposes
  - RF accessories (connectors and cables)
  - Communication devices (for example, cellular phones, or a set of walkie talkies).

Stage 1 (Preliminary Survey)

A preliminary survey is necessary before visiting potential installation sites. As much detail as possible should be obtained about the two designated ODU installation sites and the area between them.

❋ **To perform a preliminary survey:**

1. Mark the two designated installation sites on a topographic map of the area.
2. Measure the distance between the sites; check that it is within the specified range of Intrepid Series Radio.
3. On the urban map, check for developed areas situated between the two installation sites. Pay attention to these areas when performing the physical site survey; there may be tall buildings, RF towers, or transmitters, which could cause interference to the link.
4. Check the area between the two sites for obstructions such as:
   - High ground - hills or mountains

- Lakes or large bodies of water. Water has a reflection effect on RF signals like a building. This type of reflection causes the received amplitude to be reduced. As a rule of thumb, the presence of a large body of water between the link sites may double the required antenna height.

5. Determine and record the compass bearings between both ODUs, relative to north.
6. If there are obstructions between the two sites, calculate the Fresnel Zone (see *Appendix C* for details).
7. If the site chosen does not meet requirements, consider alternative sites.
8. Use the Link Budget Calculator (on the CD supplied with Intrepid Series Radio or using the Link Manager) to determine the expected performance.

Stage 2 (Physical Survey)

The physical site survey reviews the environment of the proposed Intrepid Series Radio installation location, to ensure that the link sites are suitable for the wireless network. The results of the physical site survey should be recorded.

Note *It is advisable to go on a clear day, so you can more easily see any obstructions between the two sites.*

✱ **To perform a physical survey:**

1. From the compass readings taken in the preliminary survey, find the azimuth (horizontal position) that the ODU should face towards the second ODU.
2. Using binoculars, locate any obstructions such as tall trees, high buildings, hills or mountains. Look for other RF towers between the two sites. Mark the locations of the obstructions on the map.
3. Determine the location for the ODU (having regard for existing rooftop installations and tower space). It should be above any obstructions, considering the Fresnel Zone (see *Appendix C*).
4. If you need to install the ODU on a tower, make sure that the tower is far away from overhead electric power lines.
5. Determine a location for the indoor equipment; it should be as close as possible to the ODU. At an existing site, there is probably an equipment room with cable-routing channels.

Note *The IDU–ODU cable length limit is 100m, in accordance with IEEE 10/100BaseT requirements.*

6. Measure and record the path length of the cable from the ODU position to the indoor equipment room.
7. Determine the ground and lightning connection points of the installation. The Intrepid Series Radio ODU and IDU must both be grounded.
8. Using the ohmmeter, measure and record the resistance of the required installation to the grounding point. The resistance must be less than 10Ω.
9. Review the results of the physical site survey. Decide if the site is suitable for the Intrepid Series Radio wireless network installation.
   - If the site is suitable, continue with stage 3, the RF survey

- If the site is not suitable, survey another site.

Stage 3 (RF Survey)

The RF survey examines the wireless environment of the Intrepid Series Radio installation site, to determine whether there are available channels within the Intrepid Series Radio operating frequency band. An RF survey is performed using a spectrum analyzer.

It is advisable to familiarize yourself with the spectrum analyzer before going out on site, specifically the Max Hold and Marker functions.

You should perform the RF survey at both proposed link sites.

The survey should be carried out during a busy time of day, to best judge the worst-case radio interference. Allow 2–4 hours duration for a good RF survey.

Note — *It is possible to install the Intrepid Series Radio link and use the Link Manager to find a clear channel. Each frequency channel can be evaluated in turn. Achievement of a clear channel is indicated by the Quality bar on the Channel Setting window becoming green.*

2.7 Outdoor Installation

Mounting the ODU

The ODU can be mounted on a pole or a wall. In both installations, the supplied mounting kit is used to secure the ODU.

Note — *A mast-sited ODU typically uses a pole attached to the mast.*

An Intrepid Series Radio link operates in pairs of two ODUs with the same configuration. Both ODUs must be installed, and the antennas aligned for maximum throughput.

Warning

Prior to connecting cables to the ODU, the protective earth terminal (screw) of the ODU must be connected to an external protective ground conductor or to a grounded pole.

- **Only a qualified person using the proper safety equipment should climb the antenna mast**
- **Only qualified professional personnel should install or dismantle ODUs and masts.**

✱ **To mount the ODU on a pole or a wall:**

1. Ensure that the ODU is properly grounded.
2. Mount the ODU onto the pole or wall. Ensure that the unit is oriented so that the cable connectors are at the bottom. **(If they are on top, water may penetrate into the unit causing damage.)** It is possible to mount an ODU horizontally.
3. Refer to *Appendix B* for detailed ODU mounting kit contents and schematics.

Notes

- *Do not tighten the ODU to its mounting brackets until the alignment process of the antenna is complete.*
- *Ensure that there are no direct obstructions in front of the ODU or interference from man-made obstacles.*

Mounting External Antennas

If you are using ODU with an integrated antenna, skip to *Mounting the Lightning Protection Devices* below.

The supplied mounting kit is used to mount the antenna onto a pole. The antennas must be aligned for maximum throughput.

Warning

Do not stand in front of a live antenna.

❋ **To mount an external antenna:**

1. To mount an external antenna ensures that the antenna is properly grounded and then mounts the antenna onto the pole. Refer to *Appendix B* for detailed antenna mounting instructions.
2. Follow the mounting instructions supplied with the antenna.

Mounting the Lightning Protection Devices

The use of lightning protection is dependent on regulatory and end user requirements. The Intrepid Series Radio ODU is designed with surge limiting circuits to minimize the risk of damage due to lightning strikes. GE MDS recommends the use of additional surge arrestor devices to protect the equipment from nearby lightning strikes.

Refer to *Appendix D* for detailed installation instructions of lightning protection devices.

Outdoor Connections

Connect the outdoor devices once they are installed.

❋ **To complete the outdoor connections:**

1. Connect the ground cable to the ODU chassis as marked on the ODU.
2. Connect the antenna cable(s) to the ODU.
3. Connect the lightning protection device to the ODU (see *Appendix D*).
4. Attach the ODU-IDU cable to the ODU RJ-45 connector (see *Appendix A*)for the connector pinout)
5. Screw in the cable glands to ensure hermetic sealing of the ODU.
6. Secure the cables to the pole, mast or brackets using UV-rated cable ties.

2.8 Indoor Installation

Mounting the IDUs

The Intrepid Series Radio IDUs can be placed on a desktop or mounted in a rack. The figures below illustrate typical IDU panels. There may be differences in panels depending on the hardware ordered.

Figure 2-4. Typical IDU Rear Panel

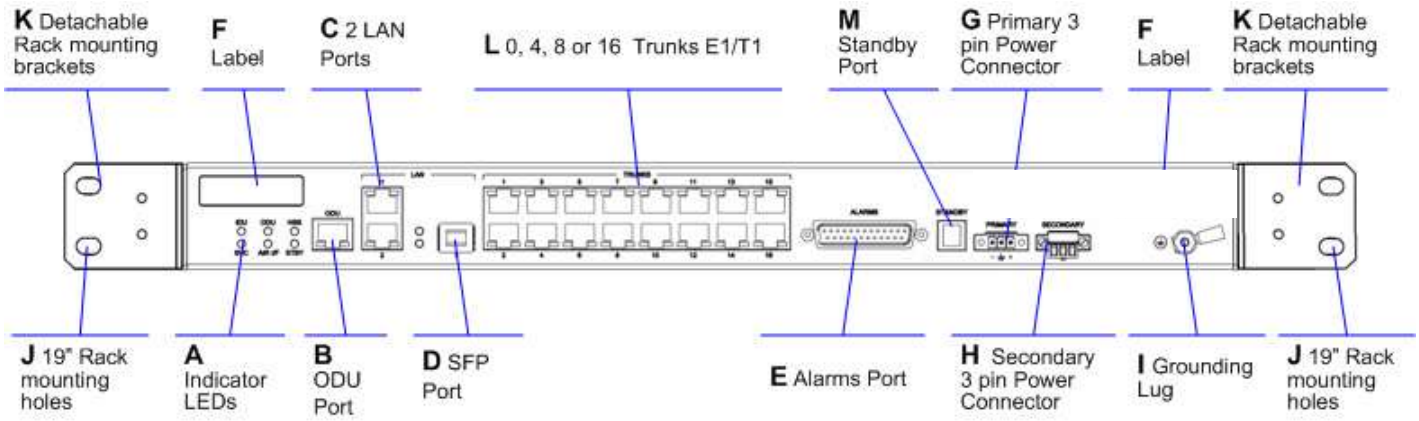


Figure 2-5. Typical IDU-E Front Panels

✱ **To mount an IDU-E:**

1. If the rack already holds other equipment, ensure that it is properly grounded.

Warning

Do not proceed with installation into a "live" rack unless it is properly grounded.

2. Attach the rack mounting brackets (K) to the IDU-E.
3. Bolt the IDU-E into an empty slot in the rack, ensuring that it sits securely.
4. Ground the IDU-E to the rack using grounding lug I. The IDU should be left permanently grounded.

Note *Instead of using the rack mounting brackets, the IDU-E may be rail mounted using the four screw holes on each of its sides.*

Connecting Power to the IDU

The IDUE has redundant power connection circuits.

The connectors are 3 pin in line female, with polarities (left to right) minus, ground, plus. To avoid damage to the IDU, always use an AC/DC adapter supplied by RAD.

Ensure that the IDUs at both sites are powered up.

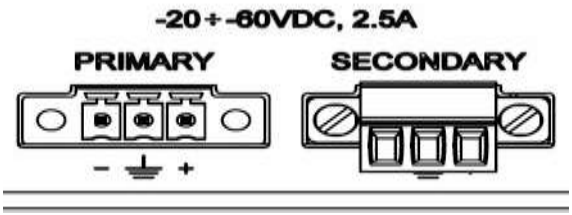


Figure 2-6. IDUE Power Connectors

Connecting the ODU to the IDU

The ODU-IDU cable conducts all the user traffic between the IDU and the ODU, and also provides power to the ODU. The maximum length of the ODU-IDU cable is 100m (328 ft) in accordance with 10/100BaseT standards.

The ODU-IDU cable is supplied pre-assembled with RJ-45 connectors, at the length specified when ordering, or as a cable drum with spare connectors. If the ODU-IDU cable was not ordered, use an outdoor class, CAT-5e 24 AWG shielded cable. See *Appendix A* for wiring specifications.

❋ **To connect the ODU to the IDU:**

1. Route the cable from the ODU to the IDU, secure the cable along its path
2. Connect the cable to the ODU RJ-45 connector on the IDU.

Installing a Link using PoE Devices

The PoE device is a simple unit having a power input connector and two Ethernet ports. It is AC powered, and has a power LED.

❋ **To prepare a link using PoE devices:**

1. To connect the ODU to the PoE device, route the cable from the ODU to the PoE device, secure the cable along its path and connect the cable to the P-LAN-OUT RJ-45 connector on the PoE device.
2. Connect it to AC power.
3. Repeat steps 1 to 2 for the second link.

Connecting to Ethernet Equipment

❋ **To connect Ethernet user equipment to the IDU:**

- Connect user switch/router or any other compatible device to the IDU panel RJ-45 or SFP ports designated LAN. Refer to *Appendix A*, for RJ-45 connector pinout.

Note *Do not connect two LAN ports to the same network, or flooding may occur.*

❋ **To connect user equipment to the PoE device:**

- Connect a user switch, router or any other compatible device to the PoE device RJ-45 port designated LAN-IN. Refer to *Appendix A* for connector pinout.

Connecting to E1/T1 Equipment

E1/T1 devices are connected to Intrepid Series Radio via balanced RJ-45 ports designated TRUNK. There may be multiple trunk ports available depending on unit ordered.
Refer to *Appendix A* for the E1/T1 connector pinout.

❋ **To connect E1/T1 equipment to the IDU:**

- Connect Intrepid Series Radio to the E1/T1 devices using standard straight E1/T1 cables.

2.9 Connecting and Aligning ODUs / Antennas

You perform antenna alignment using the ODU's audible tone. To speed up the installation time, alignment of an Intrepid Series Radio system should be performed by two teams simultaneously, at site A and at site B.

✱ **To align ODUs with integrated antennas or external bipolar antennas:**

1. For external bipolar antennas: Using a coax cable with N-Type connectors, connect the vertical polarization connector of the antenna to the ANT 1 connector of the ODU.
2. For external bipolar antennas: Using a coax cable with N-Type connectors, connect the horizontal polarization connector of the antenna to the ANT 2 connector of the ODU.
3. Ensure that power is connected to the IDUs at both sites.
4. Ensure normal operation of the IDUs by the LED indications on the front panel.
5. Provided that site A detects the signal from site B, the ODU starts beeping 20 seconds after power up, and continues beeping until the ODUs are aligned, and the installation is complete.
6. In the following steps, "antenna" refers both to an external antenna and an integrated antenna.
7. Direct the antenna of site B in the direction of site A. This is simplified if a previous site survey has been completed and azimuths are known.

Warning

When aligning the antennas, do not stand in front of a live antenna.

8. Make a horizontal sweep of 180 degrees with the site A antenna so that the strongest signal from site B can be detected.
9. Slowly turn the site A antenna back towards the position of site B, listening to the tone until the best signal is reached. See the following figure for audible signal variations.

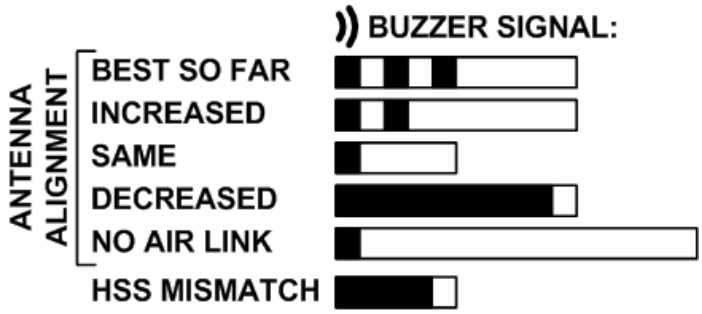


Figure 2-7. Beep Sequence for Antenna Alignment

Note

- *Three beeps and a pause is 'best signal so far'.*
- *Two beeps and a pause is 'signal quality increased'.*
- *One beep and pause is 'no change in signal'.*
- *Long beep and short pause is 'signal quality decreased'.*
- *One beep and a long pause is 'no air link'.*
- *Any other signal does not relate to antenna alignment.*

10. Secure the site A antenna to the pole/wall.
11. Repeat steps 4 to 8 for site B.

2.10 Working with the Link Manager Application

The Intrepid Series Radio management application is distributed on CD-ROM as an executable file. System-specific PC resources required by the application are detailed in *Table 2-3*.

Table 2-3. PC Requirements for the Link manager

	Windows 2000	Windows XP Pro	Windows Vista/Windows 7
RAM	128 MB	512 MB	1 GB
Processor	P III	P IV	P IV Dual Core

- Disk: 1 GB free hard disk space
- Network: 10/100BaseT NIC
- Graphics: Card and monitor that support 1024 × 768 screen resolution with 16 bit color
- Microsoft Explorer 5.01 or later.

Installing the Link Manager

❋ **To install the Link Manager:**

1. Insert the CD-ROM into your CD-ROM drive.

   The installation starts automatically.
2. Follow the on-screen instructions of the installation wizard to complete setup of the Link Manager program in the desired location.

Starting the Link Manager

❋ **To start the Link Manager:**

1. Connect the managing computer to one of the two LAN ports of the IDUE as shown below.

Figure 2-8. LAN Ports on the Front Panel of the IDUE

If you are not using a direct connection as above, ensure that you have IDU to managing computer connectivity (e.g. through a LAN).

2. Check that you have connectivity to the ODU. You can do this by opening up a command line session (**Start>Run** and then type, **cmd**). At the command prompt, type: ping 10.0.0.120

   You should receive a reply from Intrepid Series Radio.

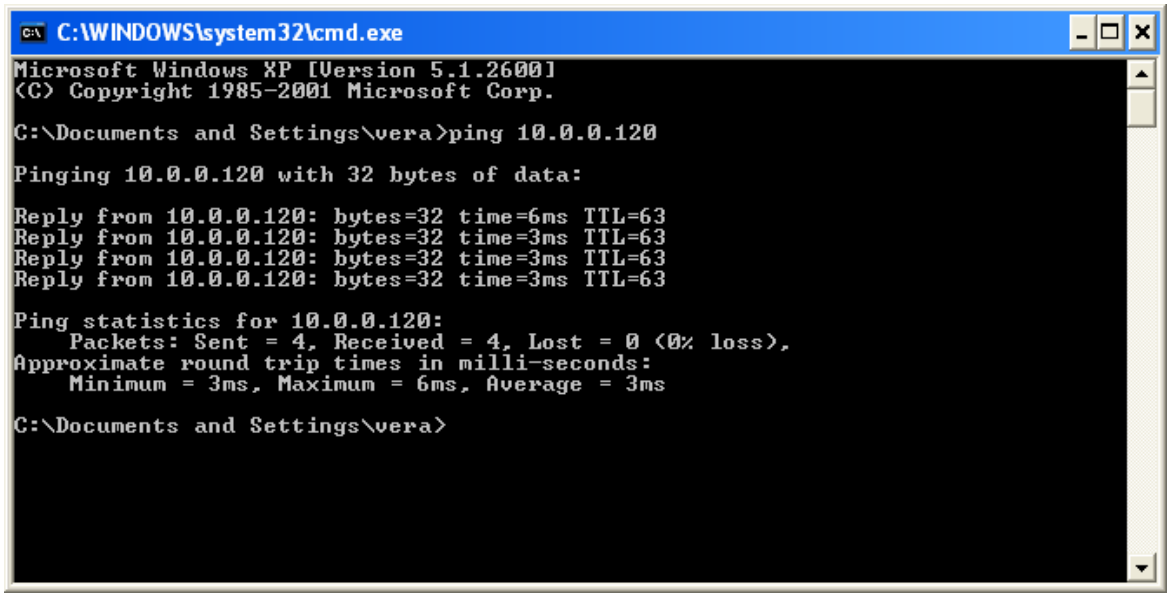


Figure 2-9. Pinging an Uninstalled and Unconfigured Link

Any other response from ping means that the ODU is not responding. Check your Ethernet connection and that both the IDU and ODU are switched on and then try again.

3. Dismiss the command line session.
4. Double-click the Link manager icon on the desktop, or click Start > Programs > Link manager > Link manager.

   The Login dialog box appears.

Figure 2-10. Login Screen

5. Type an IP address for the ODU (if you connect through a network), or click Local Connection (if you are connected directly to the IDU port).

Caution

- If you log in on Local Connection, but your physical connection is **not** local (i.e. anything other than a direct connection between the managing computer and the IDU), then any configuration you carry out may affect other links in the network.

- If you log in via an over-the-air IP address, you will receive a warning. If you reset the site to which you are connected to factory settings, you can lock yourself out of the link.
- Network login (IP address to the ODU) is recommended.

Note

- *If you log on using **Local Connection** through a PoE device, you will need to connect it to the managing computer using a crossed Ethernet cable.*
- *The default IP address for the ODU is 10.0.0.120. The subnet mask is 255.0.0.0. The actual IP address is defined during link configuration (see Chapter 4).*

6. Select your user type:
   - An **Observer** has read-only access to the link. An Observer can monitor the link, generate reports, but may not change any link parameters.
   - An **Operator** can install and configure the link.
   - An **Installer** can, in addition to functioning as an Operator, also change the operating band. The latter function requires familiarity with local regulations.

Table 2-4. User Types

User Type	Default Password	Function	Community	Community String
Observer	*admin*	Monitoring	Read-Only	*public*
Operator	*admin*	Installation, configuration	Read-Write	*netman*
Installer	*wireless*	Operator plus set band	Read-Write	*netman*

Note

Change default passwords as soon as possible.

7. If you are a user with Read-Write permission, click **Options** to enter the Community options.
   - If you are using the system for the first time, leave the default Community passwords, ***netman*** for read-write, and ***public*** for read-only.
   - If Community values were previously defined, enter them under Community in the Read-Only or Read-Write boxes.
   - If you are a user with read-only permission, click the Read Only Mode check box.

Note

Intrepid Series Radio is protected with Community passwords. A user may be defined with read-only permission or with read-write permission (see Chapter 4 for more details).

Figure 2-11. Login Screen with Community Options Visible

Login Errors

This section describes problems that may occur during login.

Unsupported Device

Attempting to connect to an unsupported device on an otherwise valid IP address (for example, a LAN printer) results in the following error message:

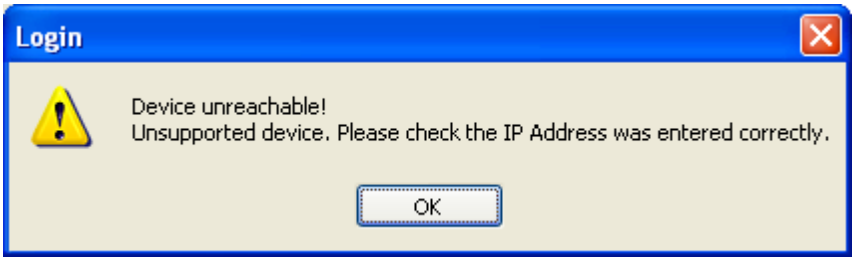


Figure 2-12. Unsupported Device Message

Incorrect IP Address

If the IP address chosen is invalid or the link is unreachable, the following error message is displayed:

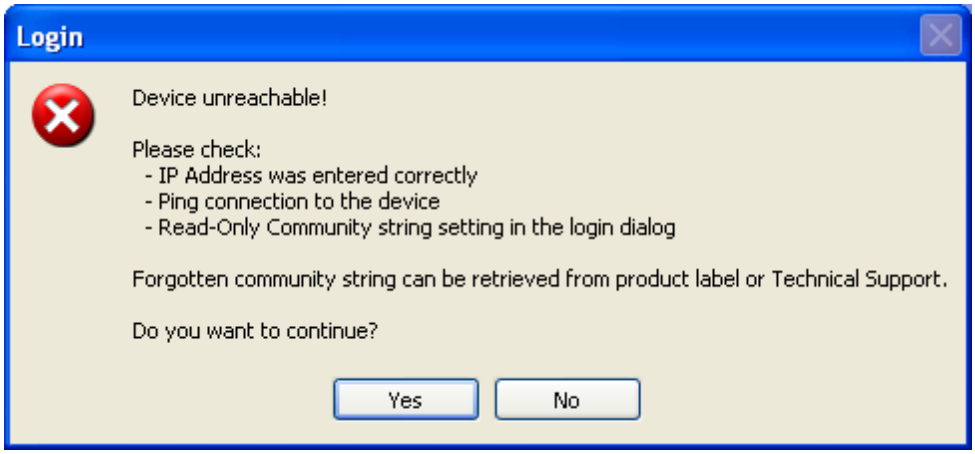


Figure 2-13. Unreachable Device Message

In both of the above situations, if you click **No**, you will see a warning graphic alongside the IP Address field.

Incorrect Password

If you type an incorrect password in the Login screen, a warning graphic is displayed alongside the password field.

Invalid Read/Write Community String

This results in the following message:

Figure 2-14. Invalid Community String Message

Logging in to the Over-the-Air Site

You can log in to the over-the-air site of an established link (Site B in our example). However, you will be first offered the following caution:

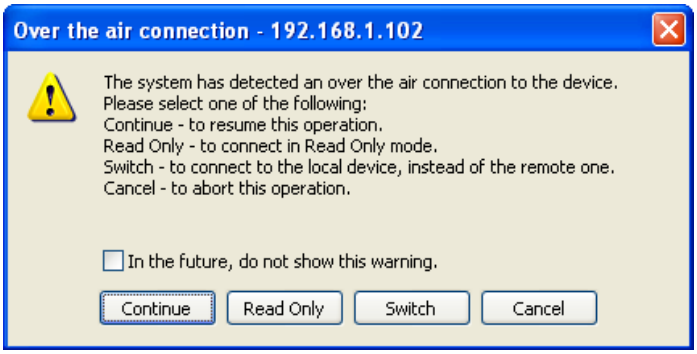


Figure 2-15. Logging in to an Over-the-Air Site

Continuing without an IP Address

The Link manager provides limited "offline" functionality when there is no accessible IDU/ODU. It is primarily for setting managing computer related parameters and running the Link Budget Calculator.

Changing the Login Password

❋ **To change the login password:**

1. From the Tools menu, select **Change Password**.

   The Change Password dialog box appears.

2. Enter the current password, and the new password.
3. Click OK to confirm.

Using Link Manager Spectrum View

Prior to running the link installation wizard may use the Link manager Spectrum View utility.

The Link Manager Spectrum View utility is an RF survey tool designed to support the link installation prior to full link service activation. The tool provides comprehensive and clear spectral measurement information enabling easier, faster and better quality installations.

You can view real-time spectrum information, save the spectral information and view retrieved spectral information from historic spectrum scans.

The spectrum measurement and estimation algorithms are designed to show accurate information while accommodating with variations in frequency, temperature and interference power while overcoming anomalies that tend to occur in high interference environments.

Note

- *Spectrum view information is supported in GE MDS MIB and can be used by external Network Management applications.*
- *The Spectrum View information is logged as part of the diagnostics information to improve link and system diagnostics and remote support. It can be retrieved from the Link manager menu using* ***Help >Get Diagnostic Information****.*

❋ **To launch the Spectrum View utility:**

- From the Link manager main window, select **Tools** > **Spectrum View**.

  The main Spectrum View window is displayed.

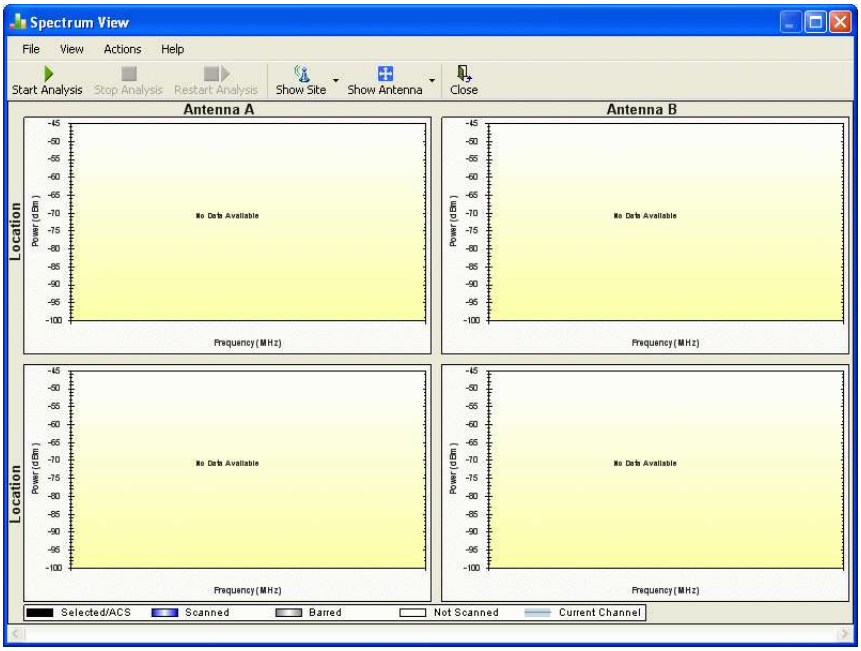
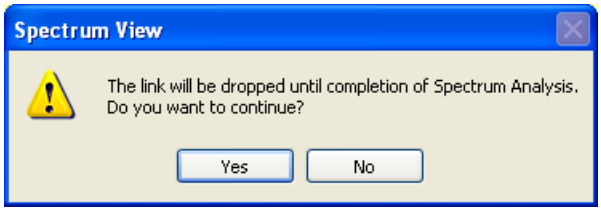


Figure 2-16. Spectrum View Utility before Spectrum Analysis

✱ **To analyze spectrum:**

1. Click **Start Analysis**.

   A warning message is displayed.



2. Click **Yes** to continue.

The managing site analysis results are displayed in a few seconds.

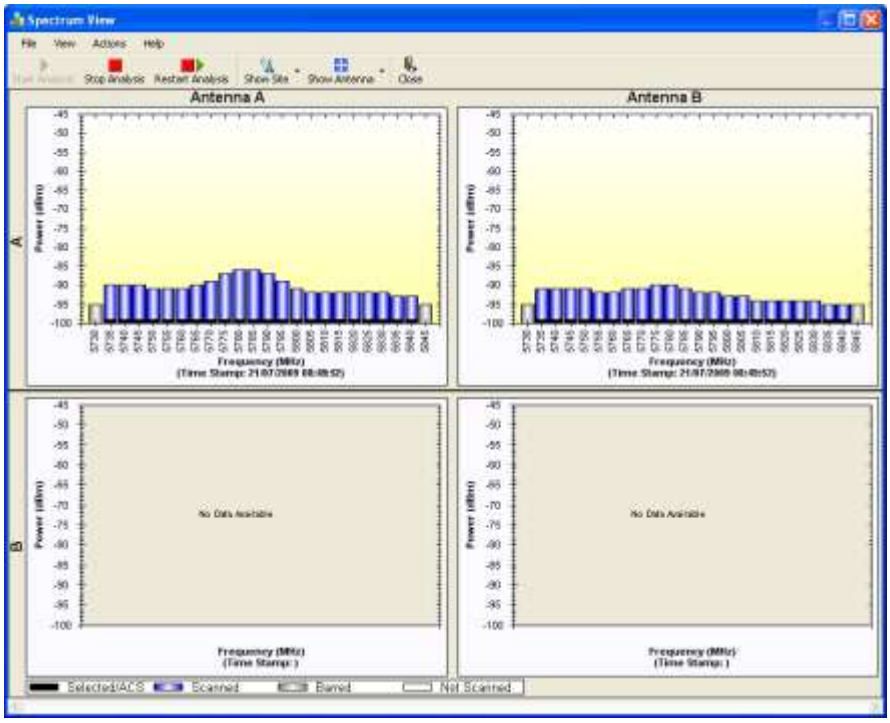


Figure 2-17. Spectrum Analysis Results for Managing Site (Site A)

The over-the-air site spectrum analysis results are displayed several seconds later.

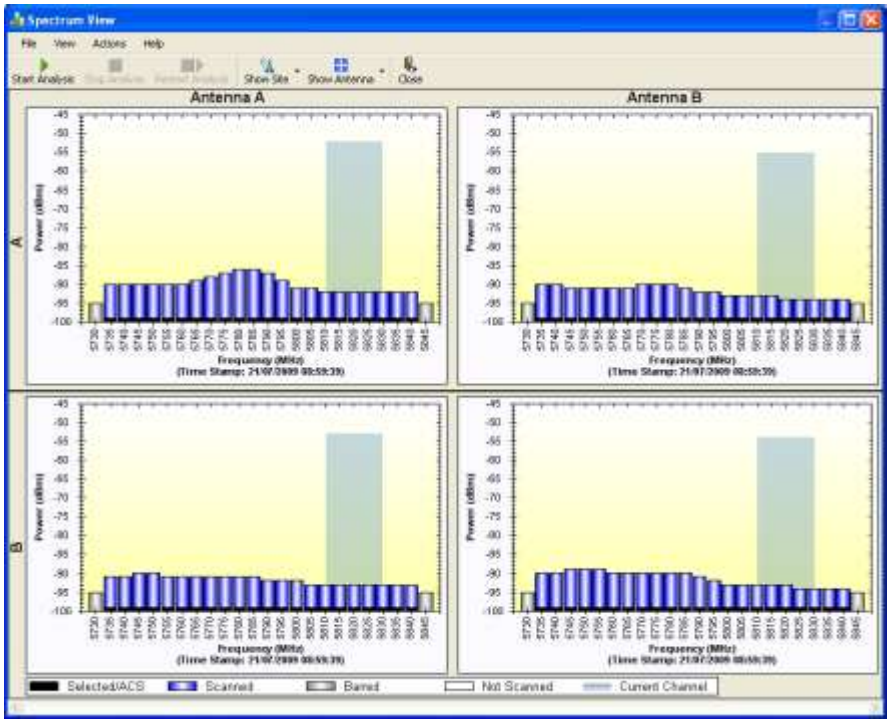


Figure 2-18. Spectrum Analysis Results for Over-the Air Site (Site B)

The analysis complete when the Start Analysis button reverts to green. It never runs for longer than ten minutes and you may stop it any time by clicking the red Stop Analysis button.

The results for the over-the-air site are displayed after the link is re-established regardless whether the analysis completes by itself or is stopped.

Display Information

Figure 2-19 explains the Spectrum View window elements.

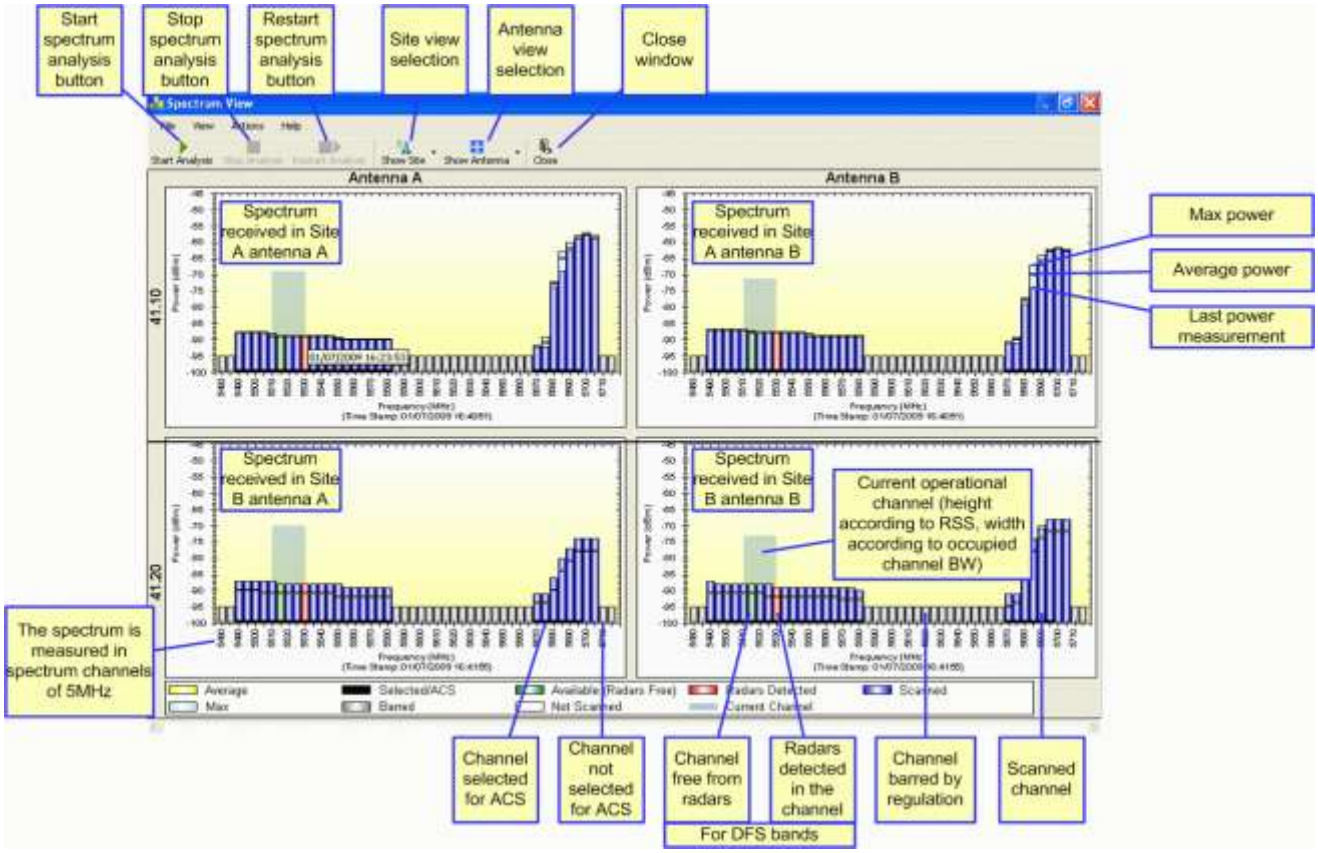


Figure 2-19. Spectrum View Window Elements

The Spectrum View provides clear information including:

- Spectral measurement for each of the 4 receivers that make an Intrepid Series Radio link (two sites x two antennas per site)
- Spectral power measurements in 5 MHz channel granularity
- Current, average and maximum power per channel
- Indication of:
  - Channels free from radars
  - Channels with radars detected
  - Barred channels (for DFS bands)
- Indication of scanned and unscanned channels
- Indication of channels selected for ACS
- Notation of the current operational channel of the Intrepid Series Radio link

- Time stamp of the last spectrum scan
- Further, it supports zoom capability, selective view of antennas and sites constituting the link and selectable detail level.

Changing the Display

Moving the mouse anywhere over one the display areas changes it to a cross hair. The mouse may then be used to select an area for zooming, or to enable a right-click System menu.

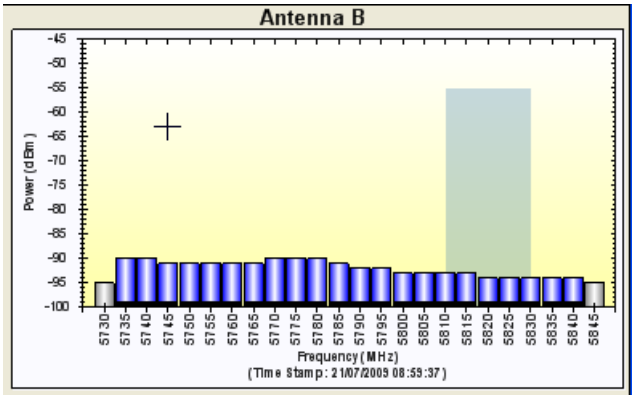


Figure 2-20. Mouse Pointer Active for Zooming

✱ **To zoom on specific channels:**

1. Press the right mouse button down.
2. Select a rectangle on a spectrum view display above the channels in interest.

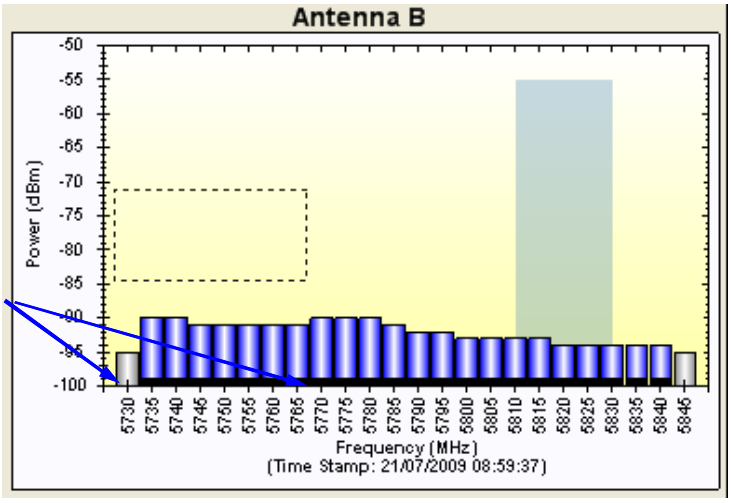


Figure 2-21. Selecting an Area of Interest to Zoom

3. Release the right mouse button.

   The channels below the selected area become zoomed.

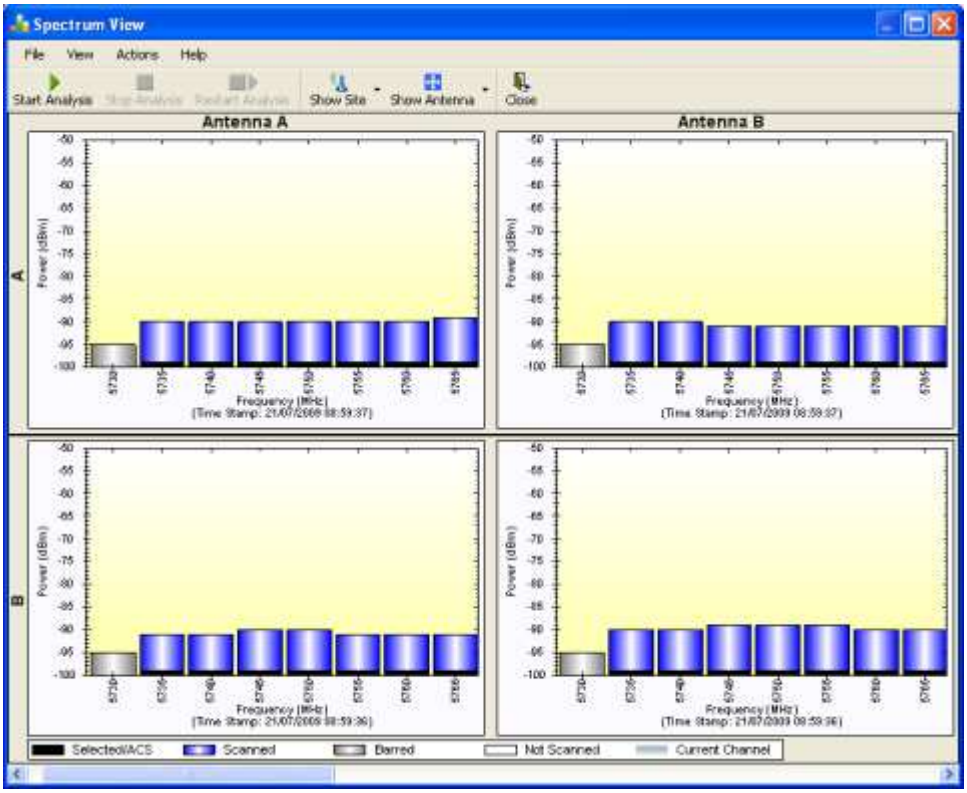


Figure 2-22. Selected Channels Zoomed

✱ **To reverse the zoom:**

1. Right-click within any Spectrum View panels.

   System menu is displayed.

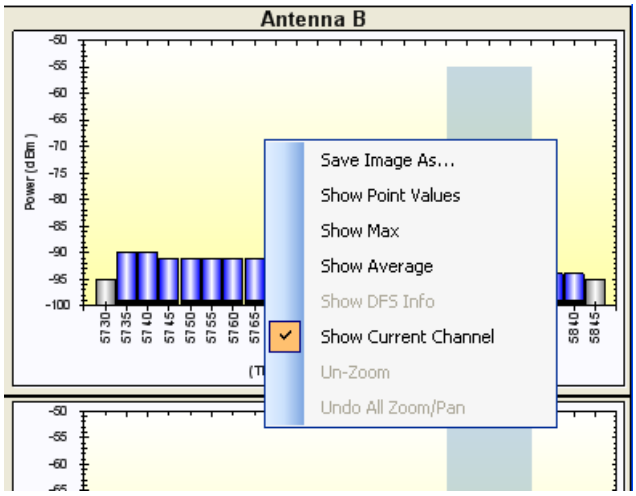


Figure 2-23. System Menu

2. Select **Un-Zoom** to return to the normal display.

✱ **To show peak values recorded during analysis:**

1. Right-click within any Spectrum View panels.

   System menu is displayed.

2. Select **Show Max**.

   Display shows the maximum recorded values.

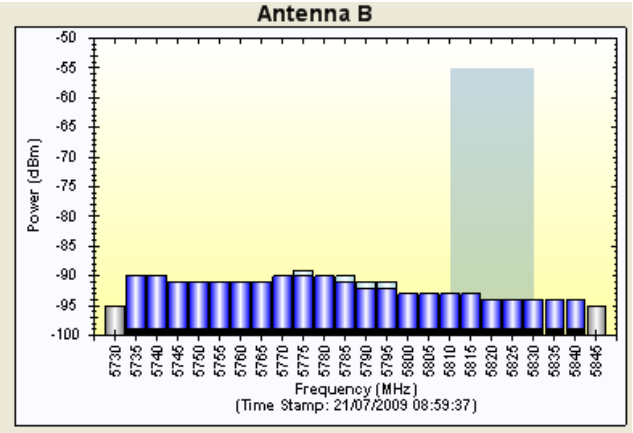


Figure 2-24. Maximum Recorded Values

✱ **To show average values recorded during analysis:**

1. Right-click within any Spectrum View panels.

   System menu is displayed.

2. Select **Show Average**.

   Display shows the average recorded values.

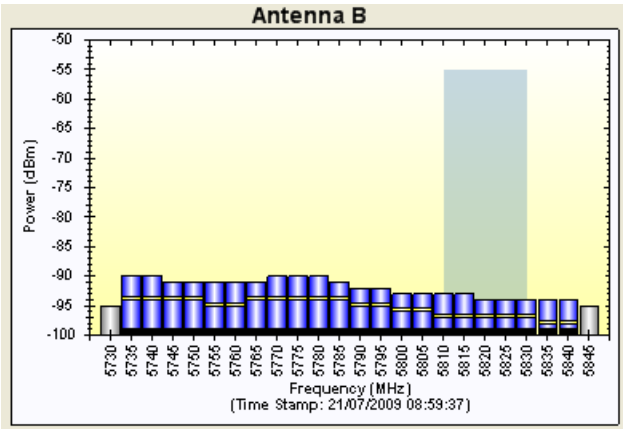


Figure 2-25. Average Recorded Values

✱ **To restrict panels to be displayed:**

- From the View menu, select:
  - **Show Site** to display spectral analysis for a specific site.
  - **Show Antenna** to display spectral analysis for a specific antenna.

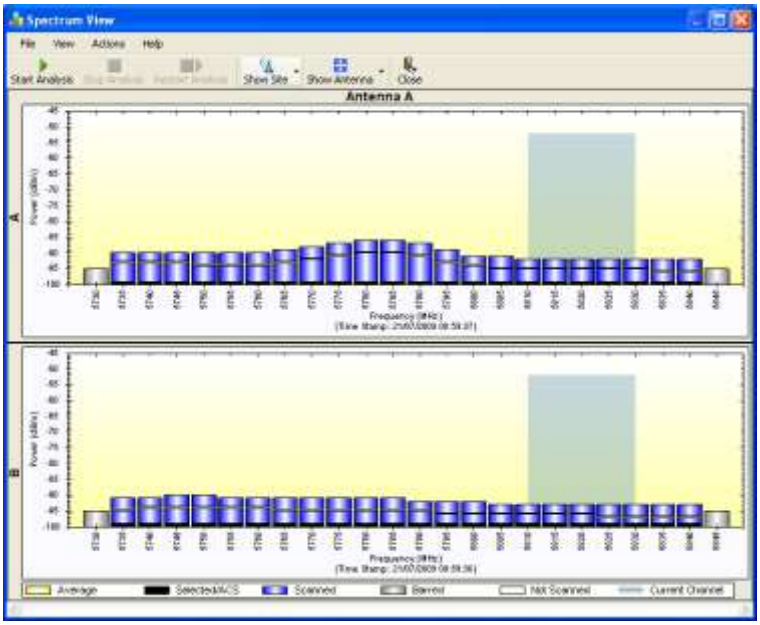


Figure 2-26. Displaying Spectral View for Antenna A only

Saving Spectrum Analysis Information

Spectrum analysis information can be saved in a CSV (comma separated values) text file. It can be retrieved from the Link manager menu using **Help** > **Get Diagnostic Information.**

✱ **To save the spectrum analysis information:**

- From the file menu, select **Save**.

  Below is an example of a saved spectrum view information. It can be later imported into a spreadsheet program, such as MS Excel.

Spectrum View - Site: A

Frequency,Is Scanned,Last Scan Timestamp,Last NF-AntennaA,Last NF-AntennaB,Average NF-AntennaA,Average NF-Anten-naB,Max NF-AntennaA,Max NF-AntennaB

5735,True,30/11/2009 08:20:52,-89,-90,-90,-91,-89,-90,

5740,True,30/11/2009 08:20:52,-89,-90,-90,-91,-89,-90,

5745,True,30/11/2009 08:20:52,-89,-90,-90,-91,-89,-90,

...

5830,True,30/11/2009 08:20:52,-92,-94,-93,-94,-92,-93,

5835,True,30/11/2009 08:20:52,-92,-94,-93,-95,-92,-94,

5840,True,30/11/2009 08:20:52,-92,-94,-93,-95,-92,-94,

Rx Power - AntennaA: -55

Rx Power - AntennaB: -55

Spectrum View - Site: B

Frequency,Is Scanned,Last Scan Timestamp,Last NF-AntennaA,Last NF-AntennaB,Average NF-AntennaA,Average NF-Anten-naB,Max NF-AntennaA,Max NF-AntennaB

5735,True,30/11/2009 08:20:53,-91,-90,-92,-91,-91,-90,

5740,True,30/11/2009 08:20:53,-90,-89,-91,-90,-90,-89,

5745,True,30/11/2009 08:20:53,-90,-89,-91,-90,-90,-89,

...

5830,True,30/11/2009 08:20:53,-93,-94,-94,-94,-93,-93,

5835,True,30/11/2009 08:20:53,-93,-94,-94,-95,-93,-94,

5840,True,30/11/2009 08:20:53,-93,-94,-94,-95,-93,-94,

Rx Power - AntennaA: -57

Rx Power - AntennaB: -55

The column headings are wrapped around. The table values in dBm are noise-floor (NF) relative. The CSV file imports easily into most spreadsheet programs, such as MS Excel.

Note *Spectrum view information is supported in the product MIB and can be used by external network management applications.*

Installing the Link

After the login the main Link Manager window is displayed.

Note *For the purposes of illustration, the following IP addresses will be used:*

- *NMS – 192.168.1.100*
- *The log-on ODU – 192.168.1.101*
- *Over-the-air ODU – 192.168.1.102.*

The subnet mask for both sites is 255.255.255.0 and no default gateway is defined.

If the login is successful, Intrepid Series Radio displays the opening window.

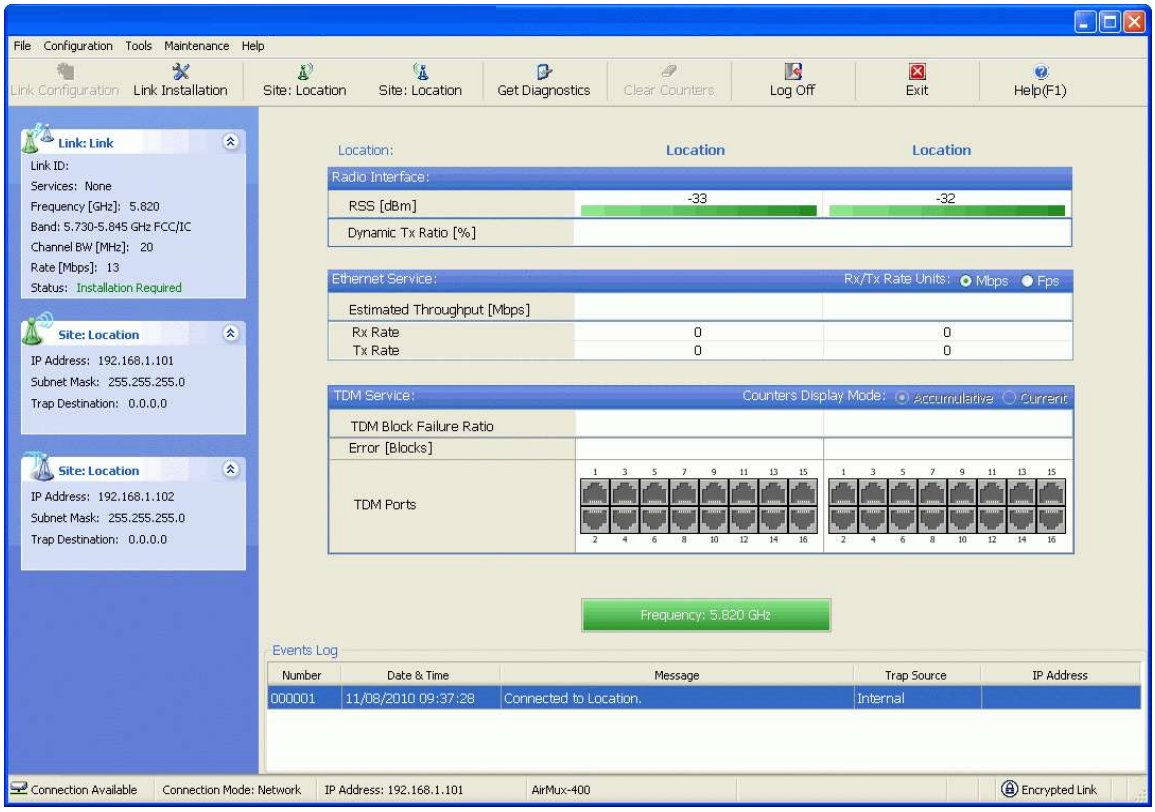


Figure 2-27. Link manager Main Window

Note

The procedure required to make the link functional has three phases:

1. Link Installation – detailed below.

   Installation actually gets the link operational by setting the link parameters. It uses a fixed channel at the lowest possible modulation, BPSK at 6.5Mbps and works under the harsh interference condition.

Note

During the installation procedure, the definition of all parameters is automatically applied to both sides of the link.

2. Link Configuration (see *Chapter 4*)

   Configuration provides much the same functionality as Installation, but for a running link. A fallback to Installation mode is provided for situations which cannot be handled without resetting the link, such as antenna realignment and IDU or ODU replacement.

   The Link Installation and Configuration phases are both carried out with Wizards, which "walk you through" the processes. The Wizards are visually quite similar and will be described in detail below.

3. Site Configuration (see *Chapter 4*)

   Site specific configuration for each side of the link is available at any time - under a running link or under the restricted Installation mode.

   Site Configuration consists of a set of panels, which may be invoked individually in any order, as needed.

Note *An installed and configured link can be returned to installation mode for re-installation and configuration from last settings or from factory settings.*

- *Reversion to installation mode requires a complete break in the link service*
- *Configuration mode may vary the service throughput and quality, but without a service break.*

Link Installation Overview

Link installation procedure includes the following steps:

1. Initiating the link installation wizard
2. Defining system parameters
3. Selecting a channel
4. Defining transmit power and system settings
5. Viewing configuration summary and completing the wizard.

Initiating the Link Installation Wizard

✱ **To initiate the link installation wizard:**

1. In the tool bar of the Link manager main window, click the **Link Installation** button.

   The Installation Wizard opens.

Note *The Link Installation button is only accessible if antennas are properly aligned.*

2. Click **Next** to proceed with the installation procedure.

Figure 2-28. Link Installation Wizard, Opening Screen

Note *The bottom data area reproduces the corresponding data from the main window, which is obscured by the above panel.*

Defining System Parameters

The System dialog box allows configuration of the general link and site parameters.

✱ **To define the system parameters:**

1. From the System dialog box, configure the following parameters:
   - Enter a Link ID. **The Link ID must be identical for both ODUs in the link, otherwise they will not communicate**. The Link ID must include at least eight alphanumeric characters. Up to 24 characters are allowed. You should use a Link ID composed of both alphabetic and numeric characters.
   - Link Name for the link identification. The default name is "Link". It is recommended to change the default name.
   - Site 1 and Site 2 names. The default names are both "Location". It is recommended to change the default names. Throughout this manual, A for Site 1 and B for Site 2 are used.
   - Link password (optional). Default password is ***wireless-bridge***.

Note *The link password is associated with the link, it does not have anything to do with the Link manager login password.*

If an incorrect password is entered, a link is established but configuration cannot be performed and no services are available. A new link password may be obtained from RAD. You can also acquire an alternative password as explained below.

2. Click **Next** to continue.

   Intrepid Series Radio starts evaluating the link at a default rate of 6.5 Mbps.

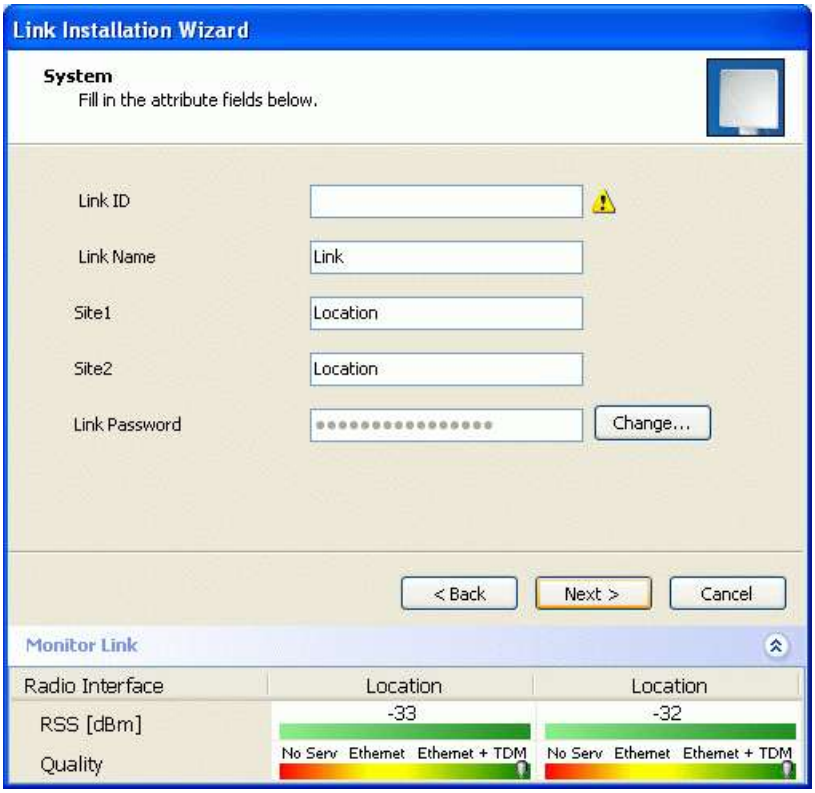


Figure 2-29. Link Installation Wizard, System Dialog Box

✱ **To change the link password:**

1. Click the Change button in the System dialog box.

   The Change Link Password dialog box opens.

2. Enter the current link password. (The default link password for a new ODU is ***wireless-bridge***). Select the Hide characters check box for maximum security.
3. Enter a new password.
4. Confirm the new password.

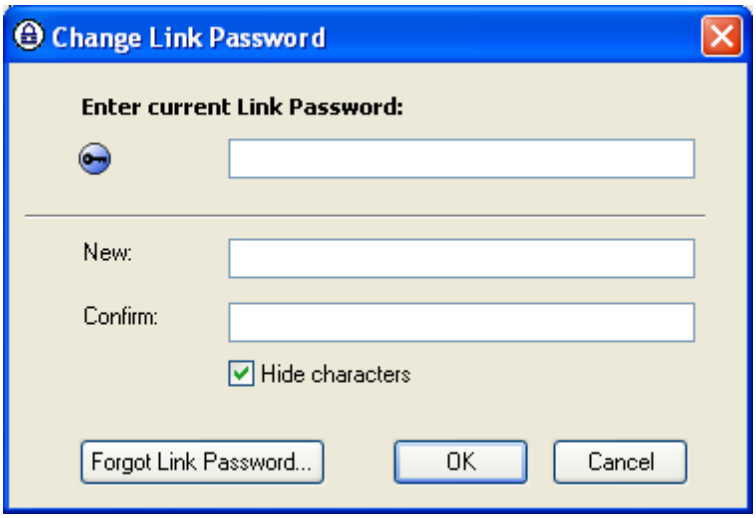


Figure 2-30. Change Link Password Dialog Box

❋ **To acquire a new password:**

1. Click the Forgotten Link Password button.

   Link Password Recovery dialog box is displayed.

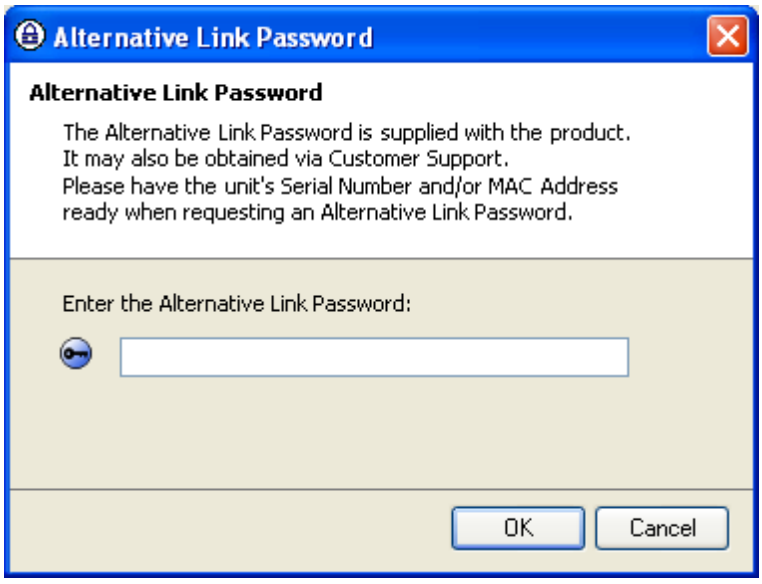


Figure 2-31. Link Password Recovery Dialog Box

2. Follow the instructions to use the Alternative Link Password, and click **OK** to finish.

   The Change Link Password dialog box is displayed.

3. Enter a new password.
4. Retype the new password in the Confirm field.
5. Confirm the link password change.
6. Click OK to complete the procedure.

Note

- *Restoring Factory Defaults returns the Link Password to **wireless-bridge**.*
- *If the link is inactive, then the link password may also be changed from the Site Configuration dialogs.*

Selecting Channels

Intrepid Series Radio features an Automatic Channel Selection (ACS). In the event of sync loss, ACS chooses the first available channel in a list of monitored channels. A channel switch takes place sufficiently fast as to ensure no loss of service.

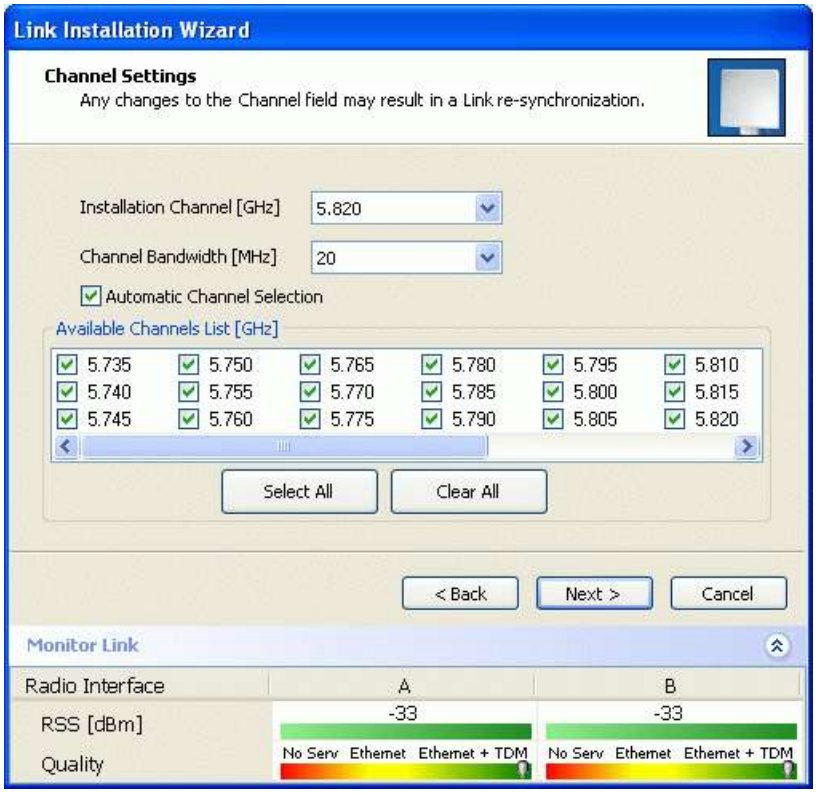


Figure 2-32. Link Installation Wizard, Channel Settings Dialog Box

❋ **To select channels to be used by the link:**

1. Select the main frequency from the Installation Channel box.
2. Click the check box if Automatic Channel Selection is required.
3. The Available Channels List contains all of the allowable channels for the link. Check the channels that can be automatically selected.

   Selecting a new channel causes the system quality to change. The Quality bar provides an indication of the link quality from **No serv**(ice) (red) to **Ethernet + TDM** (green) as shown in the bottom of the figure above.

❋ **To select channel bandwidth:**

1. Select the required channel bandwidth (10, 20 or 40 MHz) for Intrepid Ultra Series Radio, and 10 and 20 Mbps for Intrepid Series Radio.
2. Click **Next**.

Configuring Transmit Power and Antenna Settings

The choice of Tx power, antenna gain and cable loss determines the EIRP and is affected by such considerations as radio limitations and regulatory restrictions.

Before proceeding to antenna installation details, the following background information should be considered:

Each Intrepid Series Radio ODU is made of two radio transceivers (radios). The radios make use of algorithms that utilize both polarization and space diversity resulting in enhanced capacity, range and link availability. The number of antennas (i.e. radios) used is determined by user configuration and by automatic system decisions, explained below.

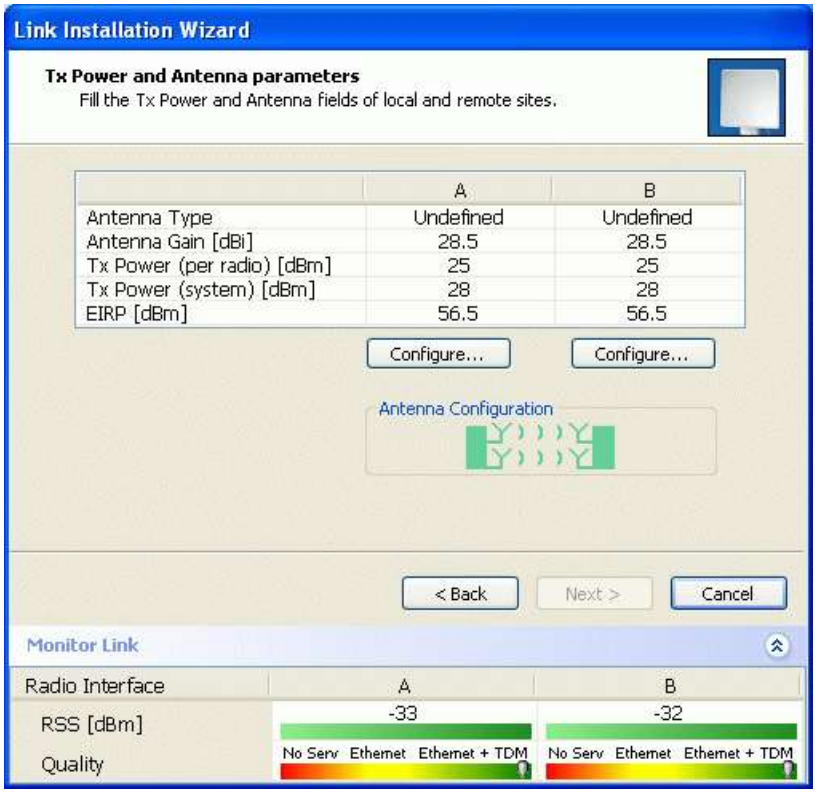


Figure 2-33. Transmission Power and Antenna Parameters

Dual Antennas at Both Sites

When using dual, single-polarized antennas at both sites (single bipolar antenna or two monopolar antennas) you can choose between MIMO Mode and Diversity mode.

MIMO Mode

With MIMO the system doubles the link capacity. At the same time, it keeps the same rate and modulation per radio as was used with single antenna, thus increasing capacity, range and availability.

For example with a dual antenna Intrepid Series Radio can transmit at modulation of 64 QAM and FEC of 5/6 and get an air rate of 130 Mbps, compared to 65 Mbps with single antenna.

To work in this mode, each antenna port must be connected to an antenna, the RSS level in both receivers should be balanced and a minimal separation between the antennas must be maintained. (For example, by using dual polarization antennas a cross polarization separation is attained).

Upon selecting Antenna Type as Dual, Intrepid Series Radio automatically selects MIMO mode and doubles the air rates. Link manager indicates a case of unbalanced RSS between the two antennas.

Diversity Mode

Diversity Mode uses two antennas to improve the quality and reliability of the link. Often, there is not a clear line-of-sight (LOS) between transmitter and receiver. Instead the signal is reflected along multiple paths before finally being received.

Each such "bounce" can introduce phase shifts, time delays, attenuations, and even distortions that can destructively interfere with one another at the aperture of the receiving antenna. Antenna diversity is especially effective at mitigating these multipath situations.

This is because multiple antennas afford a receiver several recordings of the same signal. Each antenna will be exposed to a different interference environment. Thus, if one antenna is undergoing a deep fade, it is likely that another has a sufficient signal. Collectively such a system can provide a robust link.

Antenna diversity requires antenna separation which is possible by using a dual-polarization antenna or by two spatially separated antennas.

Use Diversity instead of MIMO in the following situations:

- When the system cannot operate in MIMO mode
- When one of the receivers has high interference compared to the second receiver (i.e. the system is "unbalanced")
- When you achieve higher capacity in Diversity mode than in MIMO mode
- When high robustness is of importance and the capacity of Diversity mode is sufficient

Single Antennas at Both Sites

By selecting a single antenna at both sites the ODUs operate with a single radio that is connected to the ANT 1 connector. The second radio is automatically shut down.

Single and Dual Antennas

In this mode one of the sites uses the ODU with a single antenna while the other site uses the ODU with a dual antenna.

The advantages in this mode in comparison to using a single antenna in both sites are doubled total Tx power and additional polarization and/or space diversity.

Intrepid Series Radio automatically switches to this mode if one of the ODUs is connected to a dual antenna or if the RSS at one of the ODU receivers is below minimal level.

The air rates used in this mode are same as when using single antennas in both sites.

Table 2-5. MIMO and Diversity Modes

Number of Antennas		Mode	Graphic Indication	Max Full Duplex Capacity
Site A	Site B			
2	2	MIMO		50 Mbps
		Diversity		25 Mbps
2	1			25 Mbps
1	2			25 Mbps
1	1			25 Mbps

The rates used by Intrepid Series Radio are shown below:

Table 2-6. Transmission Rates

Radio	Modulation	FEC	Air-Rate [Mbps]
Single	BPSK	1/2	6.5
Single	QPSK	1/2	13
Single	QPSK	3/4	19.5
Single	16QAM	1/2	26
Single	16QAM	3/4	39
Single	64QAM	2/3	52
Single	64QAM	3/4	58.5
Single	64QAM	5/6	65
Dual	BPSK	1/2	13
Dual	QPSK	1/2	26
Dual	QPSK	3/4	39
Dual	16QAM	1/2	52
Dual	16QAM	3/4	78
Dual	64QAM	2/3	104
Dual	64QAM	3/4	117
Dual	64QAM	5/6	130

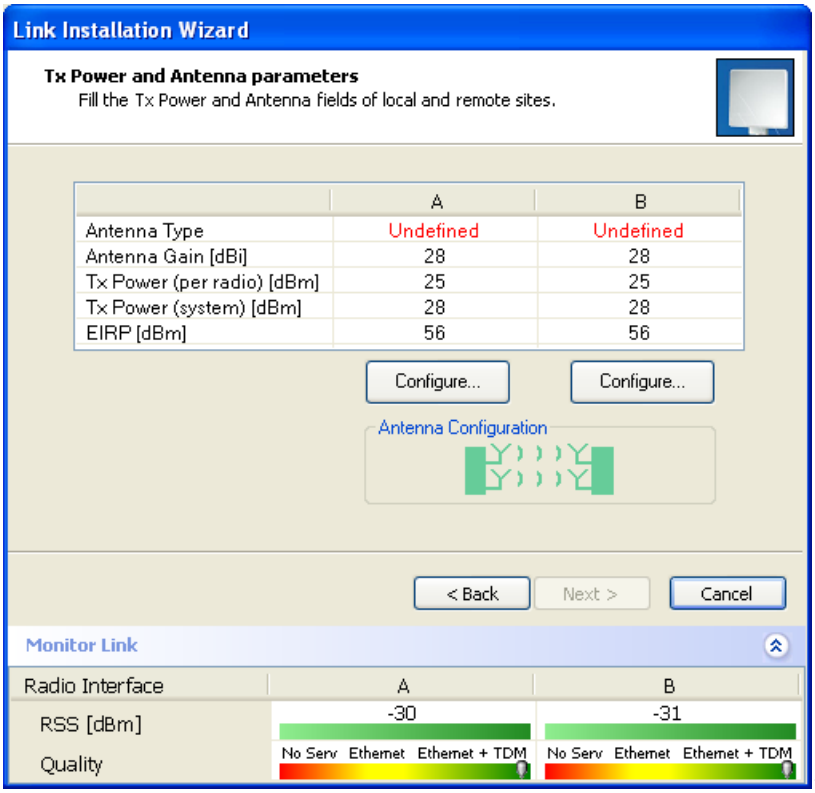


Figure 2-34. Link Installation Wizard, Tx Power and Antenna Parameters Dialog Box

Considerations for Changing Antenna Parameters

Let:

- maxAvailableTx Power denote the maximum Tx Power practically available from an ODU (Required Tx Power per Radio in *Figure 2-35*) denote the maximum Tx Power practically available from an ODU.
- maxRegEIRP (Max EIRP in *Figure 2-35*) denote the maximum EIRP available by regulation. It is determined by three factors:
  - per band/regulation
  - per channel bandwidth
  - antenna gain
- maxRegTxPower denote the maximum regulatory Tx Power for the equipment, also having regard the above three points.

Then, the following relationship must be satisfied:

$$maxAllowedTxPower \leq min(maxRegEIRP - AntennaGain + CableLoss, maxRegTxPower) \quad (*)$$

✱ **To set Tx power and configure antennas:**

1. Click the Configure buttons in turn to configure the antennas on both sides of the link. Each one offers a dialog like this:

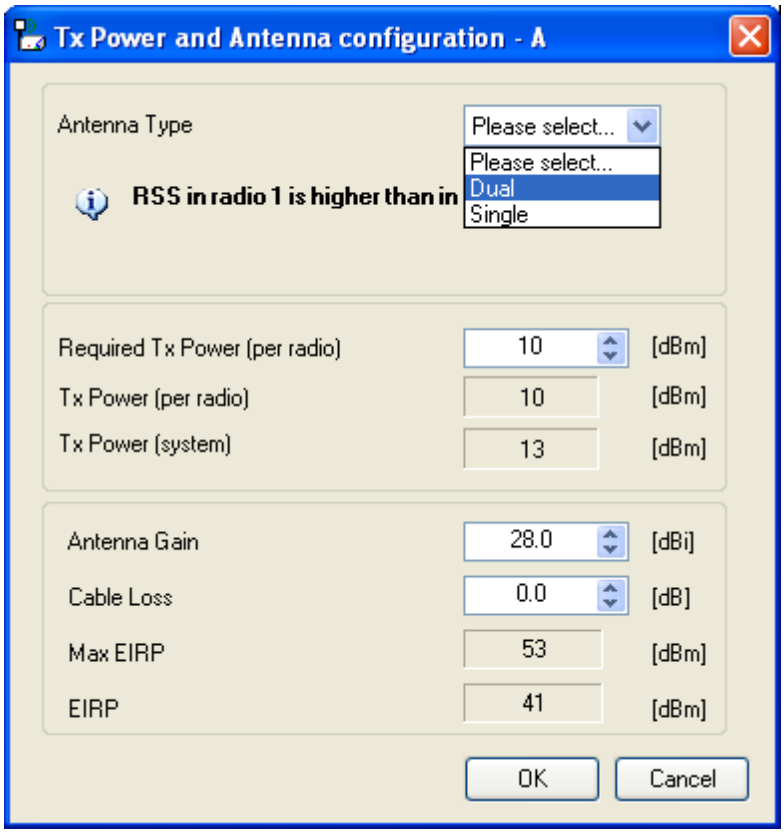


Figure 2-35. Antenna Configuration Dialog with Opened Type Selection

2. Choose the antenna type and required transmission (Tx) power for the first site and click **OK**. Repeat the process for the second site.

   The Tx power (per radio) indicates the power of each radio inside the ODU and is used for Link Budget Calculations. The Tx power (System) shows the total transmission power of the ODU and is used to calculate the EIRP according to regulations.

Note *To see the relationship between Tx Power (radio) and TX Power (system), note that* $dBm = 10 \times \log_{10} milliWatt$ *so that if you double the power in milliWatts (for two radios) then dBm will increase by* $10 \times \log_{10} 2 \approx 3$.

3. Set the Antenna Gain and Cable Loss. If do this you will receive a warning message:

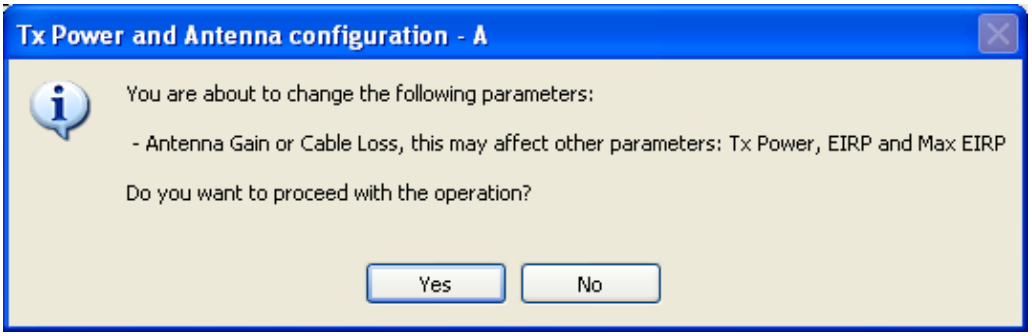


Figure 2-36. Antenna Parameters Change Warning

Note

- *The Max EIRP level will be automatically set according to the selected band and regulation.*
- *The EIRP level is the sum of the System Tx power and the Antenna Gain minus the Cable Loss.*

If inequality **(*)** above is violated, then the following warning window is displayed:

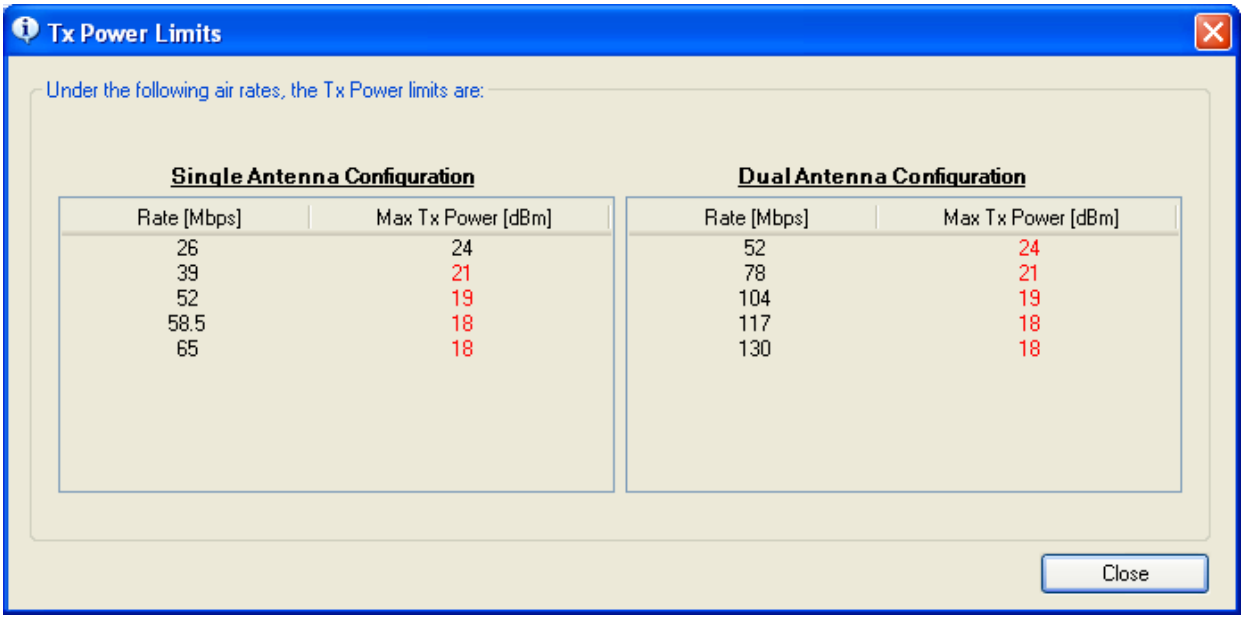


Figure 2-37. Tx Power Limits

The precise relationship between the items in inequality **(*)** and the window of *Figure 2-35* is follows:

- Required Tx Power (per radio) will be adjusted down to the lesser of the value entered and **maxAllowedTxPower**
- TxPower (system)is **maxAllowedTxPower + 3** (for 2 radios)
- Max EIRP is **maxRegEIRP**.
- EIRP is **maxAllowedTx Power + Antenna Gain - Cable Loss**

The table in *Figure 2-37* only shows rates where the maximum Tx Power is the limitation, rather than regulations. When you close the window of *Figure 2-37*, the change you requested will **not** be honored, and you will need to try again. When you close the window of *Figure 2-37*, the change you requested will **not** be honored, and you will need to try again.

Note

Since our demonstration link is entirely indoors, we have reduced Tx Power to 5 dBm to obtain a realistic RSS. Although this is much too low for field use, the method is general.

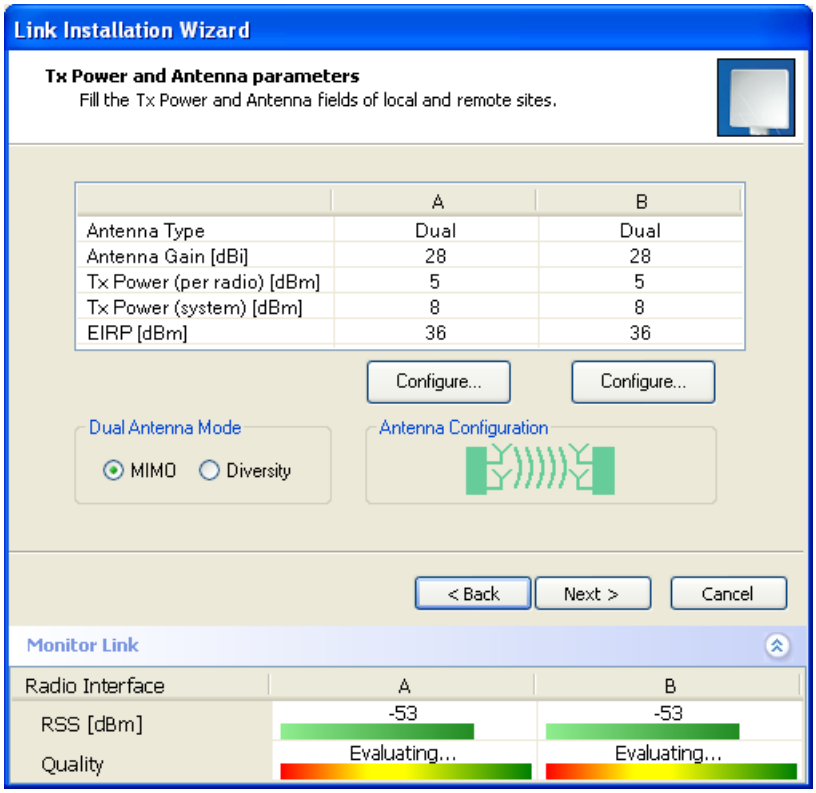
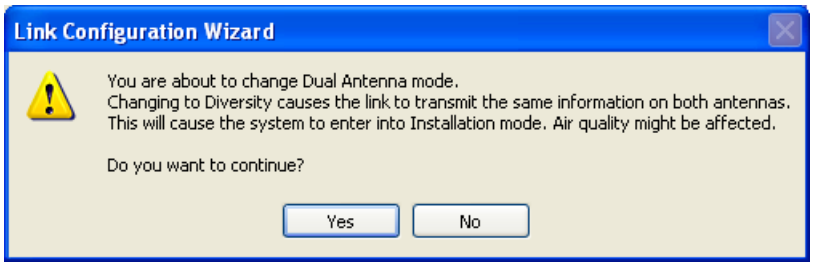


Figure 2-38. Antennas Configured for Two Dual and Tx Power 5 dBm

4. Choose Dual Antenna mode if appropriate. The green Antenna Configuration diagram indicates the active state. For dual antennas in Diversity mode it looks like this:

There are intermediate modes available for dual antennas opposite a single antenna as explained above.

If you make a change you will see a warning similar to this:



A similarly worded warning applies to a switch from MIMO to Diversity mode.

5. When you are finished with Tx Power configuration, click **Next.**

Configuring Hub Site Synchronization

Figure 2-39 displays the current status of each side of the link. See *Appendix G* for instructions about installing and configuring collocated links. If you do not require HSS, click **Next**.

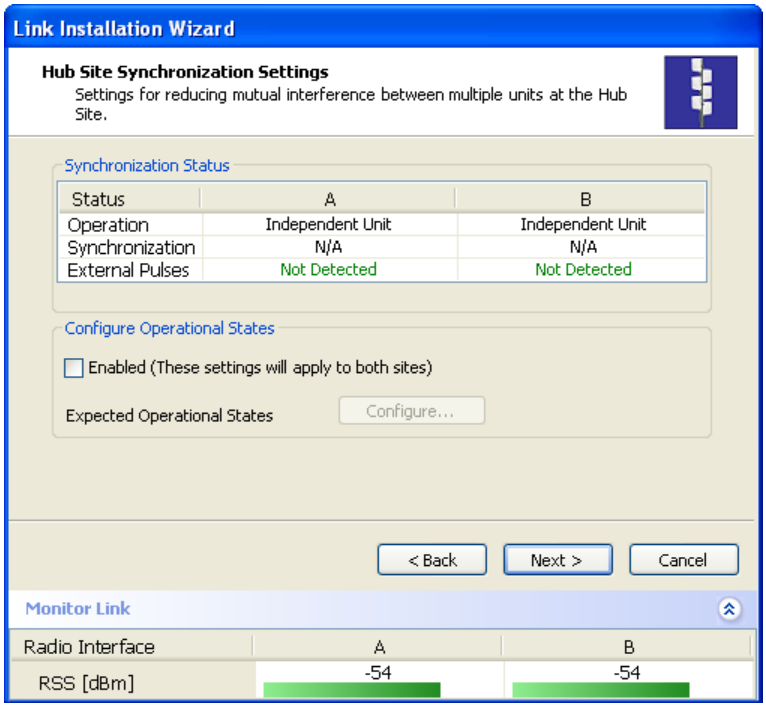


Figure 2-39. HSS Settings

Configuring the Services

Intrepid Series Radio supports Ethernet and TDM services, which are configured via the Services dialog box.

For Intrepid Ultra Series Radio models, allocate asymmetric Ethernet capacity by changing the transmission ratio between the sites, see *Configuring Asymmetric Ethernet Capacity* below.

For Intrepid Series Radio models, and collocated links, proceed to *Configuring TDM Services* below.

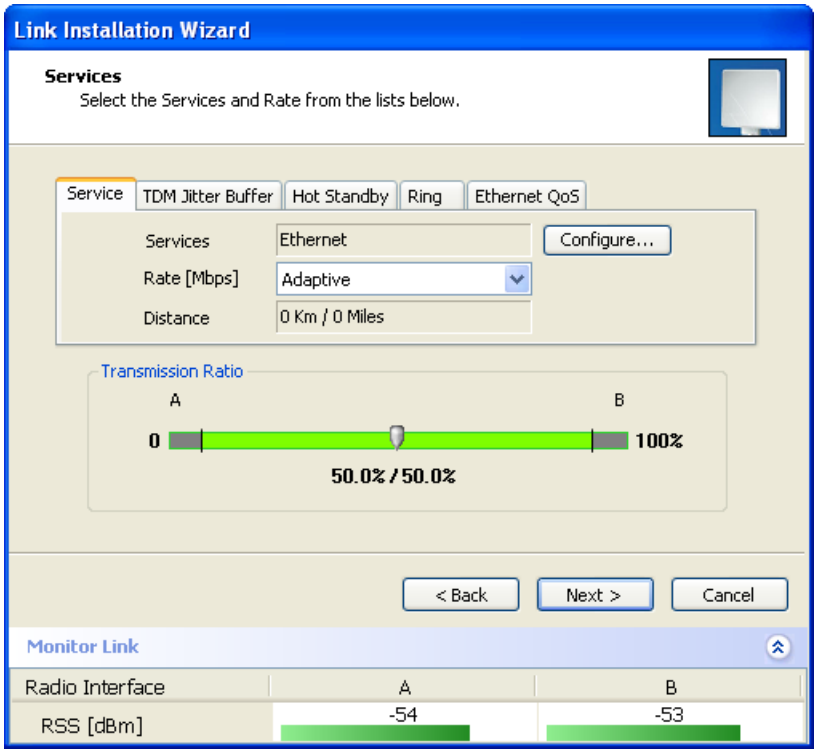


Figure 2-40. Link Installation Wizard, Services Dialog Box for Intrepid Ultra Series Radio

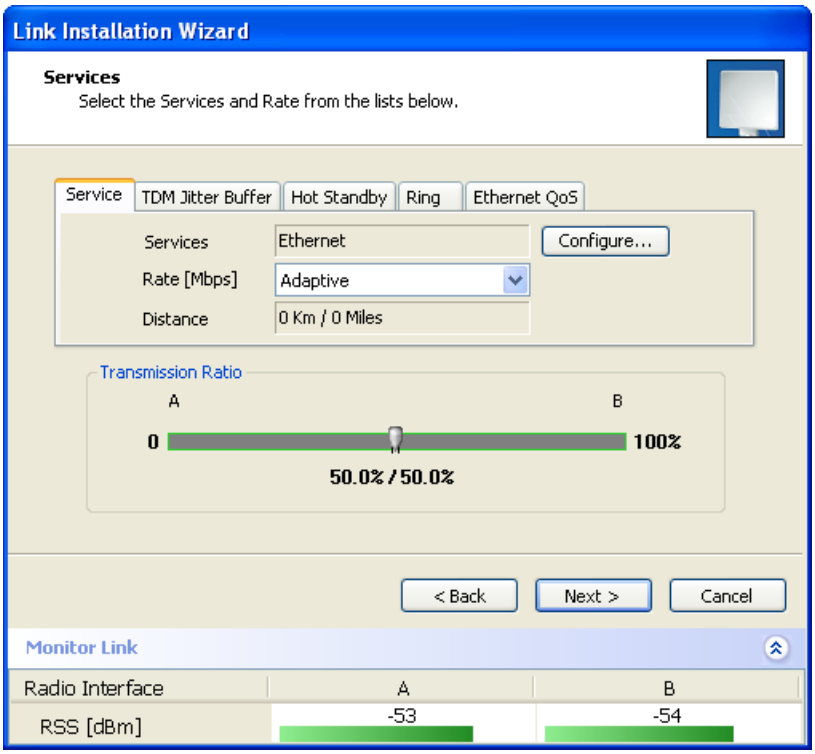


Figure 2-41. Link Installation Wizard, Services Dialog Box for Intrepid Series Radio Collocated as a Client

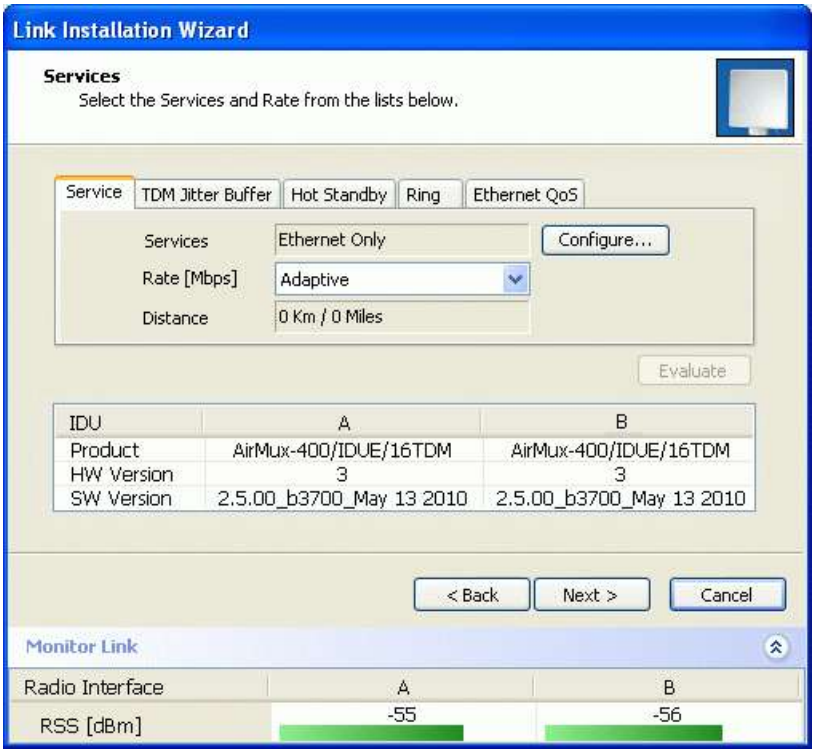


Figure 2-42. Link Installation Wizard, Services Dialog Box for Intrepid Series Radio

Configuring Asymmetric Ethernet Capacity

Ratio of the upload and download speed on the Ethernet link of the Intrepid Ultra Series Radio can be changed using the Transmission Ratio slider.

✱ **To change the Ethernet uplink/downlink ratio:**

1. Slide the Transmission Ratio slider to select the required ratio.

   For example, *Figure 2-43* illustrates allocation of the 70% of the link to the downstream Ethernet traffic and 30% – to the upstream.

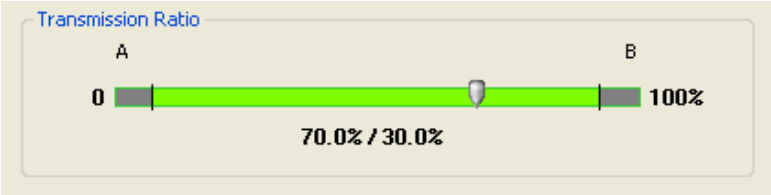
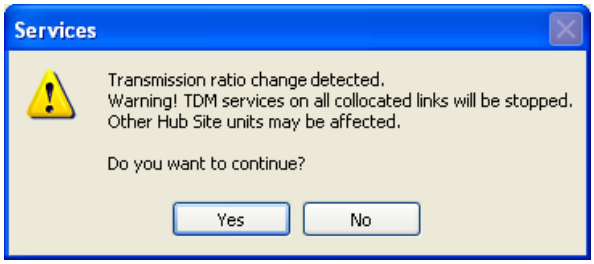


Figure 2-43. Changing the Ethernet Uplink/Downlink Ratio

The following caution is displayed:



Caution

If you have active collocated links, or if you are uncertain of whether collocated links provide TDM services, do not use this option now. You can do it at a less disruptive time using the Link Configuration (see *Chapter 4*).

2. Click **Yes** to continue.
3. If you are not using TDM services, click **Next** to complete link installation.

Limitations on the Use of Asymmetric Allocation

For non-collocated links, capacity allocation between uplink and downlink traffic is determined automatically according to actual Ethernet traffic and air interface conditions. Your manual allocation using this feature "cuts in" during congestion.

Asymmetric Allocation and Collocation

The use of Asymmetric Allocation is limited where the link is collocated.

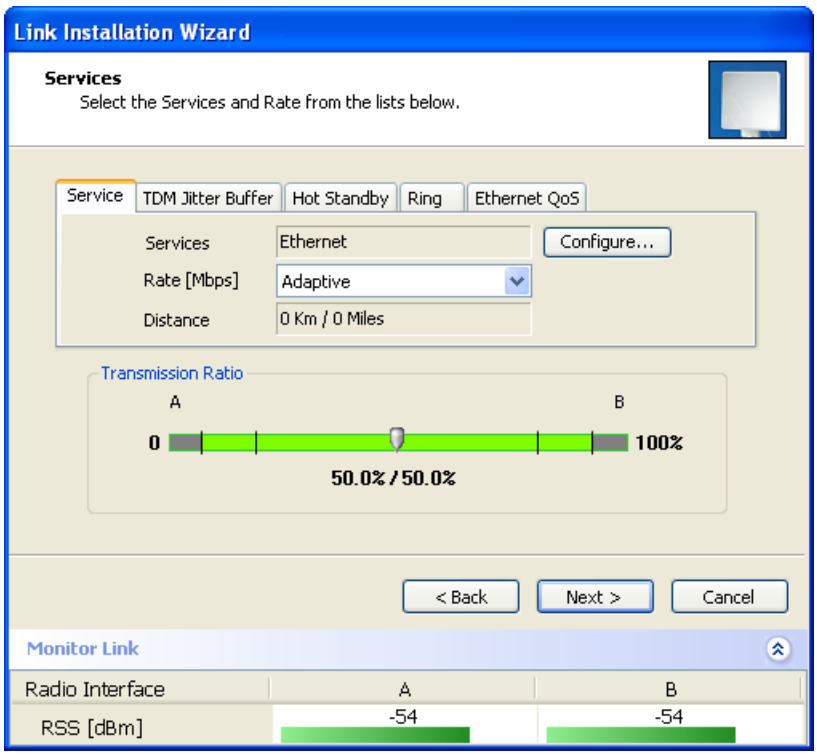


Figure 2-44. Services and Rates - Intrepid Series Radio Master and Clients

The yellow areas should **not** be used. Using these areas, you may lose the collocated link with the longest distance between sites.

Asymmetric Allocation and TDM

You cannot use this feature when TDM services are used. Selection of TDM ports as in the next section resets the Ethernet balance to 50% in each direction and the green slider does not appear in subsequent installation or configuration runs.

Cancelling TDM port use makes the allocation bar reappear, re-enabling asymmetric Ethernet traffic allocation.

Configuring TDM Services

✱ **To configure the TDM services:**

1. Click **Configure**.

   The TDM Services dialog box is displayed.

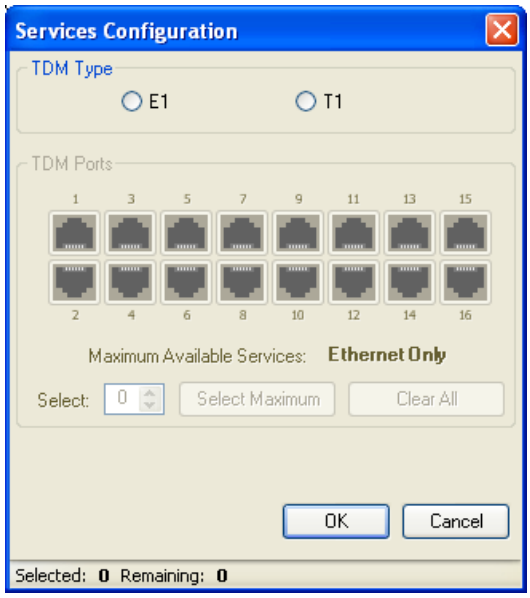


Figure 2-45. Link Installation Wizard, TDM Services Dialog Box

2. Select a TDM service type: E1 or T1.

   TDM Ports section becomes available.

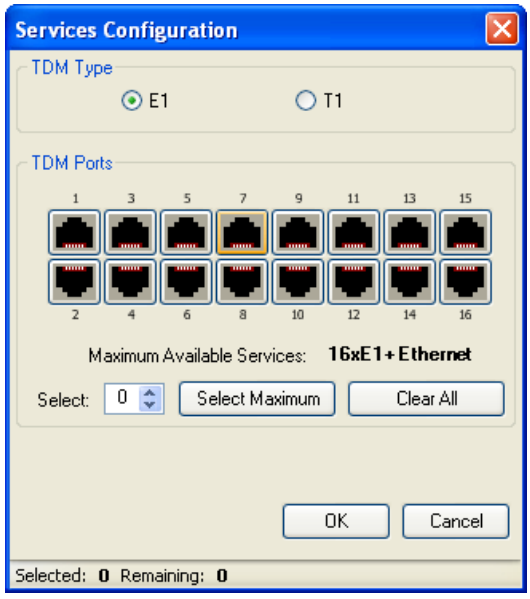


Figure 2-46. Link Installation Wizard, TDM Services Dialog Box, TDM Ports are Available

3. Select active TDM ports:

   - Use **Select** spin box to choose consecutive service ports

   or

- Click **Select Maximum** to choose all TDM port available for current air interface capacity

  or

- Click individual ports to choose them.

Note

- *Ethernet service is always selected.*
- *The number of available services is changed in accordance with actual air interface capacity.*
- *The selected ports are enabled for both sides of the link. You cannot for example, use ports 1, 3, 5, 7 on one side and 2, 4, 6, 8 on the other.*

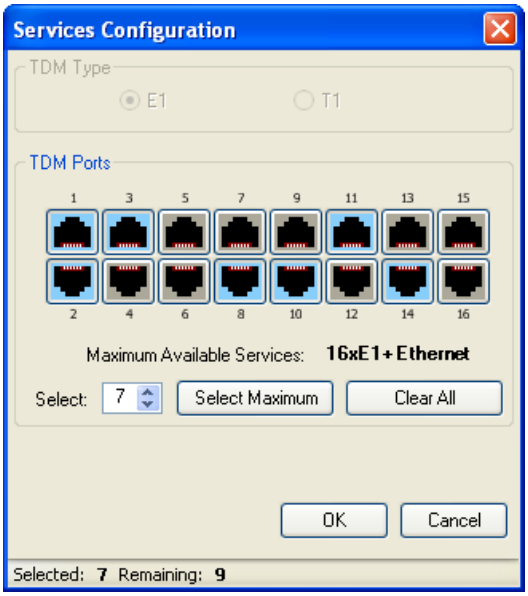


Figure 2-47. Link Installation Wizard, TDM Services Dialog Box, Seven TDM Ports are Selected

4. Click **OK**.

   The Services dialog box is updated to reflect your choice:

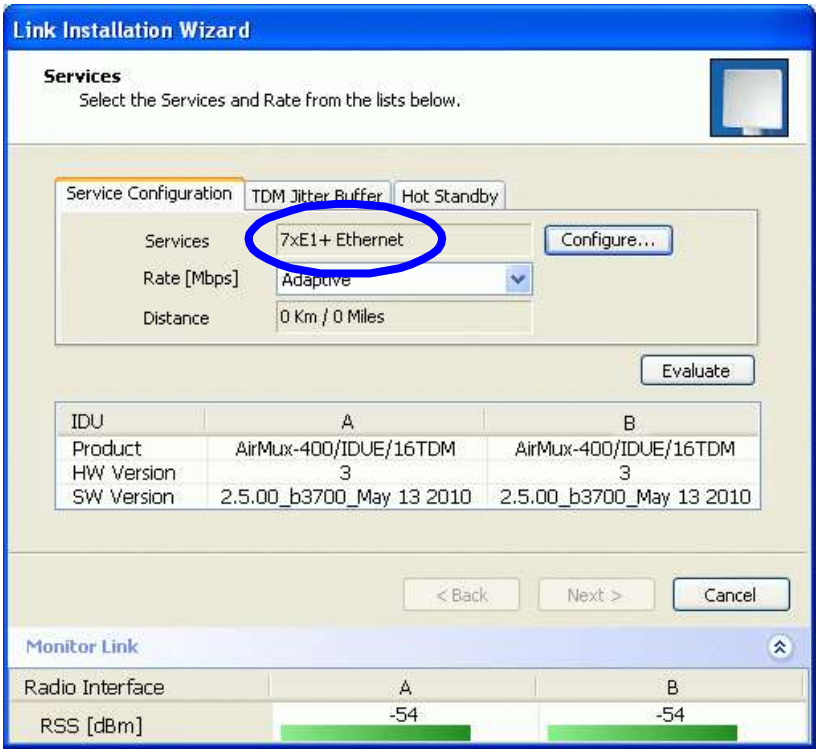


Figure 2-48. Link Installation Wizard, Services Dialog Box, Services are Selected

Selecting Modulation Rate

You can choose a specific modulation rate or use adaptive rate to dynamically adapt the air interface rate by changing both the signal modulation and coding.

✱ **To select modulation rate:**

1. In the Services dialog box, choose Adaptive or one of the available rates.
2. Click **Evaluate** to continue or click the TDM Jitter Buffer tab to set the TDM jitter buffer size.

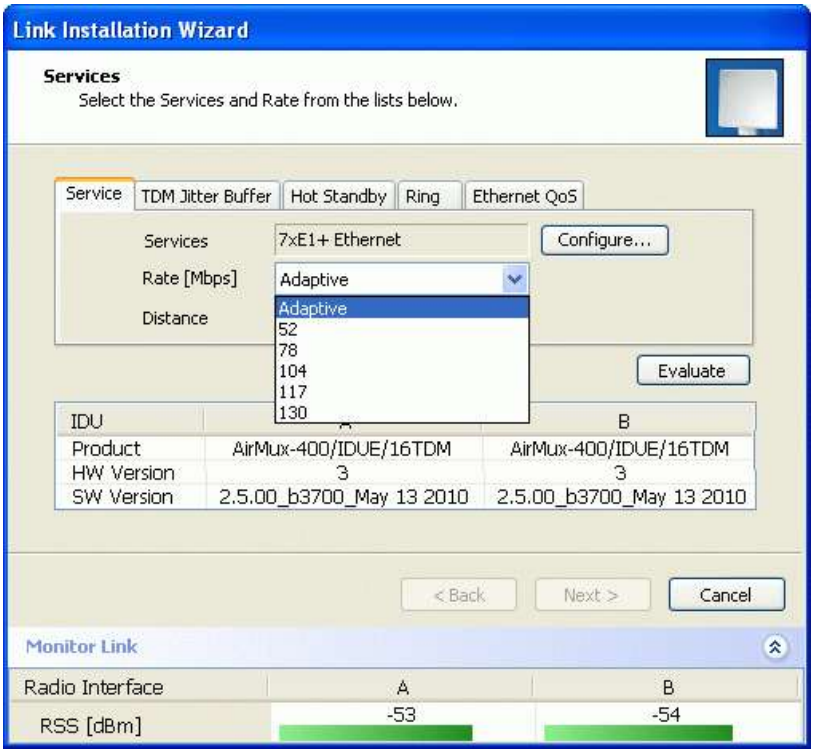


Figure 2-49. Selecting Modulation Rate

Configuring TDM Jitter Buffer Size

The receiver jitter buffer for each site can be enlarged, thereby increasing system resistance to interference (the larger the jitter buffer, the longer the interference period that the system overcomes without TDM errors). You can also decrease the jitter buffer to decrease the system delay.

The jitter buffer can be configured between 2.0 and 16.0 ms.

✱ **To configure TDM jitter buffer size:**

1. Click the **TDM Jitter Buffer** tab.

   The TDM Jitter Buffer Configuration dialog box is displayed.

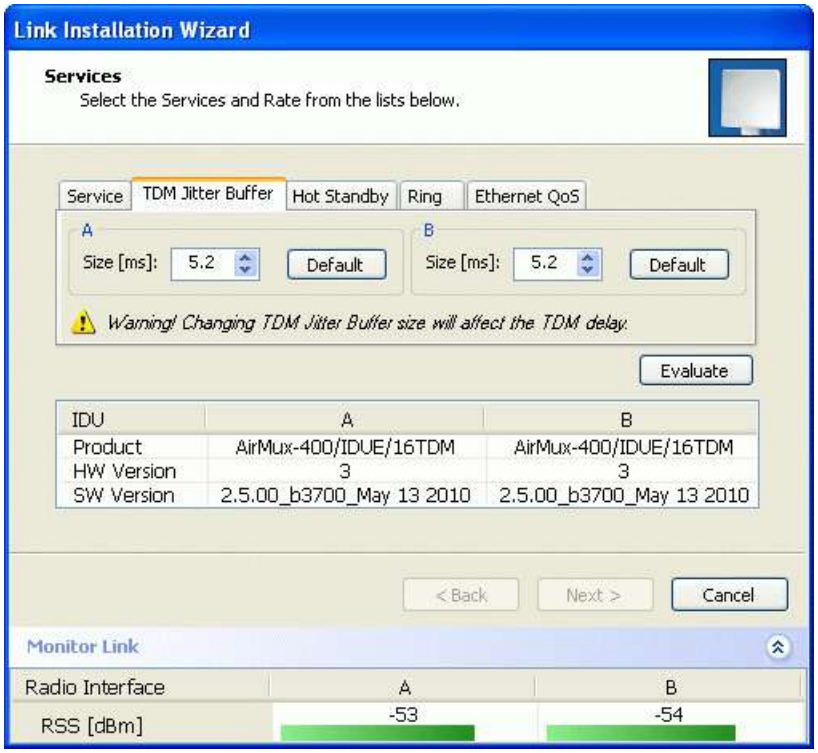


Figure 2-50. TDM Jitter Buffer Configuration Dialog Box

2. Set the desired jitter buffer depth value for both sites.
3. Click **Evaluate** to check the TBFR (TDM Block Failure Ratio).

   The TBFR evaluation bar is displayed at the bottom of the screen.

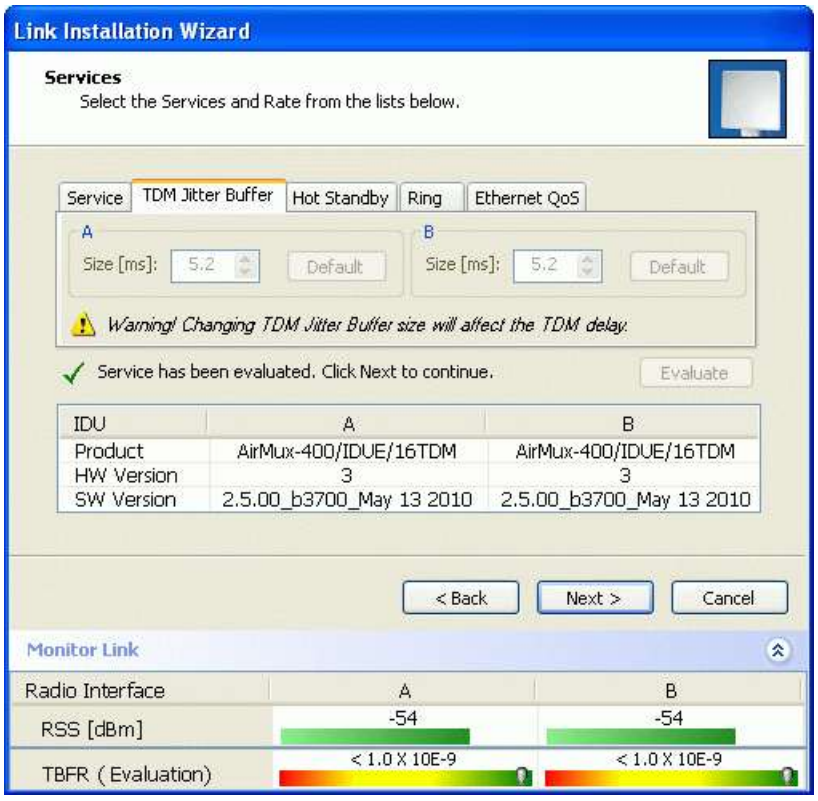


Figure 2-51. TDM Jitter Buffer Configuration Dialog Box, TBFR Evaluation Bar Displayed

4. Click **Next**, which performs the change or **Back** to cancel the change.
5. When done, click **Evaluate** to evaluate the overall service performance.
6. Click **Next** if you are satisfied, or **Back** to change the settings.

Selecting TDM Clock Type

Flexible timing scheme allows the Intrepid Series Radio TDM ports to derive clock from different sources and distribute it between local site and remote sites. TDM clock type is selected via the TDM Parameters dialog box:

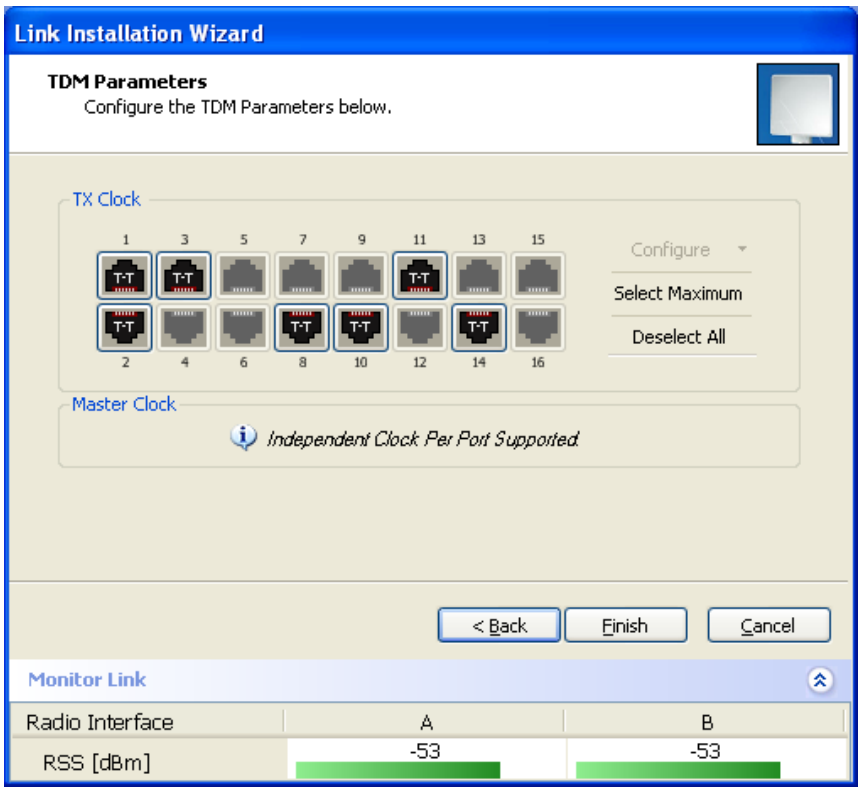


Figure 2-52. TDM Parameters Dialog Box

✱ **To select a TDM clock type:**

1. From the TDM Parameters dialog box,
   - Click **Select Maximum** to choose all TDM port available for current air interface capacity

     or
   - Click **Select All** to select all TDM ports

     or
   - Click individual ports to choose them.
2. Click **Configure**.

   A drop-down list with available options is displayed.

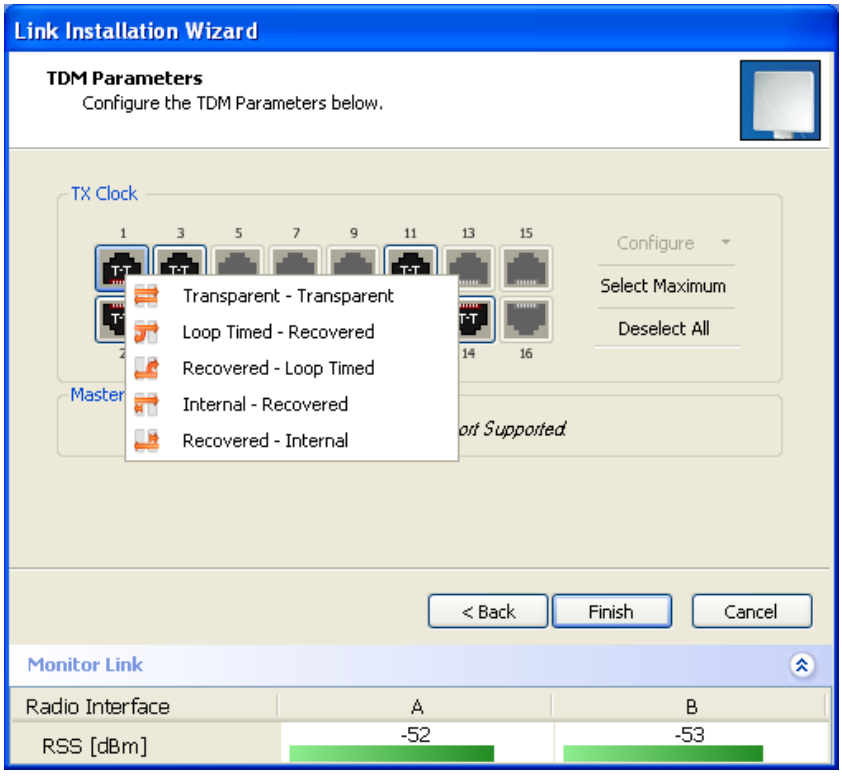


Figure 2-53. TDM Parameters Dialog Box, Clock Configuration in Progress

3. Select a TDM port clock type to be one of the following:
   - **Transparent/Transparent** – The clock at Site A regenerates the clock from Site B and vice versa.
   - **Loop time/Recover** – The Site A port receive clock is used as the transmit clock for that port on both sides of the link.
   - **Recover/Loop time** – The Site B port receive clock is used as the transmit clock for that port on both sides of the link.
   - **Internal/Recover** – The Site A port uses its internal oscillator to generate its transmit clock while the Site B port regenerates the clock received at the Site A port.
   - **Recover/Internal** – The Site B port uses its internal oscillator to generate its transmit clock while the Site A port regenerates the clock received at the Site B port.

Completing the Link Installation

The last screen of the link installation wizards allows you to view the configuration summary.

✱ **To complete the link installation:**

- In the Installation Summary dialog box, click **Done**.

  The main Link manager window is displayed (*Figure 2-55*).

Figure 2-54. Link Installation Summary

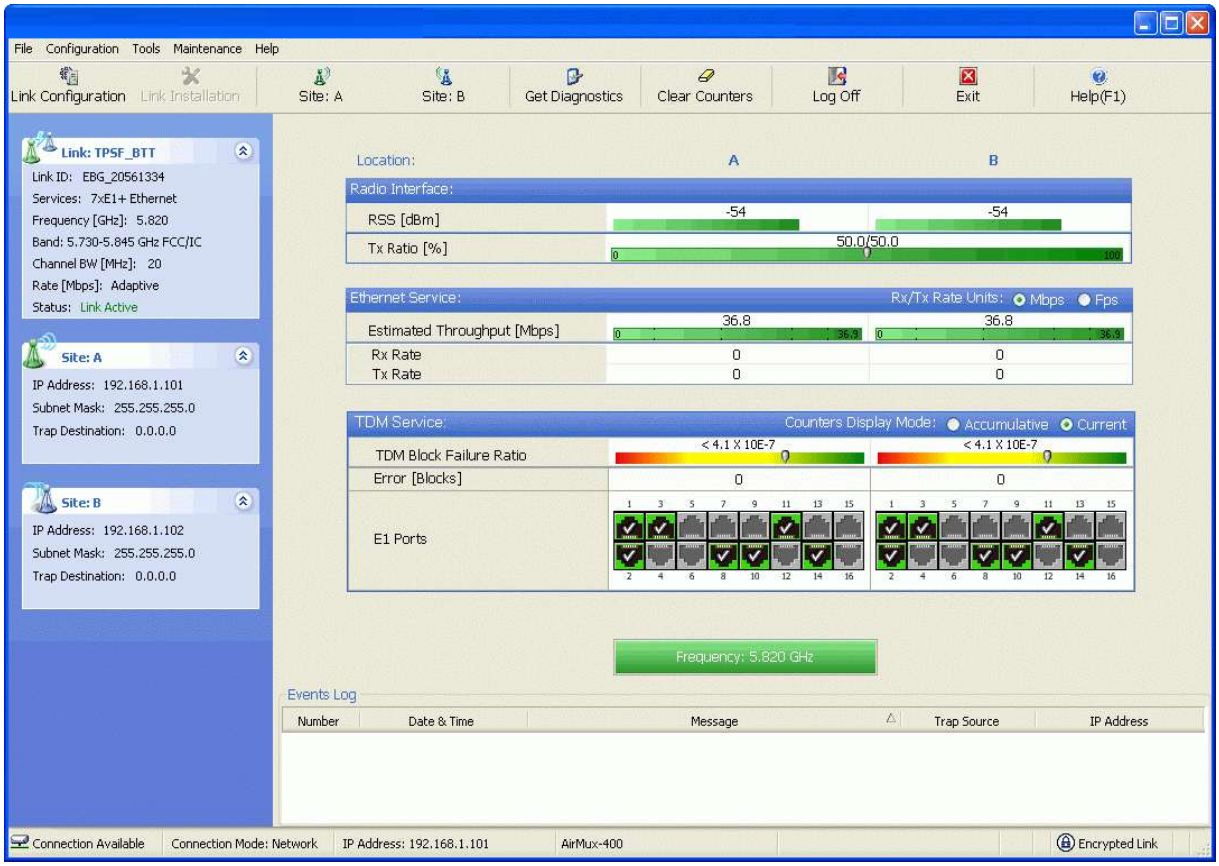


Figure 2-55. Main Window after Link Installation, TDM Services Enabled

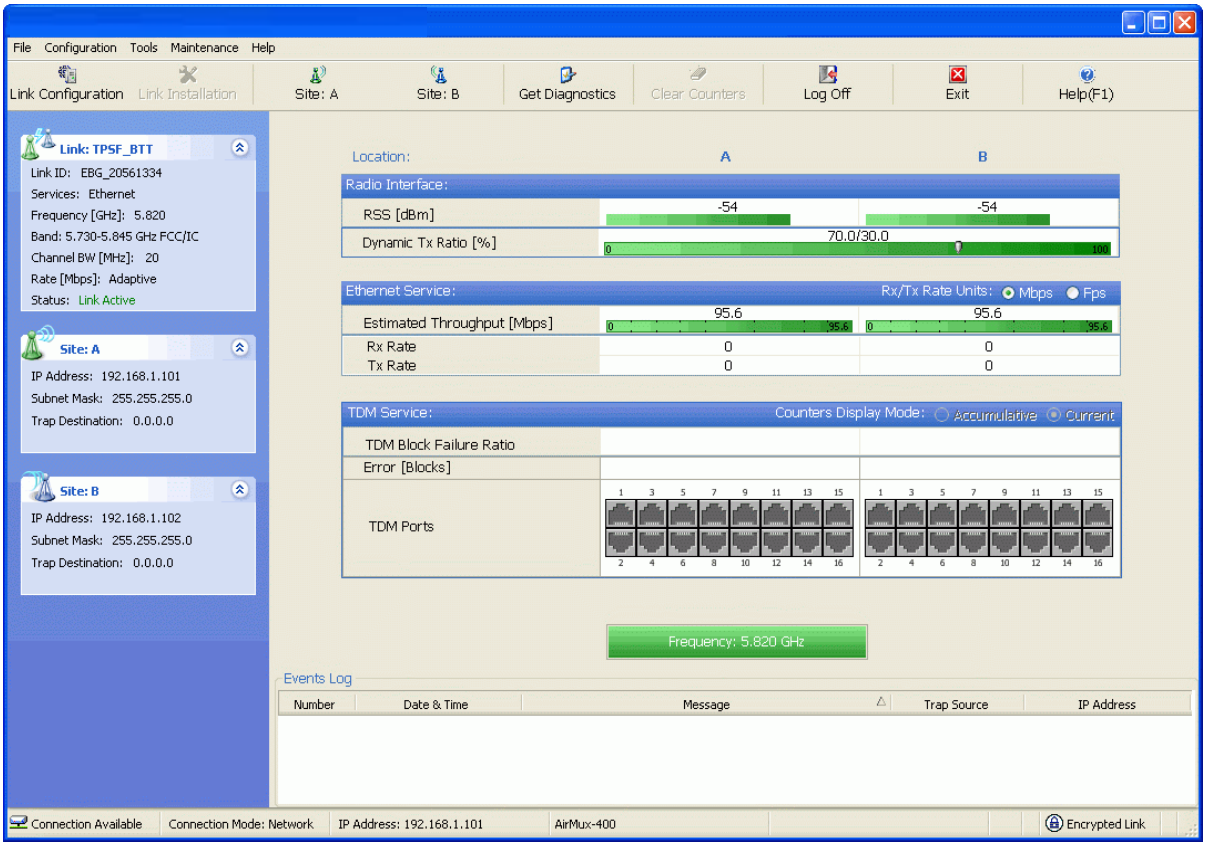


Figure 2-56. Main Window after Link Installation, Asymmetric Capacity Allocation, no HSS

✱ **To verify the installation:**

- Verify that the Radio Signal Strength (RSS) is according to expected results as determined by the Link Budget Calculator.

Caution

Installation mode, as described above, may be re-entered using **Configuration | 1 Configure Site A** and **Installation Mode** the Site Configuration dialog. Some Installation mode functionality may cause a break in link service.

If you can accomplish link changes without breaking the service, always prefer to use Link Configuration mode, described in *Chapter 4*.

Chapter 3

Operation

This section provides the following information for Intrepid Series Radio:

- Operating procedures (turning-on and turning-off)
- IDU indicators
- Normal indications
- Default settings
- Managing the Intrepid Series Radio.

3.1 Turning On the Unit

✱ **To turn on Intrepid Series Radio:**

- Connect the AC/DC converter to the IDU power connector and to the mains. See *Chapter 2* for full instructions on connecting the power.

  The PWR indicator lights up (IDU only) and remains lit as long as the IDU is receiving power.

Intrepid Series Radio requires no operator attention once installed, with the exception of occasional monitoring of front panel indicators and statistics data. Intervention is only required when Intrepid Series Radio must be configured to its operational requirements, or diagnostic tests are performed.

The front panel of the IDU-S and IDU-C includes a series of LED indicators that show the operating status of the unit. *Figure 3-1* , *Figure 3-2*, *Figure 3-3* show the IDU front panel. *Table 3-1* describes the front panel indicators.

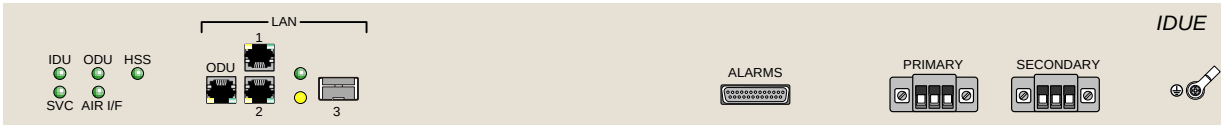


Figure 3-1. Ethernet-only IDU-E Front Panel

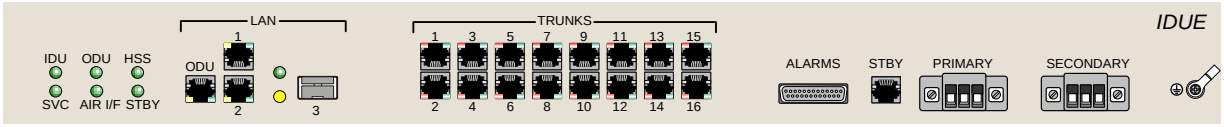


Figure 3-2. TDM/Ethernet IDU-E Front Panel

Figure 3-3. ID-S Front Panel

Table 3-1. Front Panel LEDs

Name	Color	Description	Location
IDU	Green	IDU operational	Front panel
	Orange	During power-up only	
	Red	Failure	
ODU	Green	ODU-to-IDU communication link is operating	Front panel
	Red	ODU-to-IDU communication link is disrupted	
AIR I/F	Green	Wireless link is synchronized	Front panel
	Orange	During installation only	
	Red	Wireless link lost synchronization	
SVC	Green	E1/T1 line is synchronized	Front panel
	Orange	Alarm detected on Site B interface or a loopback is active	
	Red	Alarm detected on Site A interface	
		Off – Ethernet-only IDU or TDM interface has not been configured yet	
HSS	Green	On – The ODU is HSS master, generating signal, and synchronization is OK Blinking – The ODU is HSS client and synchronization is OK	Front panel
	Red	HSS not operational due to improper signal detection. This ODU is not transmitting	
	Orange	HSS is operational. One of the following conditions apply: • This ODU is a master that is generating and detecting signals • This ODU is a master that is generating signals, but detected improper signals • This ODU is a client "Continue Tx", but is not detecting signals • This ODU is a client "Disable Tx" and is detecting signals from multiple sources All orange cases transmit.	
		Off –HSS is not active or ODU is disconnected from IDU	

Name	Color	Description		Location
STBY		**MHS Mode**	**Link State**	Front panel
	Green	On – Primary Blinking – Secondary	On – Active Blinking – Not active	
	Red	Primary	Not active	
	Orange	Secondary	Active	
		Off – Off	MHS is disabled	
LINK	Green	On – Good Ethernet link integrity		LAN connector
ACT	Yellow	Blinks according to the Ethernet traffic		LAN connector
	Green	On – TDM service is OK		TDM connector
	Red	On – AIS or LOS detected Blinking – Loopback is active		TDM connector

3.2 Default Settings

Table 3-2 lists the default settings of the Intrepid Series Radio configuration parameters.

Table 3-2. Default Settings

Parameter	Description	Default Value	Menu Path	Setting Instructions
Aging Time	MAC address aging period	300 sec	–	IDU Aging Time
Ethernet Mode	Line speed and duplex mode negotiation	Auto Detect	Advanced	Configuring Ethernet Mode
Frequency	Operation channel frequency	First frequency in the range	–	Selecting Channels
Link ID	Wireless link identification	Link	–	Defining System Parameters (Chapter 2)
Link Password	Wireless link password	wireless-bridge	–	Defining System Parameters
Local-public	Local-public community name	bru1	–	Configuring SNMP Communities
Manager Logon Password	Login password of the Link Manager	admin	–	Changing the Login Password
ODU IP Address	IP address of the ODU	10.0.0.120	Management	Defining the Management Addresses
ODU Mode	Ethernet mode of the ODU	Hub	Advanced	Configuring Ethernet Mode

Parameter	Description	Default Value	Menu Path	Setting Instructions
Rate	Transmission rate	Adaptive	–	Configuring Service Parameters
Read-only	Read-only community name	public	–	Configuring SNMP Communities
Read-write	Read-write community name	netman	–	Configuring SNMP Communities
Remote-public	Remote-public community name	bru4097	–	Configuring SNMP Communities
Site 1	Site 1 name	Site	–	Defining System Parameters
Site 2	Site 2 name	Site	–	Defining System Parameters
Subnet Mask	IP address of the ODU	255.0.0.0	Management	Defining the Management Addresses
Trap destination	IP address of an NMS to be receiving traps	0.0.0.0	Management	Defining the Management Addresses
TDM Jitter Buffer	TDM jitter buffer depth	5.2	Services	Configuring TDM Jitter Buffer Size

3.3 Configuration and Management Alternatives

The Intrepid Series Radio configuration and monitoring operations are performed using one of the following tools:

- GUI-based management utility (Link Manager)
- Telnet.

Most of the Intrepid Series Radio management and operation parameters are set using link configuration wizard. If necessary, the local and remote unit parameters can be reconfigured via the Intrepid Series Radio management utility.

Telnet management is performed from a Telnet host using *display* and *set* commands.

The capabilities of the two options listed above are identical.

Note *PulseNet NMS management software provides access to the Link Manager via its topology map.*

Working with the Intrepid Series Radio Management Utility

Before starting a management session, make sure that a communication link between local and remote units exists. The Link Status indication bar in the middle of the Main menu

must be green and the *Radio Link - Sync* message must appear in the event log (see *Figure 3-4*).

Figure 3-4. Main Screen, Wireless Link is Active

The Link Manager main screen consists of the following elements:

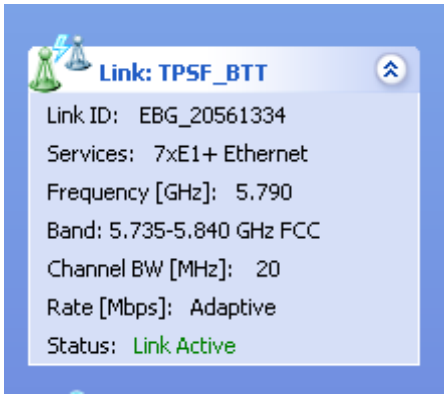
- Toolbar – includes buttons serving for:

  - Link Configuration – Changes configuration parameters of an operating wireless link; assigns text files for storing alarms, statistics and configuration data. This button is disabled until a link installation has been completed.
  - Link Installation – Performs preliminary configuration of the system. This button is disabled after the link is installed.
  - Site: <Site 1 name> – Opens the Site configuration dialog for Site A. Same as Configuration > 1 Configure <Site 1 name>
  - Site: <Site 2 name> – Opens the Site configuration dialog for Site B. Same as Configuration > 2 Configure <Site 2 name>
  - Get Diagnostics – Obtain system information
  - Clear Counters – Disabled
  - Log off – Closes the current session and logs off Link Manager
  - Exit – Exits Link Manager.

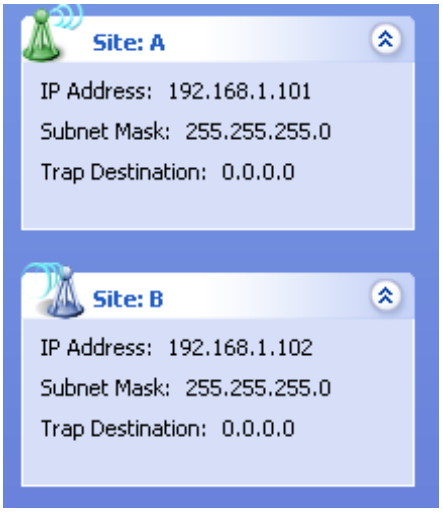
- Menu Bar

  - File– Log off, and exit
  - Configuration – use for link configuration, individual site configuration or link installation
  - Tools –performance monitoring, active alarms, recent events, software upgrade, changing band (installation only), changing password and preferences
  - Maintenance – running loopbacks, clearing counters, resetting Intrepid Series Radio
  - Help – displays user manual, link budget calculator, system information, Link Manager build version.

- Link detail pane summarizes information on the radio link (link ID, configured services frequency, channel bandwidth, current rate and link status)

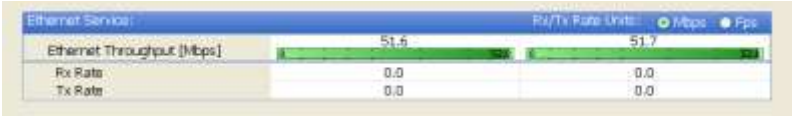


- Site detail pane show basics link site details (IP address, subnet mask, trap destination)



- Monitor pane, is the main source of real time information about link performance at both link sites. It includes the following panes (top to bottom):
  - Radio Interface, Received Signal Strength (RSS) in dBm and transmission ratio (Intrepid Ultra Series Radio only).

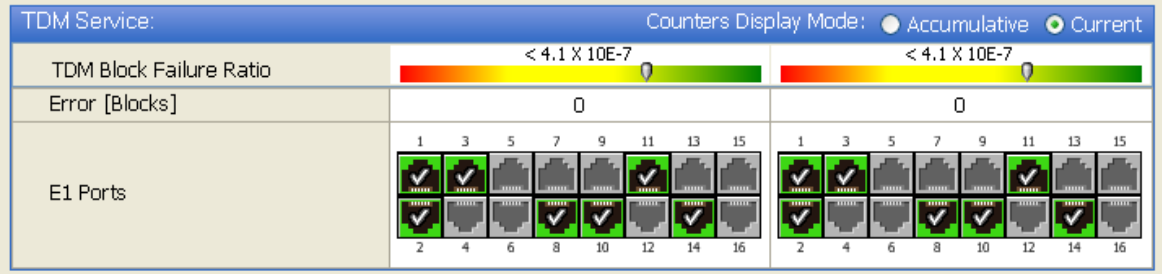
- Ethernet Service:



  - Estimated Ethernet Throughput: The numbers are the current calculated throughputs at each site. The colored bars (with numbers) indicate the maximum possible throughput having regard for air conditions.
  - Rx and Tx Rates: The Rx and Tx rates are the receive and transmit rates **on the LAN side** of each ODU, not the air side. For a balanced link, the Rx and Tx rates at the LAN side of Site A will match the Tx and Rx rates at the LAN side of Site B respectively. In all cases, The LAN side Rx rate shown will be the same as the air side Tx rate for each individual ODU.

    Actual Ethernet traffic received and transmitted rates per site, is in Mbps of Fps, selectable in the panel title bar.

- TDM Services, enables you to switch between Accumulative and Current view:



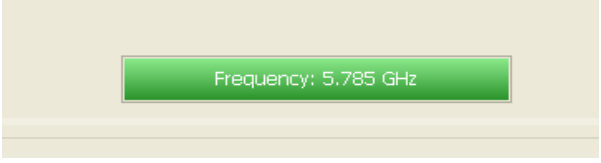
  - TDM Block Failure Ratio. It is zeroed by the **Clear Counters** button in the tool bar.
  - Error block count is shown immediately above the active TDM channels display.
  - The color of the TDM ports reflects their current status:

    Green – operational

    Red – error: LOS and AIS

    Yellow – active loopback

- Frequency box: It shows the link frequency. The color of the box indicates the status:



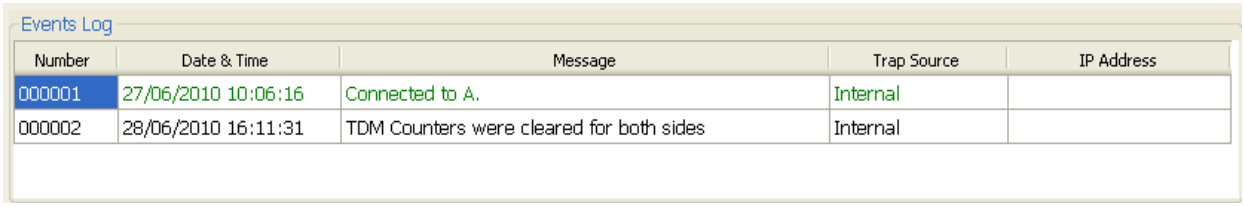
  Green – active link

  Red – inactive link

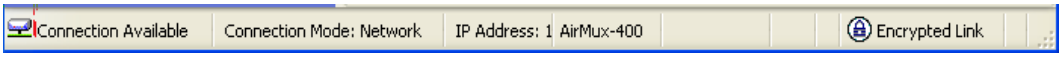
Magenta – authentication or compatibility problem

Brown – severe compatibility problem

- Events Log stores alarms generated from both sides of the link



- Status Bar displays the current system status:



  - Connectivity icon showing how the device is connected to the Ethernet.
    - Over-the-Air connection – using the IP address of the remote unit
    - Local connection – direct connection to the IDU without using an IP address
    - Network connection - through a LAN

    ODU is unreachable
  - Encryption icon showing if the link is encrypted:

    Encrypted link

    Unencrypted link (lock open)

    Link Password Validation failed. The link is encrypted with default keys. Service and configuration is unavailable. Need to change the link password in either site
  - Link Lock:

    Link Lock is enabled

    Link Lock is encrypted

    Link Lock mismatch
  - Ethernet ring member
  - DFS in use
  - Active alarm is present

Verifying the Application Software Version

Before continuing the management session, verify that the unit is running version 2.5 of the application software.

✱ **To verify the application software version:**

1. From the Main menu, select **Configuration**.
2. Select a local or remote site.

The configuration dialog box opens.

3. Select **Inventory**.
4. In the Inventory screen verify that that the software version 2.5.
5. If the application software version is 2.5, proceed to *Chapter 4* for further instructions on how to configure the unit for management and operation.
6. If displayed number is below 2.5, see *Chapter 6* for software upgrade instructions.

Working with Telnet

Typically, the Telnet host is a PC or a Unix station with the appropriate suite of TCP/IP protocols. The login name is *admin* and the login password is identical to the community strings. Read/write allows using *display* and *set* commands (default value is *netman*).

✱ **To enable Telnet access:**

1. Display Protocol tab of the Management menu (Site Configuration > Management).
2. Enable Telnet access by ticking the Telnet check box.

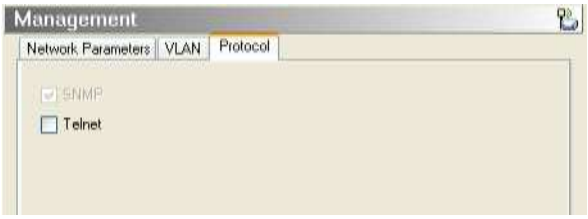


Figure 3-5. Enabling/Disabling Telnet Access

Table 3-3 lists the Telnet commands supported by Intrepid Series Radio.

Table 3-3. Telnet Commands

Command	Description
display inventory	Display ODU product name, name, location, hardware and software revisions, uptime, MAC address, IDU product name, IDU software and hardware revisions
display management	Display IP, subnet, gateway, traps table
display link	Display state, SSID, channel BW, RSS, TSL, frequency/ACS, DFS, rate/ARA, distance
display Ethernet	Display bridge mode, aging time, port table (state, status and action)
display rfp	Display RFP for GSU
display ratio	Display transmission ratio for GSU
display tx_phase	Display transmission phase for GSU
display gpsinfo	Display GPS information for GSU
display tdm	Display clock mode, master clock mode, current clock, quality[1], TDM table (line status, error blocks)
display ntp	Display time, server and offset

Command	Description
display PM <interface:AIR,LAN1,LAN2,TDM1,TDM2,TDM3,TDM4> <interval:current,day,month>	Show the performance monitor tables for each interface according to user defined monitoring intervals
set ip <ipaddr> <subnetMask> <gateway>	Set the ODU IP address, subnet mask and gateway The user must reset the ODU after the command completion
set trap <index:1-10> <ipaddr> <port:0-65535>	Set a specific trap from the traps table (set trap 3 10.0.0.133 162)
set readpw <oldpasswd> <passwd>	Set the read access password (read community)
set writepw <oldpasswd> <passwd>	Set the read-write access password (read-write community)
set trappw <oldpasswd> <passwd>	Set the trap community string
set buzzer <mode:0=OFF,1 =ON>	Toggle the buzzer mode (0 – off, 1 – on)
set tpc<power:Value between minimal TX power, and maximal TX power>	Set the ODU transmit power. If a wrong value is entered, both min and max values shall be displayed in the error reply
set bridge <mode:0=Bridging OFF, 1= Bridging ON >	Set the ODU bridge mode (0 – off, 1 – on)
set name <new name>	Set the name of the link
set location <new location>	Set the name of the location
set contact <new contact>	Set the name of the site manager
set Ethernet <port: MNG,LAN1,LAN2> <mode: AUTO,10H,10F,100H,100F, DISABLE>	Set the mode and speed of each ethernet port
set rfp <index> (2-6)	Set RFP for GSU
set ratio <ratio>	Set transmission ratio for GSU
set tx_phase <mode:1=normal,2=shifted>	Set transmission phase for GSU
reboot	Reset both the IDU and the ODU. The user shall be prompt that the command will reset the device and that he/she has to restart the Telnet session.
help	Displays the available commands

Figure 3-6 shows the available Telnet commands via the Help command.

Chapter 4
Configuration

This chapter describes configuration procedures, which are performed after the physical installation of the local and remote Intrepid Series Radio units and the Installation Link wizard has been performed. The following parameters are configured via the Link configuration wizard:

- System parameters
- Frequency channel
- Transmit power and antenna
- Service parameters
- Ethernet ring.

The following parameters are defined via the Site Configuration dialog.

- System parameters
- Air interface (Transmit (Tx) power and antenna)
- Ethernet ports
- Bridge
- Maximum information rate
- VLANs.

4.1 Configuring the Link

The configuration wizard is used to redefine the configuration parameters if necessary. Both sites in the link are defined simultaneously.

Configuring the System Parameters

After installing the link, the system configuration can be modified.

Note

All parameter changes are automatically applied to both sides of the link.

✱ **To change general parameters:**

1. In the Main menu, click the **Link Configuration** button.
2. The Configuration wizard opens (*Figure 4-1*).

Figure 4-1. Configuration Link Wizard

3. Click **Next**.

The Link Configuration dialog box appears (see *Figure 4-2*).

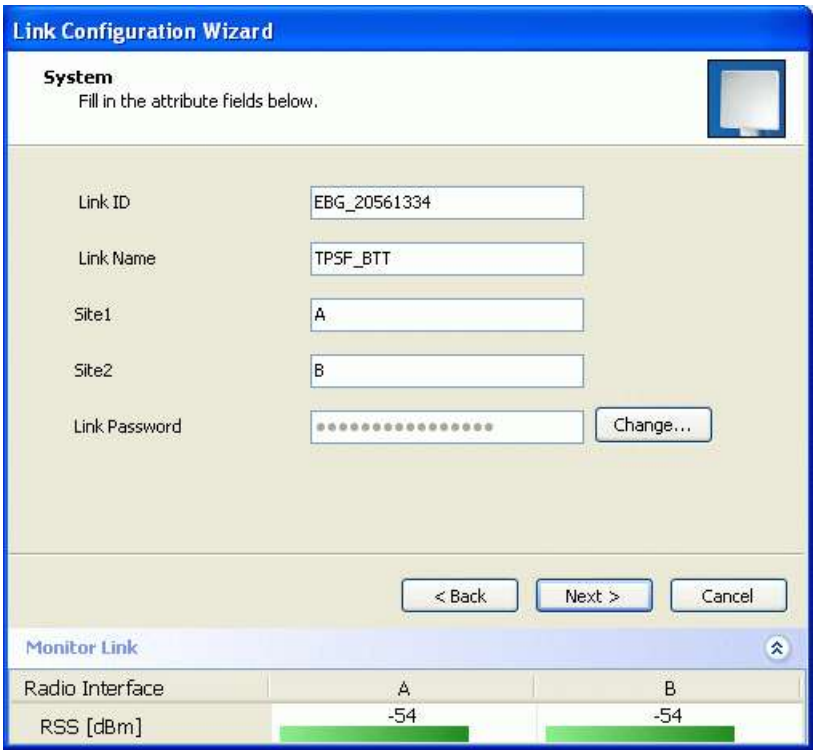


Figure 4-2. Link Configuration Wizard, System Dialog Box

4. In the System dialog box, enter the new data for the link. All fields with a white background can be edited.

Procedure for changing a link password is the same as during the link installation process, see *Defining System Parameters* in Chapter 2.

5. Click **Next**.

   The Frequency dialog box appears.

Selecting Channels

The user is required to define the operating frequency channel. Procedure for selecting channels is the same as during the link installation process, see *Selecting Channels* in Chapter 2.

Automatic Channel Select enables Intrepid Series Radio to change frequency channels automatically if the quality of the current operating channel deteriorates.

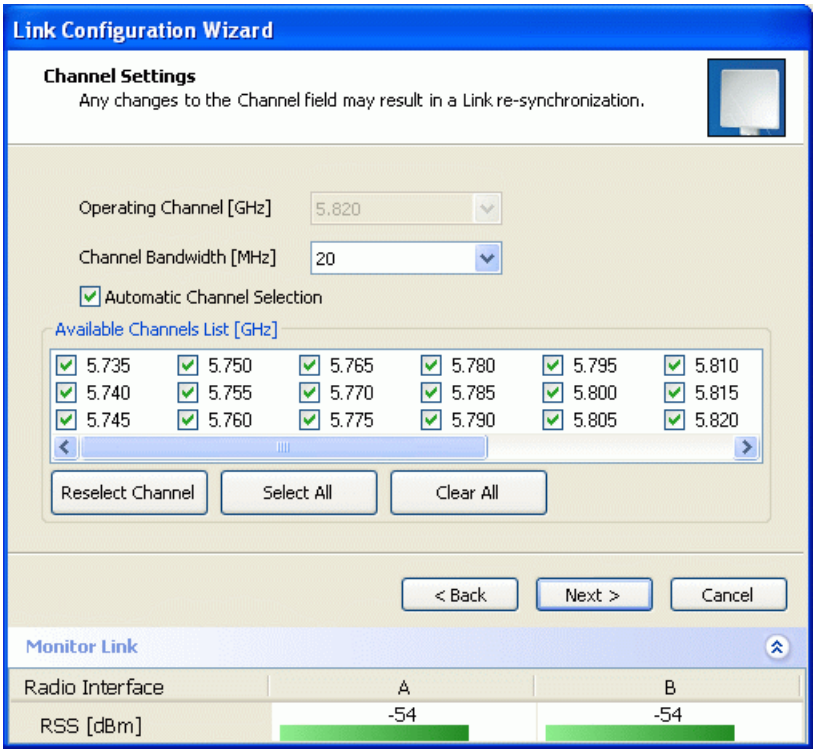


Figure 4-3. Channel Select Dialog Box – Automatic Channel Selection

✱ **To choose a channel automatically:**

1. Select the main frequency from the Operating Channel menu.
2. Select the required bandwidth.
3. Click the check box if Automatic Channel Selection is required.
4. Click the check boxes in the Available Channels List of all the allowable channels that can be automatically selected.
5. If you are not satisfied with the channel that is selected automatically, click **Reselect Channel**.

   A new channel will be selected from one of the Available Channels that have been defined.

Note *By clicking Reselect Channel, the ODU starts scanning all the channels from the available channels list and looks for radio frequency activity in each of the channels. It tries to select the optimal pure channel. If another channel is required, the operating channel that the ODU finds most pure must be removed from the available channel list.*

6. Click **Next**.

✱ **To choose a channel manually:**

1. Leave the Automatic Channel Selection box unchecked.
2. Select the main frequency from the Operating Channel menu.

   If you select other operating channel, an additional spin box is displayed. It allows you to fine-tune the frequency in increments of ±5 MHz within a range of 5.740–5.835 GHz.
3. Select the required channel bandwidth. The available choices are 10, 20 and 40 MHz for Intrepid Ultra or 10, 20 MHz for Intrepid and depending on regulation.
4. Click **Next**.

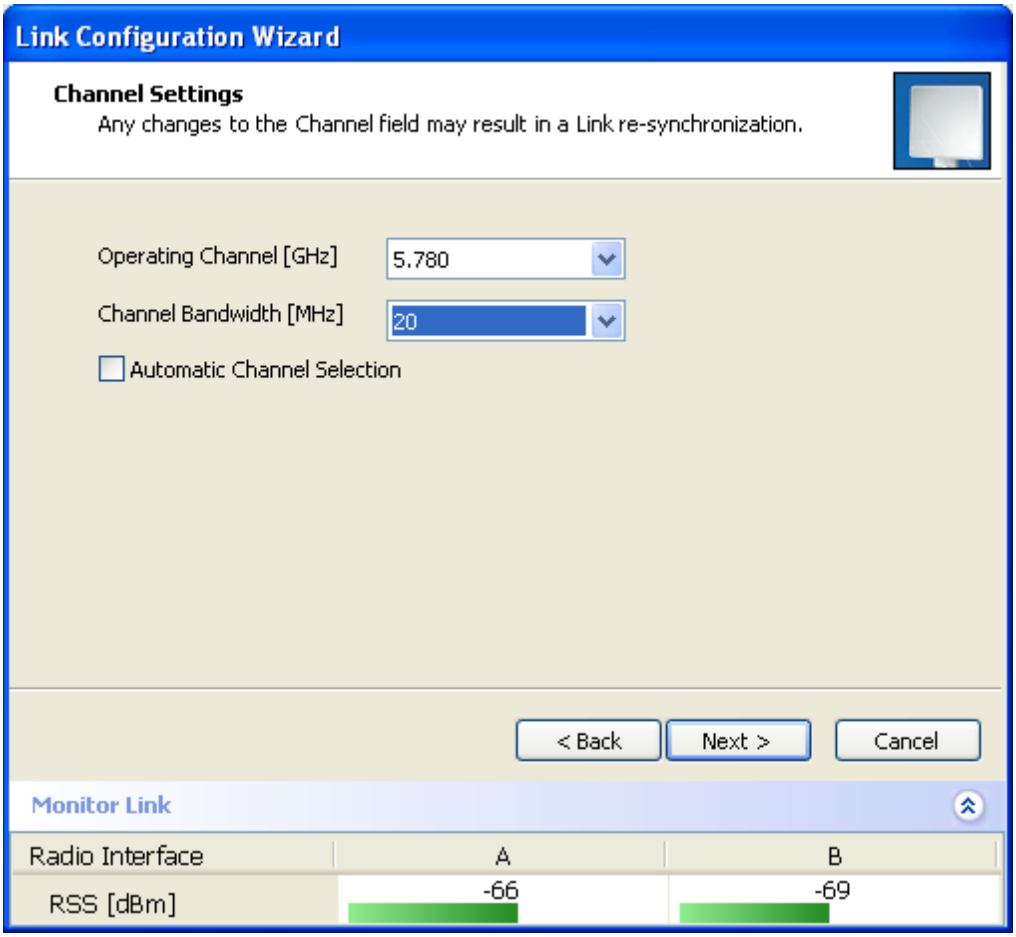


Figure 4-4. Channel Select Dialog Box – Manual Channel Selection

Configuring the Transmit Power and Antenna Settings

You can configure the transmit power and antenna parameters for the local and remote sites. Configuration procedure is the same as during the link installation process, see *Configuring Transmit Power and Antenna Settings* in Chapter 2.

Caution Changing antenna type causes a service break. The service can be restored only by installing the link again.

✱ **To configure the transmit power and antenna settings:**

1. From the Tx Power and Antenna Parameters dialog box, click **Configure** to change Tx power or antenna settings for site A or site B.

   Site A or site B dialog box is displayed.

2. Change Antenna Type, Required Tx Power, Antenna Gain or Cable Loss for the site, as explained in the link installation procedure in *Chapter 2*.

3. Click **Next**.

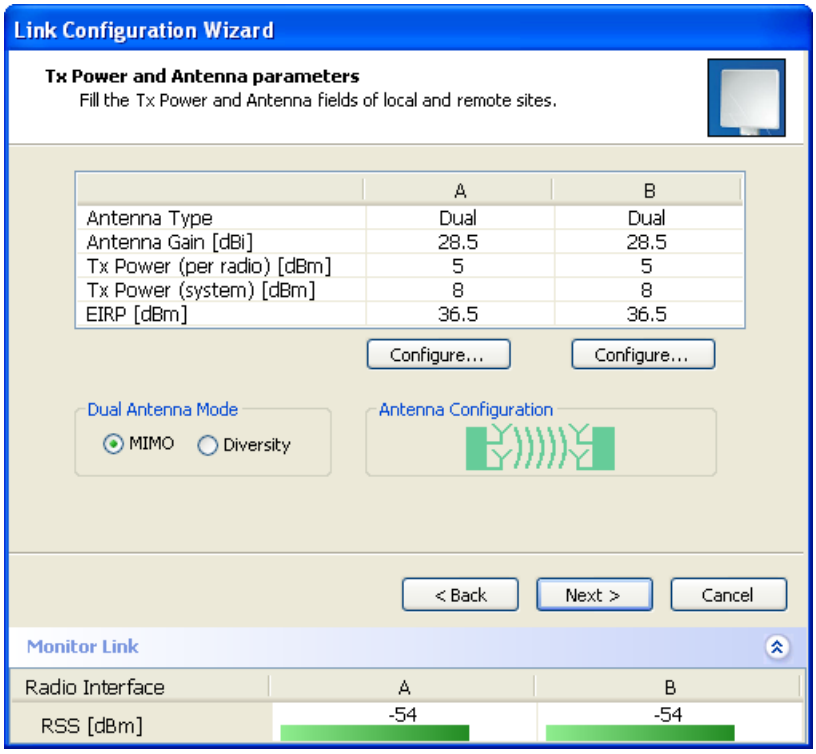


Figure 4-5. Tx Power and Antenna Parameters

Configuring Hub Site Synchronization

The Synchronization Status dialog box displays the current status of each side of the HSS link. See *Appendix G* for instructions about installing and configuring collocated links. If you do not require HSS, click **Next**.

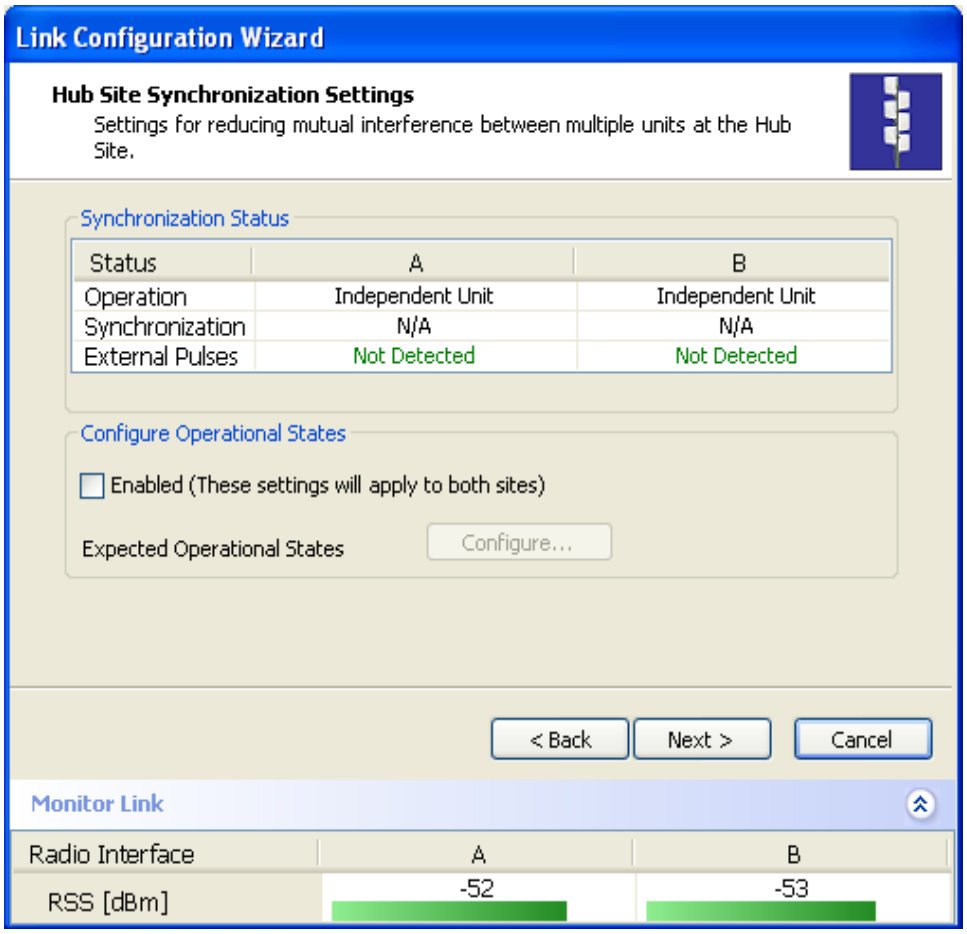


Figure 4-6. HSS Status Parameters

Configuring Ethernet Ring

An Ethernet ring consists of several nodes connected by hops (links). Loops are not allowed with Ethernet; therefore one hop is a Ring Protection Link (RPL) which "blocks" Ethernet traffic. In the event of failure in the ring, the Ring Protection Link unblocks and Ethernet traffic in the ring is restored.

Some terminology:

- Normal State – all member links are functional except the RPL which is blocked.
- Blocked – the air-link is up but Ethernet traffic is not transmitted across the link. The Ethernet service panel for the RPL in the Link Manager is labeled Idle
- Unblocked – Ethernet traffic is transmitted across the RPL. The Ethernet service panel for the RPL in the Link Manager is labeled Active
- Protection State – a member link is broken and the RPL passes Ethernet traffic
- Ring Protection Link – as described above
- Ring Link – any member link controlled by the RPL
- Independent Link – not subject to ring protection
- Ring Protection Message (RPM) – control message used to monitor and control the ring.

Note

- *RPM messages are broadcast, so it is essential (to prevent flooding) to associate the RPL and member Ring Links with a VLAN ID. This requires in turn, that equipment used in the ring either supports VLAN or can transparently pass through VLAN tagged packets.*
- *It is recommended to use different VLANs for user, management and ring traffic.*

Ethernet Ring Behavior

The following figure describes the RPL behavior during a ring failure and recovery cycle.

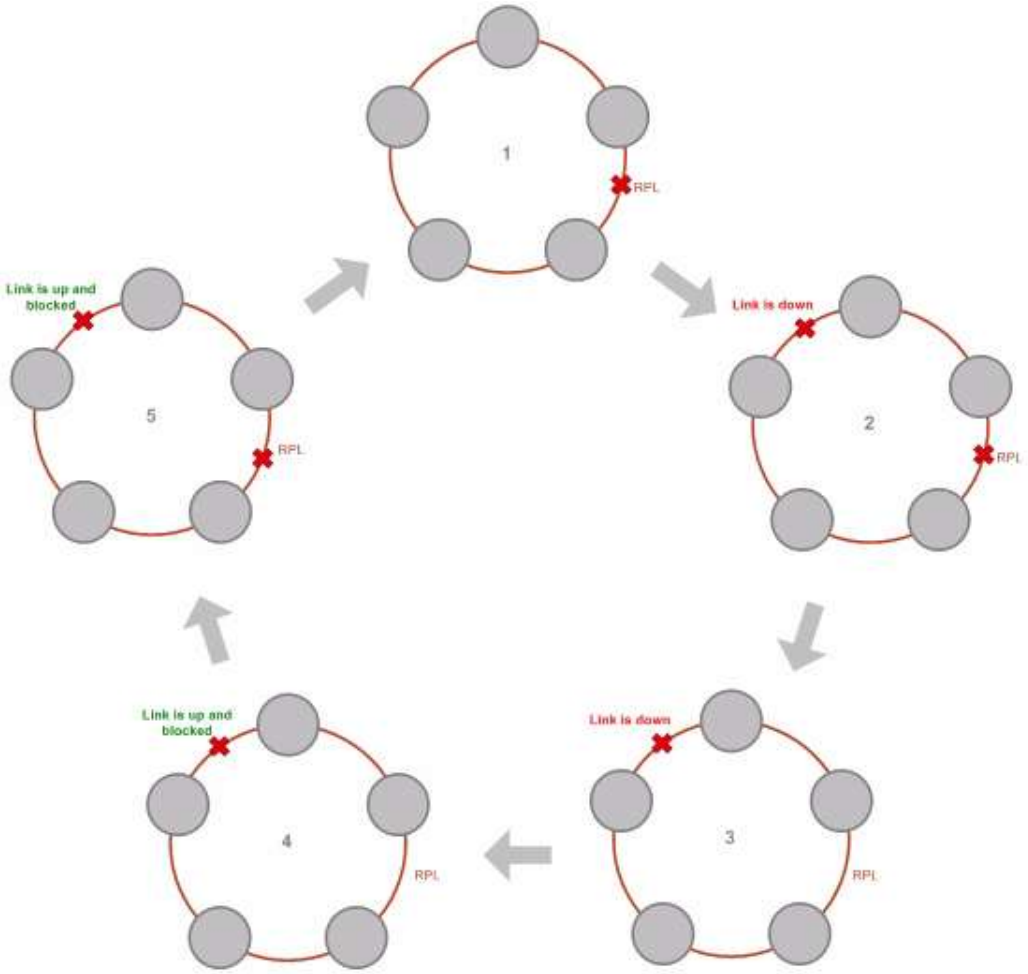


Figure 4-7. Ring Protection Mechanism

The steps below follow the numbering in *Figure 4-7*:

1. Normal operation

   Ethernet traffic runs in the ring, but does not pass through the RPL, which is blocked. The RPL does however, broadcast RPM packets through the ring.

2. Ring Link down, RPL notified

   The RPL detects a link-down condition by the non-arrival of an RPM packet. It remains blocked for the Minimum time for failure detection which is configurable using the Link Manager.

3. Ring Link down, RPL unblocked for traffic

The RPL unblocks for Ethernet traffic after the Minimum time for failure detection expires and no RPM message has been received.

4. Ring Link restored but still blocked for traffic

   The Ring Link is restored, but remains blocked for the Minimum time for recovery, set using the Link Manager, to avoid rapid fluctuations leading to potential short term loops.

5. Ring Link restored, blocked, RPL blocked for traffic

   The RPL blocks to Ethernet traffic after the Minimum time for recovery expires and restores Ethernet traffic to the Ring Link (with a special RPM packet).

Return to 1. Ring Link restored, RPL blocked

The ring is back to normal operation.

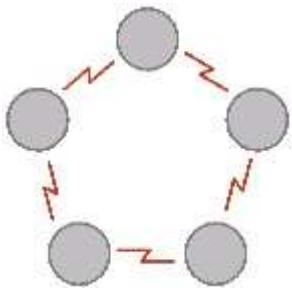
Ring Protection solution prevents Ethernet loops in the ring at all times. The ring is always broken somewhere.

- Under a ring configuration a Ring Link that was down and commences recovery, keeps blocking Ethernet traffic. The RPL identifies this situation, blocks itself and then unblocks the other Ring Link. This is the transition from step 4 to 5 in *Figure 4-7*.
- If the failed hop is not a link then there are two possibilities:
  - If the hop Ring Link can signal that it is down by issuing a Loss of Signal (LOS) at the Ethernet port, then the RPL will control the link connected to that port in the same manner as described above, to prevent an Ethernet loop.
  - Otherwise, there may be a short loop period when the RPL is still open for traffic and the Ring Link is also unblocked during the Minimum time for recovery.

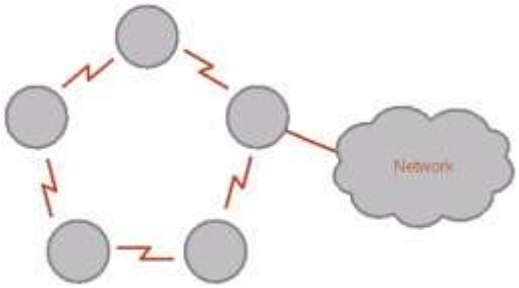
Supported Ethernet Ring Topologies

The following ring topologies are supported:

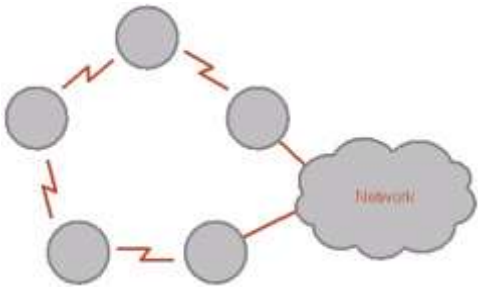
- Standalone ring. The ring is not connected to other rings



- Single-homed ring. One of the nodes is connected to another network / ring:



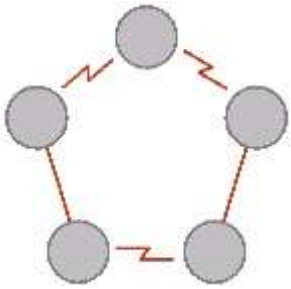
- Dual-homed ring. Two adjacent nodes are connected through a non-link (for example, microwave or fiber):



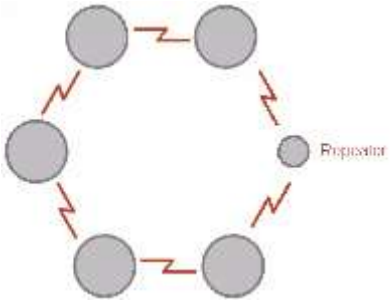
Note

- *The network has to be layer 2 and support VLANs.*
- *The ring control broadcasts RPM packets. Hence it is recommended to prevent these packets from propagating into the network.*

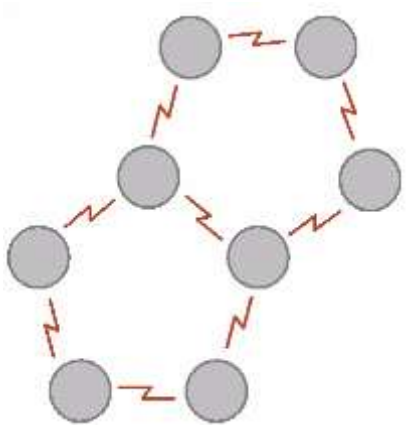
- Mixed ring. Some of the hops are connected through non- links:



- Repeater sites. Some of the hops are connected through links with PoE devices, not supporting ring functionality:



- Shared ring. RAD rings with shared hops.



Note

- *A link hop can be a part of up to 4 rings.*
- *The RPL cannot be a shared link.*
- *The two RPLs should use different Minimum Time for Activation values to prevent duplicate action causing a loop.*

Protection Switching

Protection switching occurs upon failure in the ring.

The Ethernet service restoration time depends on the number of hops in the ring. With four hops the Ethernet service is restored in less than 50 ms.

In single and dual homed topologies the service restoration may take longer due to the aging time of the external switches. Switches that are immediately aware of routing changes reduce the restoration time.

Hardware Considerations

Ethernet Ring Protection is supported by the IDU-S, IDU-C and PoE.

A typical Ring Protection Link consists of an IDU-S or IDU-E, a PoE and two ODUs as shown in *Figure 4-8*. Hence one end of the RPL and of ring controlled links, as shown in *Figure 4-8* has to be an IDU. It is recommended to have an IDU at each node to have the flexibility to change the RPL.

A ring node is built from two ODUs from adjacent links. The ODUs can be connected to either an IDU or to a PoE device as in *Figure 4-8*. Port names in the IDU are shown.

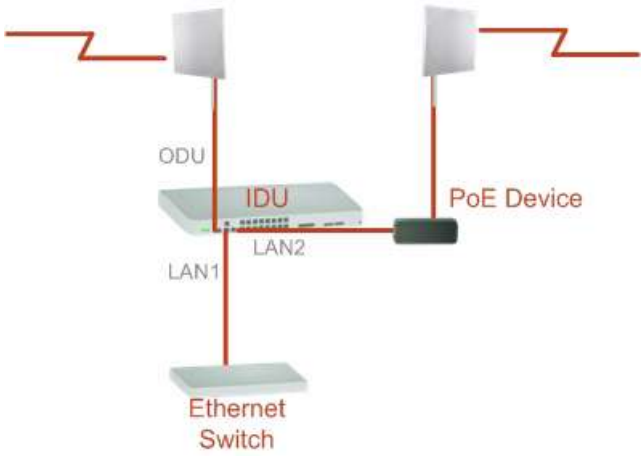


Figure 4-8. Node with IDU and PoE Device

Note *Connect the switch at the site only to one IDU.*

The switching function is carried out by the IDUs, which provide Layer 2 support.

Special Case: 1 + 1 Ethernet Redundancy

The same device may be used to provide economic 1 +1 redundancy for a single link. A 1+1 Ethernet is a ring with two nodes. One of the links is RPL. The equipment in a 1+1 Ethernet installation is as follows:

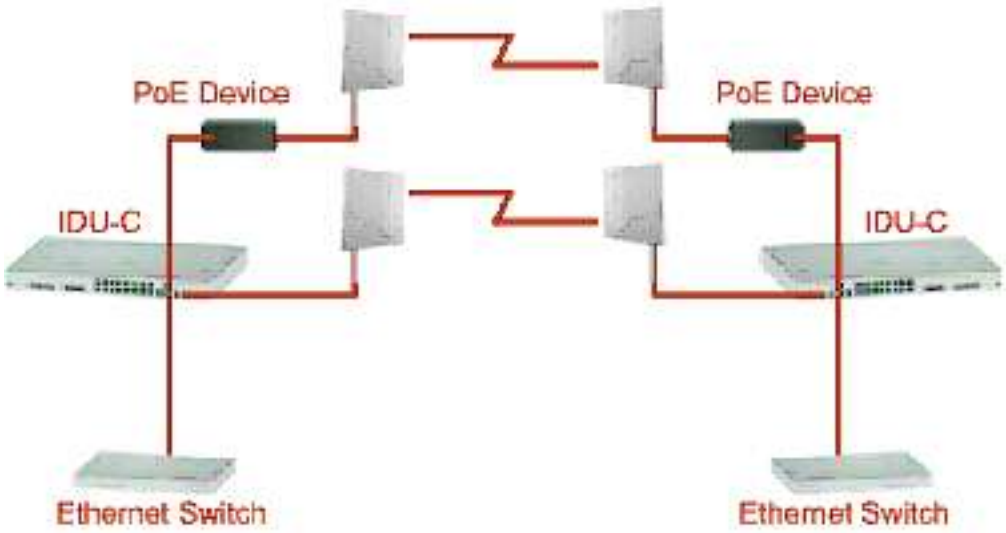


Figure 4-9. 1+1 Ethernet Protection

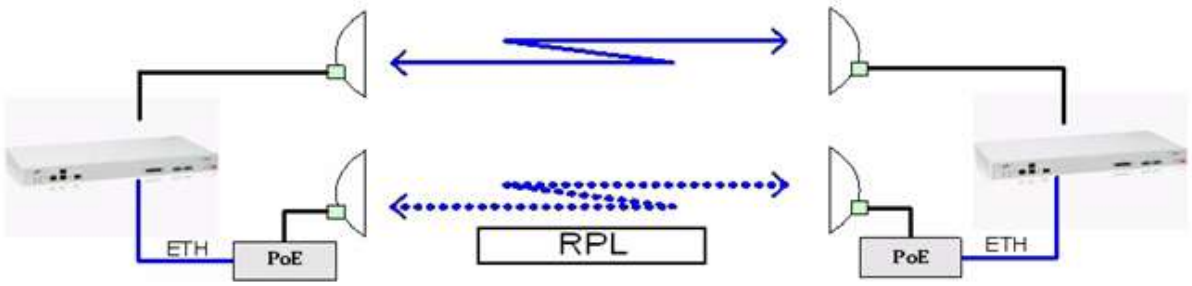


Figure 4-10. Using IDU-C or IDU-E with PoEs for the RPL

Notice that link content drops from four PoEs plus two switches to two PoEs and two IDUs.

Configuring the Ring

Creating a ring requires two stages:

1. Set up each participating link separately, in the usual way
2. For each link, run the Configuration wizard to define it as RPL or a Ring Link.

Note

- *The Ring uses a VLAN ID for the RPL. It is used to manage the Ring and nothing else; it is completely separate from the management and traffic VLANs referred to elsewhere.*
- *A regular Ring Link may be a member of up to four rings and each of their RPL VLAN IDs must be configured.*

✱ **To integrate a link into an Ethernet Ring:**

1. Using either the Installation or Configuration wizards, navigate to the Services window and choose the Ring tab.

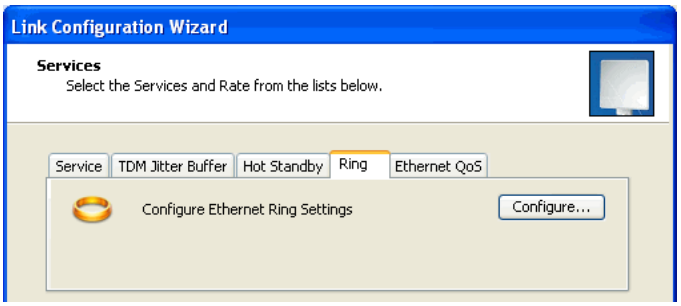


Figure 4-11. Services Window with Ring Tab Selected

2. Click **Configure**. The Ring definition window is displayed. The default is Independent Link and is used when the link is not part of any ring.

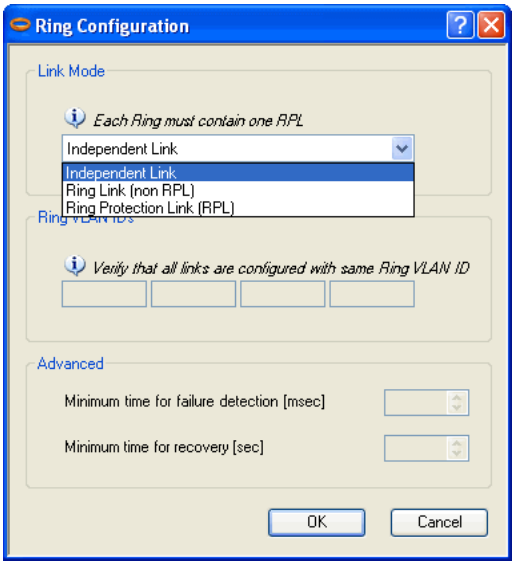


Figure 4-12. Ring Options

3. To configure the link as a regular Rink link, click **Rink Link** (Non- RPL) and enter the ring LAN VIDs (at least one) to which it belongs and click **OK**.

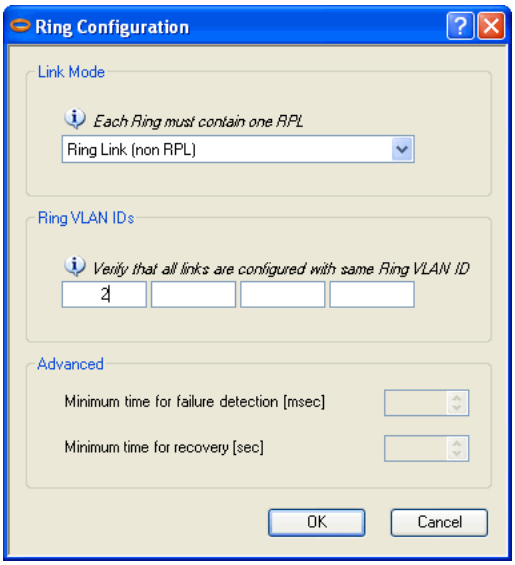


Figure 4-13. Configuring Ring LAN VIDs

4. To configure the link as RPL, click **Ring Protection Link (RPL)** and enter its Ring VID.

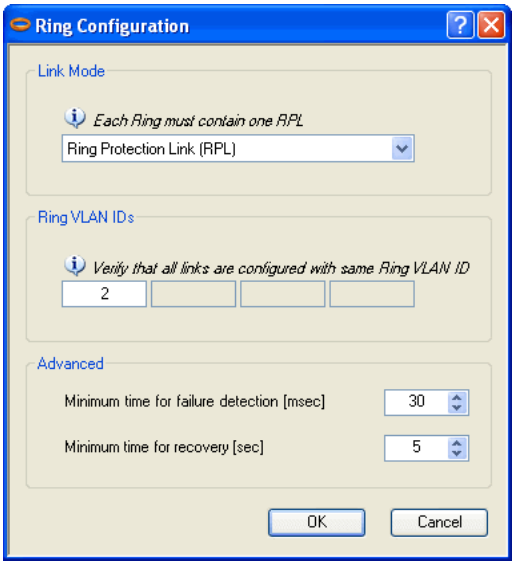


Figure 4-14. Configuring RPL VIDs

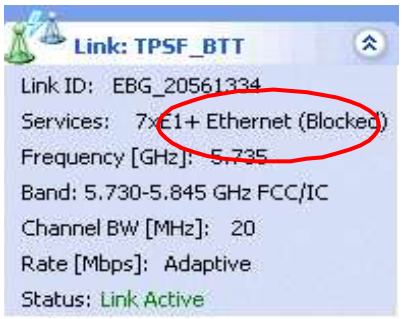
5. Enter the minimum times for failure detection and recovery.

   For dual-homed configurations, where part of the ring goes through the core, if a core segment fails, the core should be allowed to recover before the RPL enters Protection State. Otherwise, it could happen that both the core and the RAD ring will switch in parallel. You should therefore, configure a Minimum time for failure detection high enough to take this possibility into account.

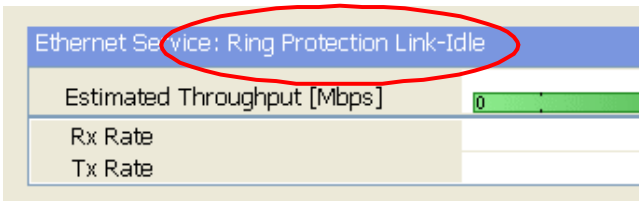
   The Minimum time for recovery is a delay switch to prevent rapid "on-off" fluctuations. It functions like a delay switch use to protect electrical devices from rapid "on-off" power fluctuations, which in this context, may lead to potential short term loops .

6. Click OK to accept your settings.

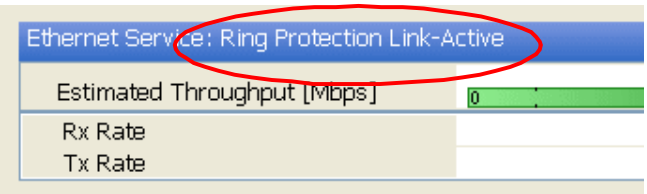
   The RPL will be clearly indicated in the Link Manager. In the Link status area on the top left, you will see an Ethernet (Blocked) notice:



   A Link-Idle message is displayed on the Ethernet Services bar:



   When the RPL cuts in as a result of a failure, the "Ethernet (Blocked)" notice disappears. The Ethernet Services bar indicated that the RPL is active:



Upon restoration of the broken link, the RPL returns to idle status with the appropriate indications on the Link Manager main window.

On the status bar for all ring member links, you will see the ring membership indicator icon:

Note

- *Do not configure more than one RPL. If you do, you will break the Ring.*
- *If you forget to configure one RPL in a ring, you will introduce a loop into your network.*

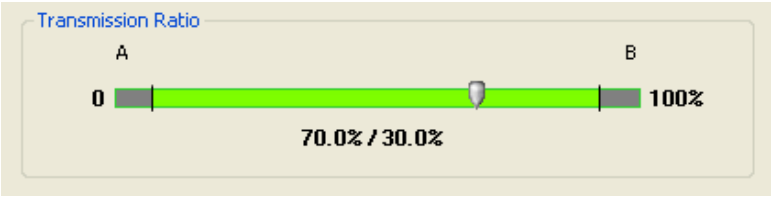
Configuring the Services

Intrepid Series Radio supports Ethernet and TDM services, which are configured via the Services dialog box. Configuration procedure is the same as during the link installation process, see *Configuring the Services* in Chapter 2.

If you are using a link that:

- is non-collocated
- is Ethernet-only
- uses model Intrepid Ultra Series Radio ODUs,

When you may use Asymmetric Allocation. You may change the capacity allocation here the same way as during link installation. Use the Asymmetric Allocation slider to select the downlink/uplink Ethernet data stream ratio:



✱ **To configure the services:**

1. In the Services dialog box, configure the TDM services, select jitter buffer depth and a rate.
2. Click **Next** to continue.

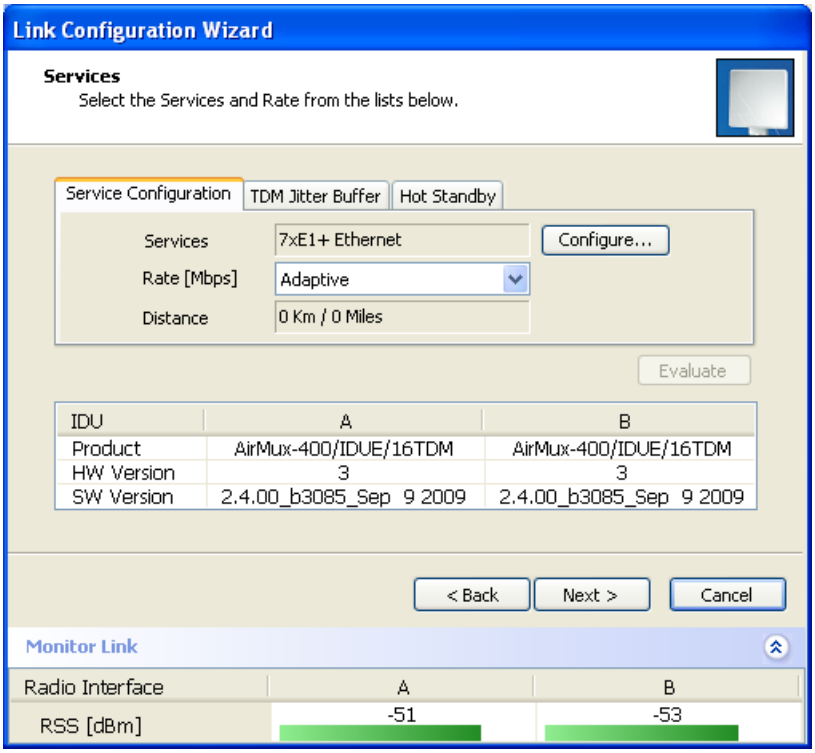


Figure 4-15. Link Configuration Wizard, Services Dialog Box

Configuring the TDM Clock

Clock type for each TDM interface is selected via the TDM Parameters dialog box. Configuration procedure is the same as during the link installation process, see *Selecting TDM Clock Type* in Chapter 2.

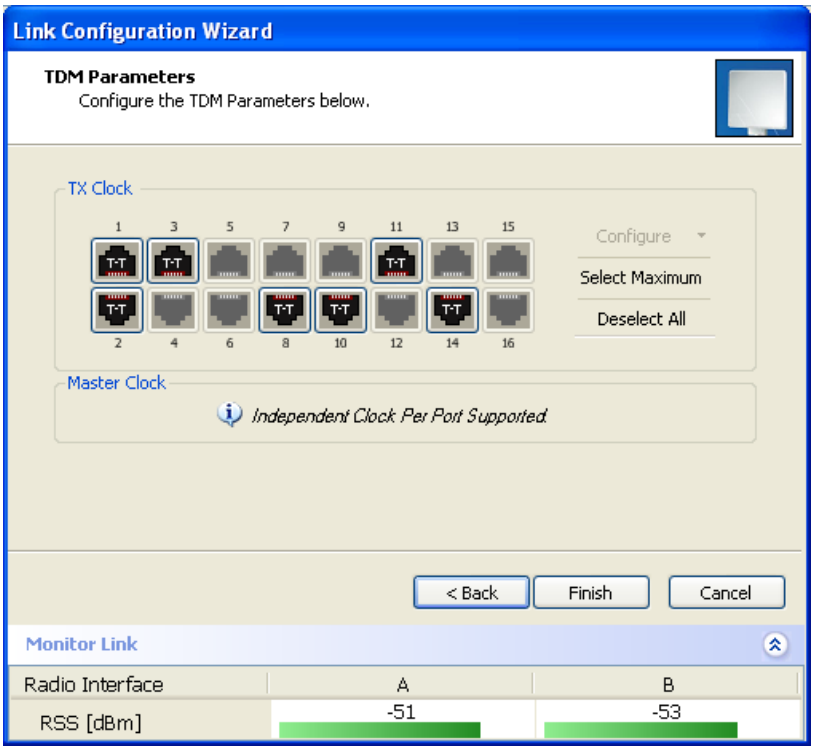


Figure 4-16. Link Configuration Wizard, TDM Parameters Dialog Box

Completing the Link Configuration

The last screen of the link installation wizards allows you to view the configuration summary.

✱ **To complete the link configuration:**

- In the Installation Summary dialog box, click **Done**.

  The main Link Manager window is displayed (*Figure 4-18*).

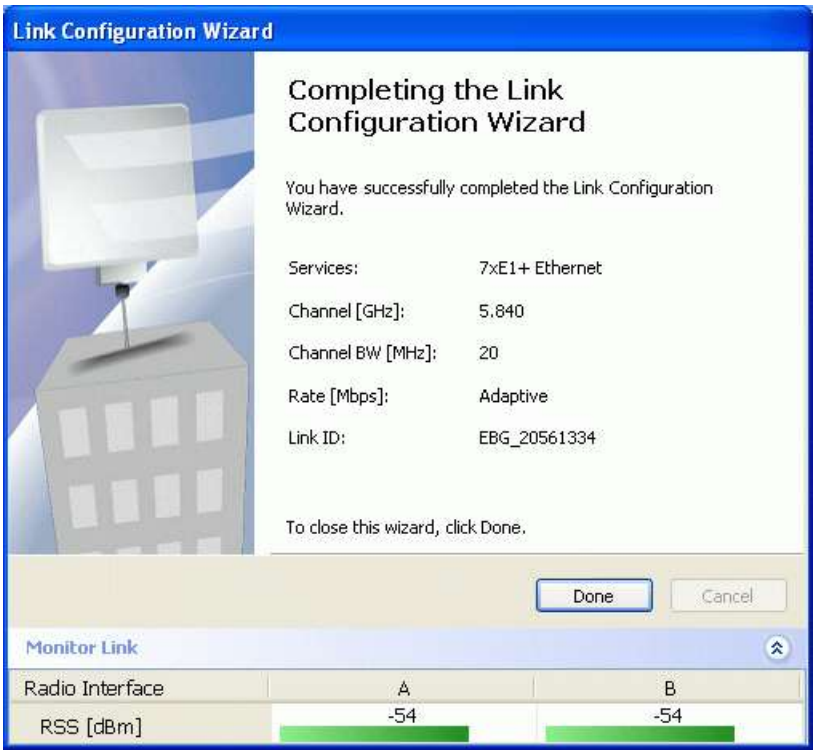


Figure 4-17. Link Configuration Wizard, Final Screen

The Finish screen appears, showing a summary of the link configuration (see *Figure 4-17*).

- Click **Done** to complete the configuration wizard.

  The Main menu is displayed.

Caution

After completing the link setup, change the default IP addresses of the ODUs (see *Defining the Management Addresses* section below.

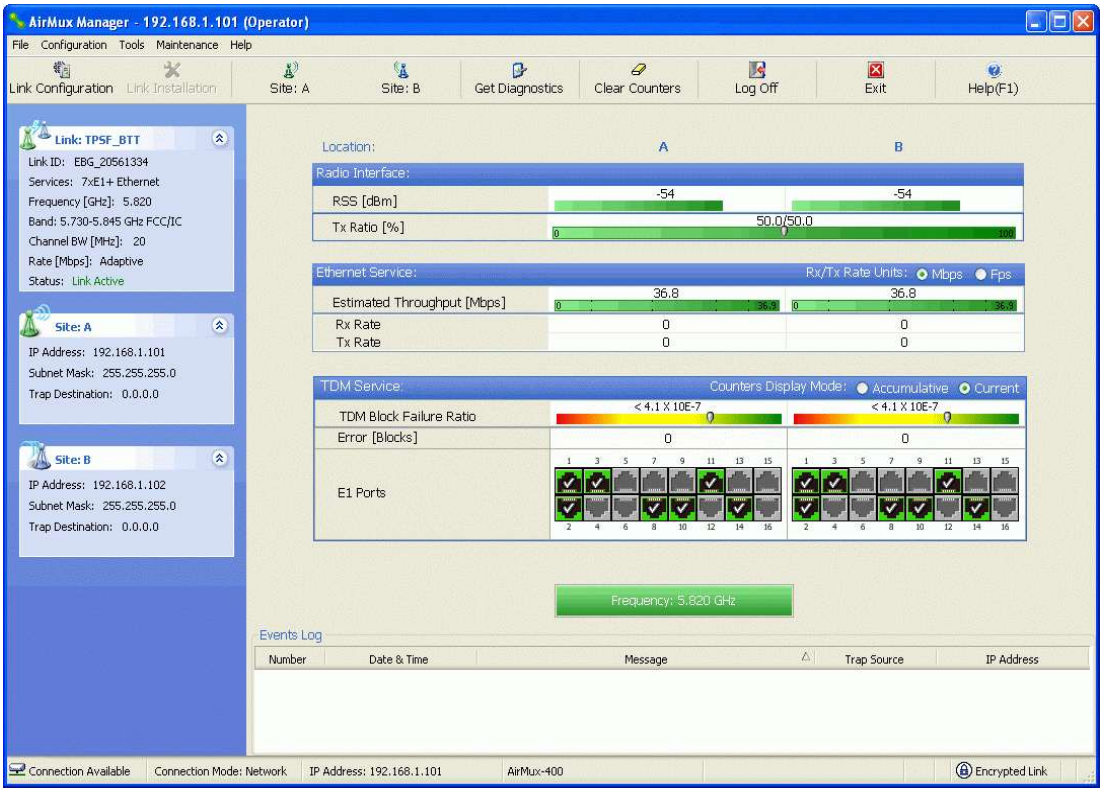


Figure 4-18. Main Window after Link Configuration

4.2 Configuring the Sites

You can edit the configuration parameters for each site individually without running a wizard.

From the Configuration dialog box, (see *Figure 4-19*) the following functions are available by selecting the items on the left of the dialog box:

System	Edit the contact person and location details. View the system details
Air Interface	Change the transmit power, cable loss, antenna type and HSS status
Inventory	View the hardware and software inventory (release numbers, model identification, MAC address)
Management	Configure the IP address, subnet mask, default gateway, the trap destination and VLAN ID.
Security	Change the community values and link password
Date and Time	Set the date and time of the link from an NTP servers
Advanced	Configure the bridge, define the LAN connection, set the external alarm inputs and restore the unit to the factory settings.

From the Configuration dialog box, the following functions are available by clicking the buttons at the top of the dialog box:

Backup	Saves a backup.ini file with the current configuration.

Restore	Loads the backup.ini file created by the backup.
Refresh	Discards the changes made and returns to the values which were previously saved
Buzzer	Mutes the beeper at startup. Reactivate the beeper during alignment.
Installation Mode	Returns to Installation Mode for the entire link. Selecting the Buzzer On/Off check box before clicking the Install Mode button mutes the Beeper.

✱ **To configure via the local or remote site:**

1. Click the required site button on the main tool bar of the Link Manager.

   or

   Click **Configuration** from the main menu and select which site to configure.

   The Configuration dialog box opens (see *Figure 4-19*).

Figure 4-19. System Configuration Dialog Box

2. Select the appropriate item in the left hand list to open a dialog box.
3. Click **Apply** to save the changes.

4.3 Configuring for Management

To allow access to the device (using the Intrepid Series Radio management utility or Telnet), it is necessary to configure its management parameters, including system information, IP address, VLANs (optional) and SNMP communities (optional).

Configuring the System Information

You can assign a name to the system, contact person and location to distinguish it from the other systems at your disposal.

❋ **To configure the system information:**

- From the System dialog box (*Figure 4-19*), configure the following:
  - Name – system name
  - Contact – system contact person
  - Location – system location.

Defining the Management Addresses

Each site must be configured separately, first site A then site B.

❋ **To define the management addresses:**

1. Click **Configuration** from the main menu.
2. Select which site to configure.

   The Configuration dialog box opens.
3. Select **Management** (see *Figure 4-20*).
4. Enter the IP address of the ODU in the IP address field.

Note *If performing configuration from the Link Manager, the IP address is that entered from the Login window.*

5. Enter the subnet mask.
6. Enter the default gateway.
7. Enter the trap destination. This is the IP address of the PC running the management application. The event log will be stored at this address.
8. Click **Apply** to save the changes.

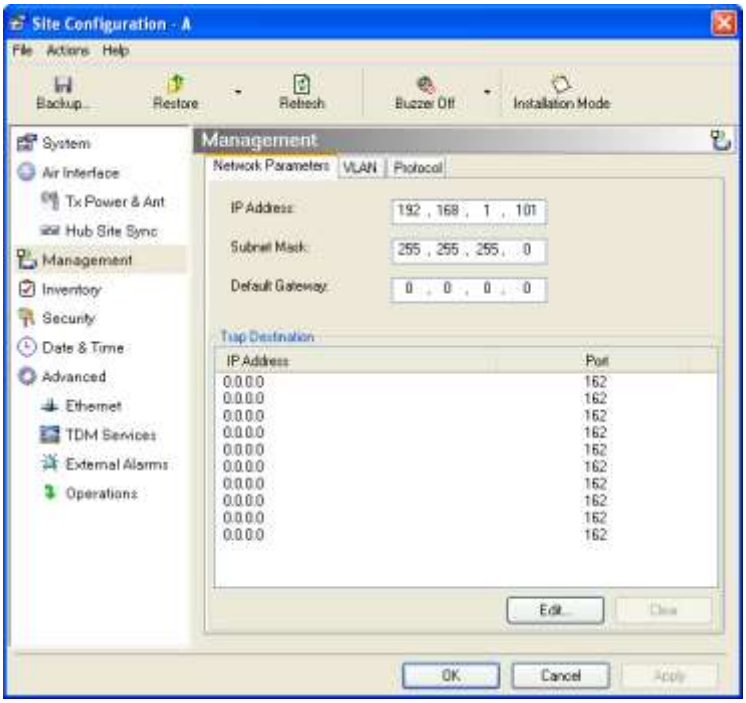


Figure 4-20. Site Configuration, Management

Notes

The Installation mode button opens the Link Installation wizard to reinstall the link. This option must be used only when the radio link is operational. Activation of the installation mode without an active radio link results in a loss of connectivity between two units.

The Backup and Restore buttons are for saving and restoring the configuration files.

Configuring VLAN Management

VLAN management enables the separation of user traffic from NMS traffic. The user decides if such a separation is required. Both sites are configured with VLAN management.

Note

VLAN IDs are used by RAD products in three separate contexts: Management VLAN, Traffic VLAN and Ethernet ring. It is recommended that you use different VLAN IDs for each context.

✱ **To enable VLAN management:**

1. Click **Configuration** from the main menu.
2. Select the site to configure.
3. Select **Management**.
4. Open the VLAN tab.
5. Check the **Enabled** box.

6. Enter a VLAN ID.

   After entering the VLAN ID, only packets with the specified VLAN ID are processed by the ODU. This includes all the protocols supported by the ODU (ICMP, SNMP, Telnet and NTP). The VLAN priority is used for the traffic sent from the ODU to the management workstation. VLAN management affects all types of management connections (local, network, and over-the-air).

7. Enter a Priority number.

8. Click **<OK>** to save the settings.

Figure 4-21: Configuring VLAN Settings

Warning

When this parameter is changed, it causes the management application to immediately disconnect. In order to avoid problems, verify the change by setting the VLAN on only one ODU. Only after proper VLAN network operation is verified, the other VLAN setting can be changed.

✱ **To troubleshoot VLAN problems:**

If the VLAN ID is forgotten or no VLAN network is connected to the ODU:

- Reset the device.

  In the first two minutes, neither the VLAN nor any VLAN connections are available. You may use this period to reconfigure the VLAN ID and priority.

Configuring SNMP Communities

The ODU communicates with the management application using SNMPv1 protocol. The protocol defines three types of communities:

- Read-Only for retrieving information from the ODU
- Read-Write to configure and control the ODU
- Trap used by the ODU to issue traps.

The community string must be entered at login. The user must know the password and the correct community string in order to gain access to the system. A user may have read-only privileges.

It is not possible to manage the ODU if the read-write or the read community values are forgotten. An alternative community key may be obtained from technical support for the purpose of setting new community; the MAC address of the ODU must be supplied.

Note

*The manager application and the ODU use the community strings **public-bru1** for the local unit and **public-bru4097** for the remote unit. These are the factory defaults.*

A new community string can be set if necessary. The read-write community and read-only community have a minimum of five alphanumeric characters. (Bru1 and bru4097 are not permitted). Changing the trap community is optional by clicking the check box.

Editing Community Strings

The community change dialog box is available from the **Configuration > Security** tab. Both read-write and read-only communities must be defined.

On entering for the first time, use the following community settings:

- Read-write community – **netman**
- Read-only community – **public**
- Trap community – **public**.

The community string can be changed when entering the system for the first time, and the community string **netman** cannot be used again.

✱ **To change a community:**

1. From the Configuration dialog box, select the **Security** tab
2. Type the current read-write community (default is **netman**).
3. Select the communities to be changed by clicking the check box.
4. Type the new community and re-type to confirm.
5. Click **OK** to save.

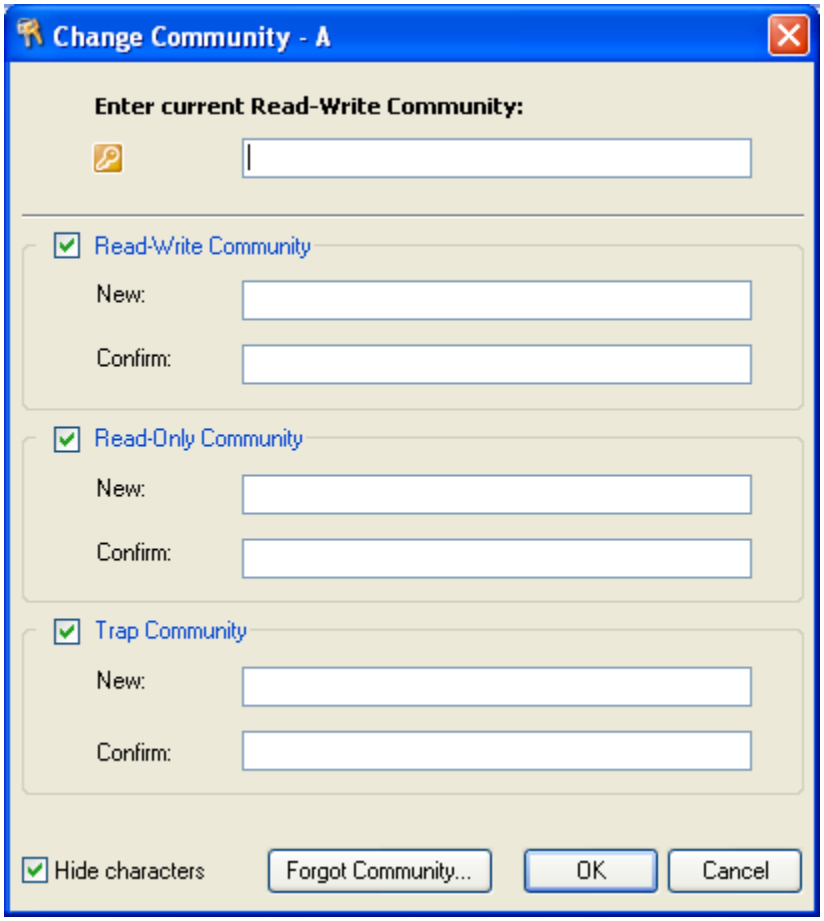


Figure 4-22. Changing the Community String

Restoring Community String

If the read-write community string is unknown, an alternative community key can be used. The alternative community key is unique per ODU and can be used only in order to change the community strings. The alternative community key is supplied with the product, and it is recommended to keep it safe.

If both the read-write community and the alternative community key are unavailable, then an alternative community key can be obtained from customer support using the ODU MAC address. The MAC address is displayed in the manager inventory tab.

When you have the alternative community key, click the **Forgot Community** button and enter the Alternative Community (*Figure 4-23*). Then reconfigure the read-write community string.

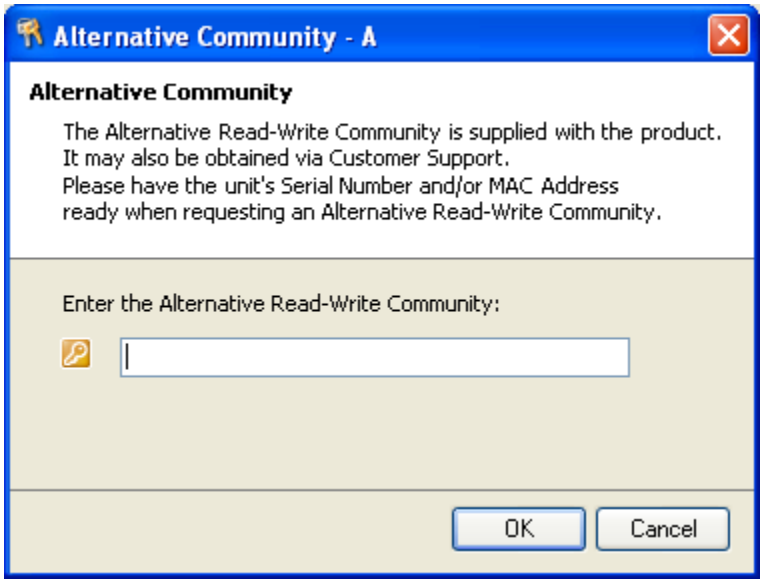


Figure 4-23. Alternative Community Dialog Box

Setting SNMP Timeouts

When using SNMP management systems, you can define monitor interval and timeout.

❋ **To configure SNMP timeouts:**

1. From the Advanced tab of the Preferences dialog box (Tools > Preferences), select the required monitor interval and timeout values in seconds..
2. Click **OK** to finish.

Figure 4-24. Preferences Dialog Box, Advanced Tab

4.4 Configuring for Operation

Changing the Transmit Power

Each site can have a different transmit power level.

Caution

Changing the Tx Power affects service quality. The same considerations apply here as were noted in the Installation procedure described in *Chapter 2*.

✱ **To change the transmit power:**

1. Click **Configuration** from the main menu.
2. Select which site to configure.

   The Configuration dialog box opens.
3. Select Air Interface (see *Figure 4-25*).
4. Select the required Transmit Power Level (see *Configuring Transmit Power and Antenna Settings* in Chapter 2).
5. Click **Apply** to save the changes.

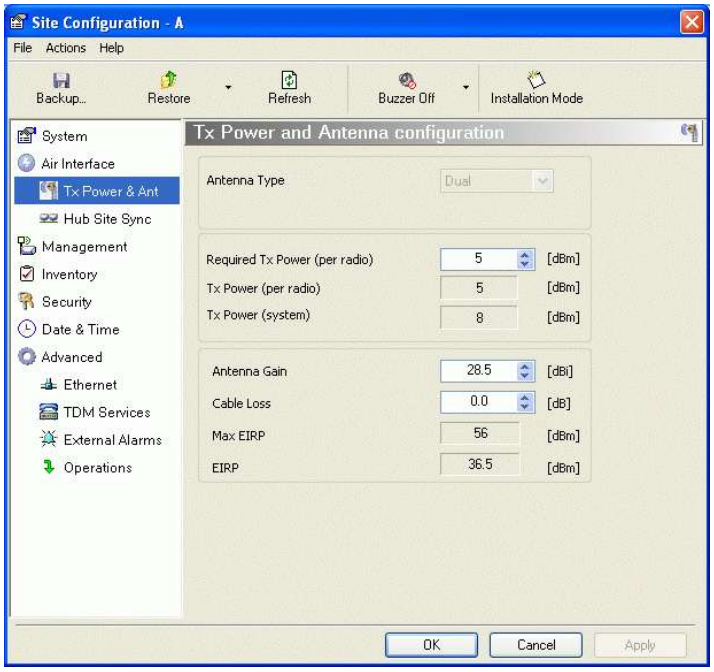


Figure 4-25. Changing the Transmit Power

Configuring Ethernet Ports

The Ethernet ports are configurable for line speed (10/100BaseT) and duplex mode (half or full duplex). Intrepid Series Radio provides an Auto detect feature where the line speed and duplex mode are detected automatically using autonegotiation. Use the manual configuration when external equipment does not support autonegotiation. The default setting is Auto Detect. (See *Figure 4-26*).

The maximum Ethernet Information Rate can be limited via the pull down menu. The default setting is Not Limited.

Note

It is not recommended to configure the port that is used for the management connection, since a wrong configuration can cause management disconnection or Ethernet services interruption.

✱ **To configure the Ethernet mode:**

1. From the **Configuration** menu, select the site to reconfigure.

   The Site Configuration dialog box opens.

2. Click **Advanced > Ethernet**.
3. In the Ethernet Ports Configuration pane, use the drop-down menu to select the LAN configuration.
4. Click **Apply** to save the changes.

Note

*It is possible to close the Ethernet service by disconnecting the Ethernet port. (**Disable** option in LAN port mode configuration) The user should be aware that it is possible to close the port and not have any access to the device. If this should occur the workaround is as follows:*

- *Connect the system from the remote site*
- *Connect via other Ethernet port (IDU-E)*
- *Power down the equipment and connect immediately after the power up (the fastest way is to enter install mode).*

Configuring the Bridge

ODU bridge configuration is required in various network topologies, such as protection (1+1) and ring application. The bridge configuration parameters are located under the Advanced tab of the Configuration dialog box (*Figure 4-26*).

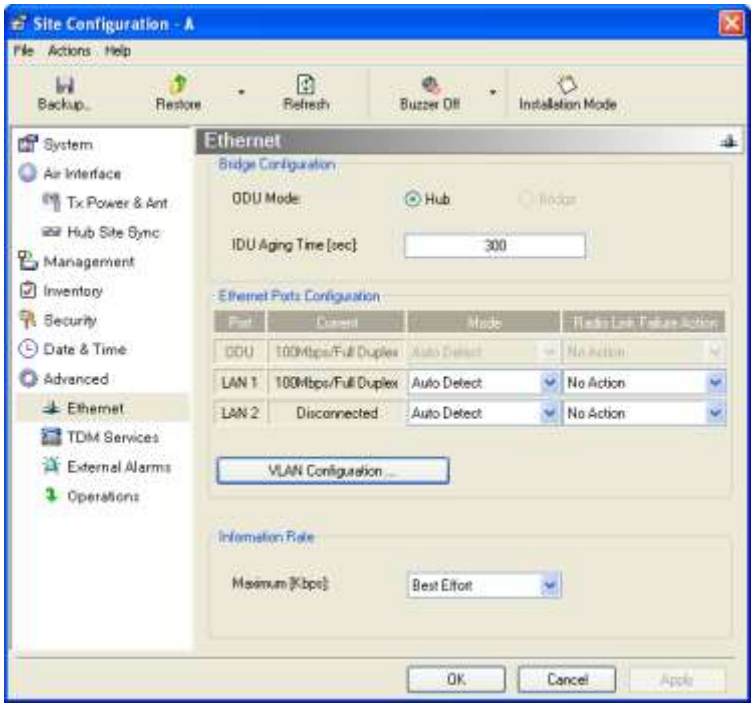


Figure 4-26. Advanced Configuration, Ethernet Configuration

Selecting the ODU Bridge Mode

This parameter controls the ODU mode with two optional values:

- Hub Mode – in Hub mode the ODU transparently forwards the all the packets over the wireless link.
- Bridge Mode – In Bridge mode the ODU performs both learning and aging, forwarding only relevant packets over the wireless link. The aging time of the ODU is fixed at 300 seconds.

Changing these modes requires system reset.

Note *Intrepid Series Radio/100 Mbps ODUs work in Hub mode only. The bridge capability is built into the IDU-E (it is not configurable). If an IDU-E is connected to an Intrepid Series Radio/100 Mbps, then the IDU-E performs the bridging.*

Defining the IDU Aging Time

This parameter controls the IDU aging time.

The IDU has a 2047 MAC address-learning table. The aging time parameter controls the time each MAC address is dropped from the table.
Default value is 300 seconds.

Notes *Any change to these parameters is effective immediately.*

Each side of the link can be configured separately, with different aging times.

The following list details common configurations; both sides are must be configured with the same parameter.

- Standard (default) Configuration for Ethernet Applications with the IDU unit
  Set IDU aging to 300 seconds, ODU set to Hub mode, *Figure 4-26*.
- Standard (default) Configuration for Ethernet Applications with PoE unit
  ODU set to Bridge mode, IDU aging is not applicable.
- Fast aging mode – for rapid network topology changes
  Set IDU aging to one second, ODU set to Hub mode.
- Hub mode
  The ODU is set to HUB mode. IDU aging is not applicable.
- Ethernet bridge
  The ODU is set to Bridge mode. The IDU aging is not applicable.

Setting the Maximum Information Rate

The maximum Ethernet throughput of the link can be limited. The default setting is Best Effort, where the highest information rate available for the link conditions and settings is used (see *Figure 4-26*). It does not affect the capacity of TDM services.

For example:

If the Link Budget Calculator or air conditions limit the capacity to X Mbps, and suppose that you use Y (< X) Mbps for TDM services, then you are left with
X - Y=Z Mbps for Ethernet.

Suppose for example, that Z = 20 Mbps.

As a service provider, you can decide to sell a package based on 10 Mbps and charge $P1 for it, or 15 Mbps for $P2 > P1. The MIR setting allows you do this.

The default value is "best effort" which gives Z above.

Note

The MIR setting is independent per direction. The minimum value is 256 Mbps.

The maximum value will be the minimum between Z above and:

- *10 Mbps for Intrepid Series Radio 10M*
- *50 Mbps for Intrepid Series Radio 50M*
- *100 Mbps for Intrepid Series Radio 100M.*

✱ **To set the Ethernet information rate:**

1. From the **Configuration** menu, select the site to reconfigure.

   The Configuration dialog box opens.

2. Click **Advanced > Ethernet.**

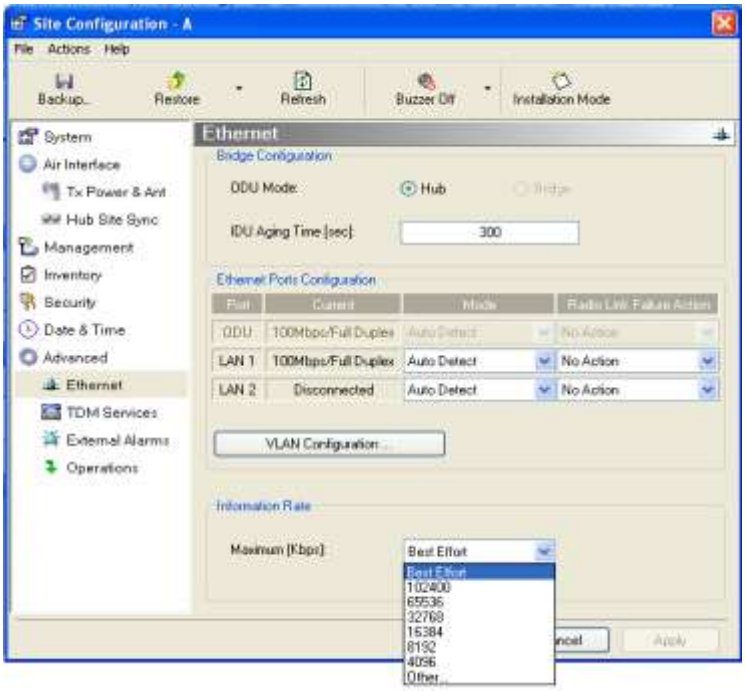


Figure 4-27. Selecting MIR

3. In the Information Rate pane, use the drop-down menu to select the maximum Information Rate.
   - Select **Other** to define the throughput with 1 kbps resolution
   - Select **Best Effort** for the highest information rate possible for the link conditions and settings.
4. Click **Apply** to save the changes.

Configuring VLANs

VLAN tagging enables multiple bridged networks to transparently share the same physical network link without leakage of information between networks. IEEE 802.1Q is used as the encapsulation protocol to implement this mechanism over Ethernet networks.

Note *If you are using a PoE device, this feature is unavailable. You may skip this section.*

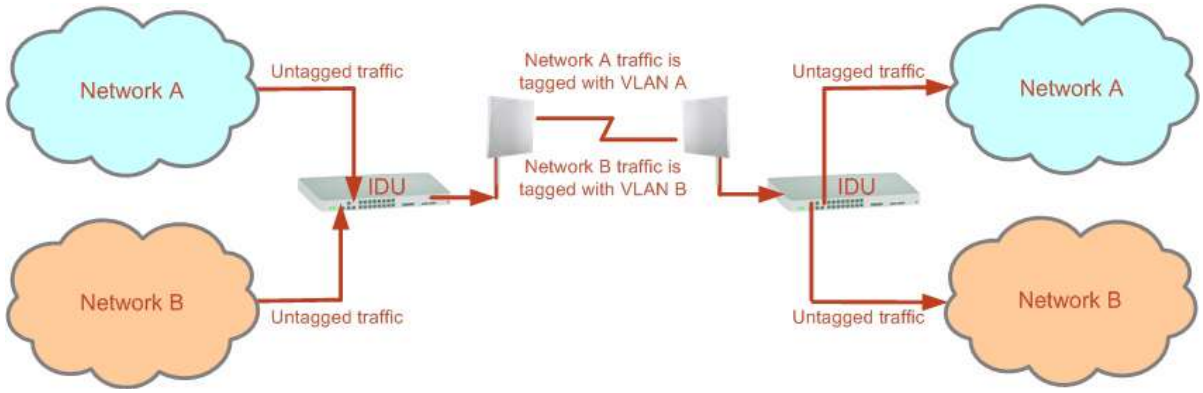


Figure 4-28. Two Network Using the Same Link with VLAN Tagging

Note *Link Manager uses the terms VLAN ID and VID interchangeably to denote a VLAN identification number.*

QinQ (Double Tagging) for Service Providers

QinQ is useful for service providers, allowing them to use VLANs internally in their "transport network" while mixing Ethernet traffic from clients that are already VLAN-tagged.

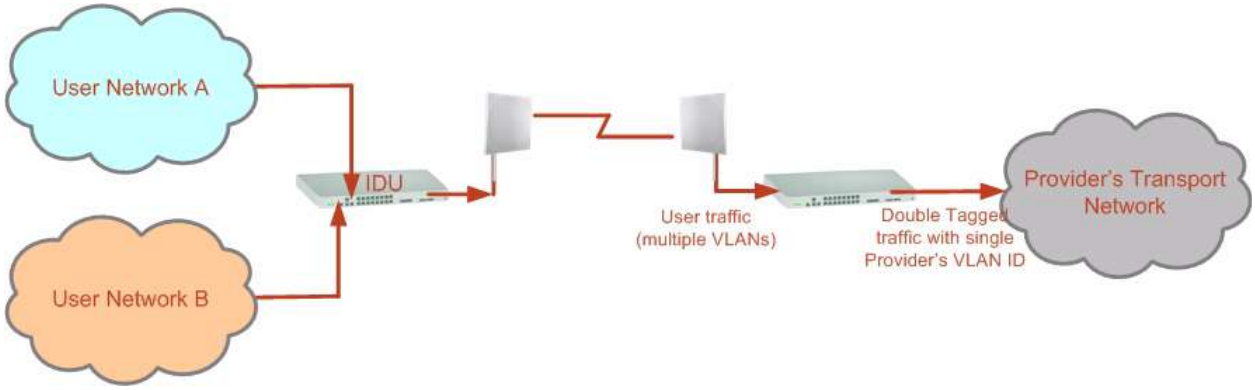


Figure 4-29. Separating Client Data Streams Using Double Tagging

The outer tag (representing the provider VLAN) comes first, followed by the inner tag. In QinQ the EtherType = 0x9100. VLAN tags may be stacked three or more deep.

When using this type of "provider tagging" you should keep the following in mind:

- Under Provider Tagging, the system double-tags egress frames towards the Provider's network. The system adds a tag with a VLAN ID and EtherType = 0x9100 to all frames, as configured by the ser¬vice provider (Provider VLAN ID).
- The system always adds to each frame, tags with VLAN ID and EtherType = 0x9100. Therefore,

- For a frame without a tag – the system will add a tag with VLAN ID and EtherType = 0x9100 so the frame will have one tag
- For a frame with a VLAN tag – the system will add a tag with VLAN ID and EtherType = 0x9100 so the frame will be double-tagged
- For a frame with a VLAN tag and a provider tag – the system will add a tag with VLAN ID and EtherType = 0x9100 so the frame will be triple-tagged and so on.

VLAN Untagging

VLAN untagging means the removal of a VLAN or a provider tag.

Port Functionality

The VLAN functionality is supported by all LAN and SFP ports in the IDU.

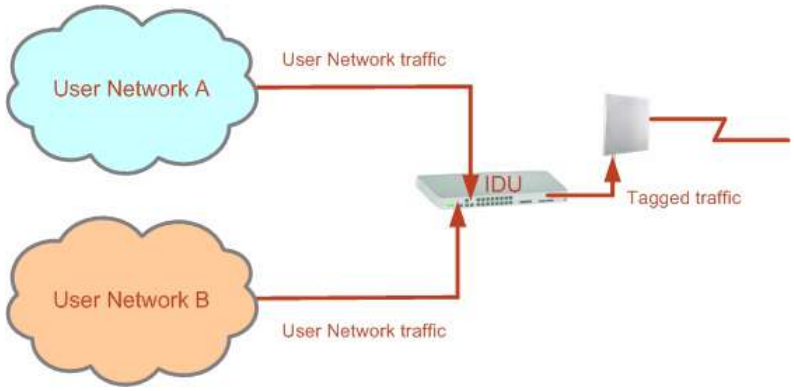
Each port can be configured how to handle Ethernet frames at the ingress direction (where frames enter the IDU) and at the egress direction (where frame exit the IDU).

The configuration is independent at each port.

Ingress Direction

Transparent – The port 'does nothing' with regard to VLANs, inbound frames are left untouched.

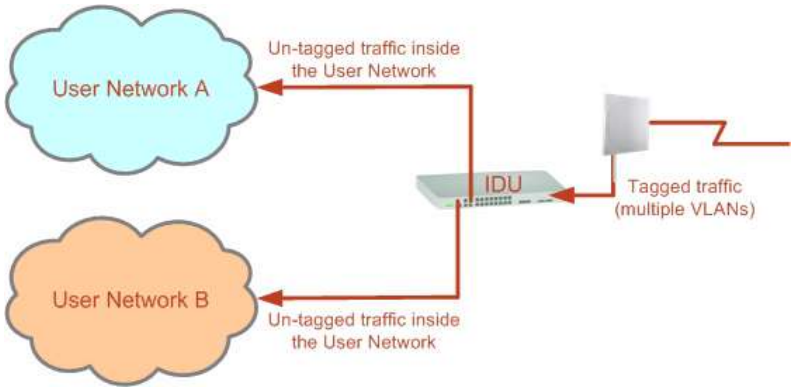
Tag – Frames entering the port without VLAN or QinQ tagging are tagged with VLAN ID and priority, which are pre-configured by the user. Frames which are already tagged at ingress are not modified.



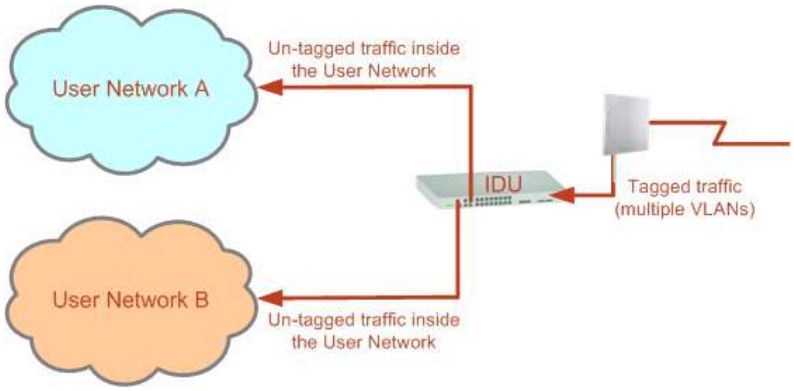
Egress Direction

Transparent – The port 'does nothing' with regard to VLANs, outbound frames are left untouched.

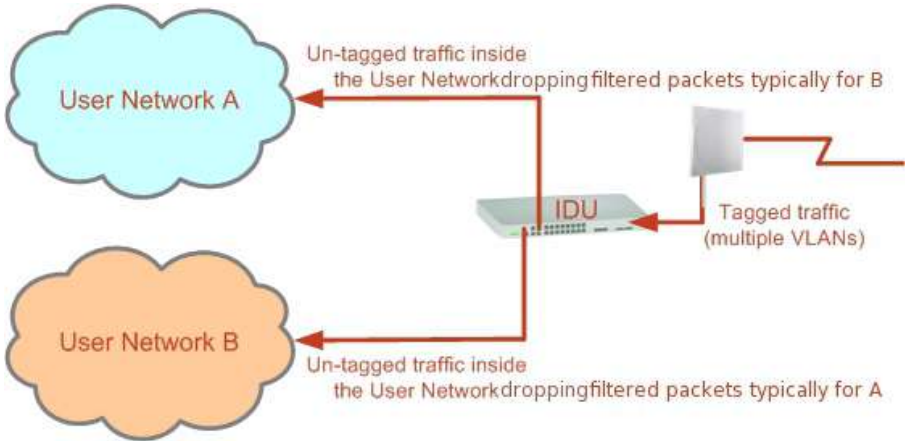
Untag all – All frames are untagged.



Untag selected VIDs – Untags only frames tagged with one of the user defined VIDs. You can define up to eight VIDs per port. Other frames are not modified.

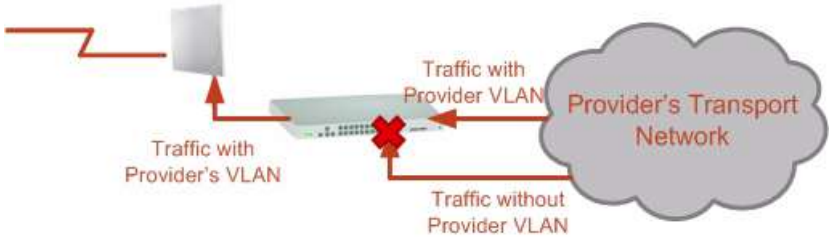


Filtered VLAN IDs at egress – This setting allows for mutual filtering of multiple ingress tags not relevant at the egress end.



Provider tagging – With provider tagging, the system double-tags egress frames towards the provider's network. All frames are tagged QinQ with a VLAN ID, which is configured by the service provider (provider VLAN ID).

With this setting, ingress frames which are not tagged with the configured provider VLAN ID are blocked (filtered).



Note *Each port can be configured independently to a tagging mode. However, only a single provider VLAN ID can be defined per IDU.*

Provider tagging without filtering – This setting functions like provider tagging. However, all ingress frames are passed through.

VLAN Configuration

VLAN IDs are used by RAD products in three separate contexts: management VLAN, traffic VLAN and Ethernet ring. It is recommended that you use different VLAN IDs for each purpose.

Management Traffic and Ethernet Service Separation

You can define a VLAN ID for management traffic separation. You should configure the system to prevent conflicts as detailed below.

When configured for the default operational mode, a "provider port" will handle ingress traffic as follows:

- Filters frames that are not tagged with the provider VLAN ID
- Removes the provider double tag

Therefore, if a port is configured for management traffic separation by VLAN and as 'provider port', then the received management frames must be double tagged as follows:

- The outer tag has to be the provider's tag (so the frame is not filtered)
- The internal tag has to be management VLAN ID

To avoid mix-ups, best practice is to:

- Separate the management and data ports
- Define only a data port with provider function

All IDU models have two LAN ports so you can easily separate management and Ethernet service.

VLAN configuration is carried out per site. It is up to you to ensure consistency between the link sites. The discussion below is based on Site A, but it also applies to Site B.

Note *Throughout this section, all VLAN IDs must be between 1 and 4094, inclusive. All VLAN priorities must be between 0 and 6, inclusive. The values entered are range-checked. If for example, you enter a VLAN ID of 4095, then 4094 will be reflected back.*

✱ **To configure VLAN tagging for Ethernet service:**

1. From the Ethernet dialog box (Site Configuration > Advanced > Ethernet), click **VLAN Configuration....**

   VLAN Configuration dialog box is displayed.

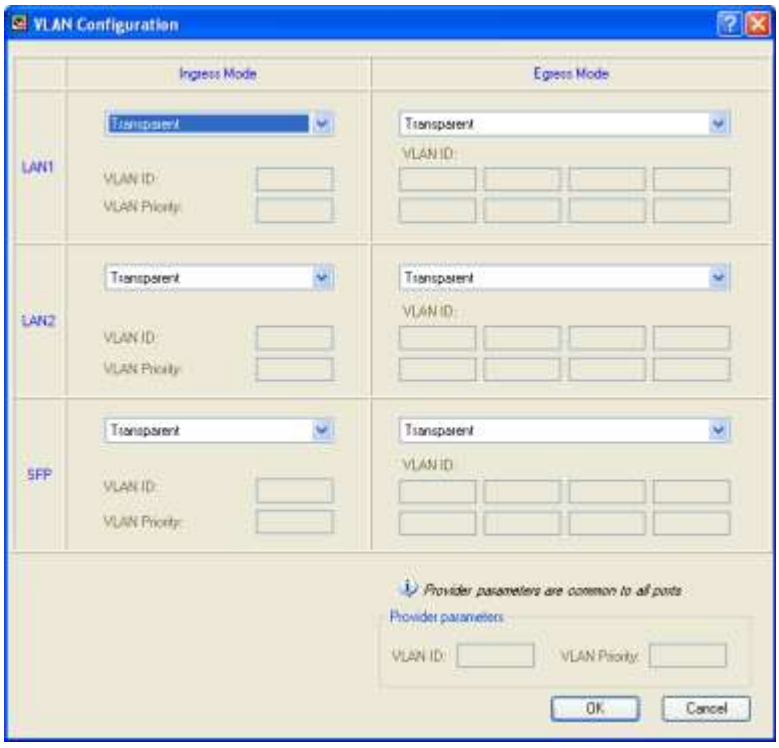


Figure 4-30. VLAN Configuration Dialog Box

2. Select ingress mode for LAN 1, LAN 2 and SFP ports: Transparent or Tag. See *Port Functionality* section above for description of the ingress modes.
3. Select VLAN ID and VLAN priority for the Tag mode.

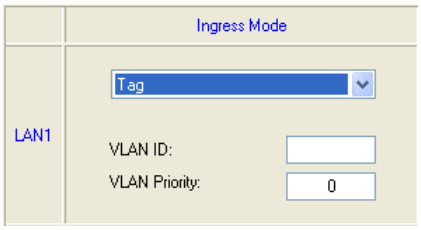


Figure 4-31. VLAN Ingress Mode, Setting VLAN ID and Priority for LAN 1

4. Select egress mode for LAN 1, LAN 2 and SFP ports:
   - Transparent
   - Untag all
   - Untag selected VLAN IDs
   - Provider tagging
   - Provider tagging without filter
   - Filtered VLAN IDs

   See *Port Functionality* section above for description of the egress modes.

   The first two choices, **Transparent** and **Untag** all require no further action.

   Untag selected VIDs causes the eight VLAN ID fields to become available:

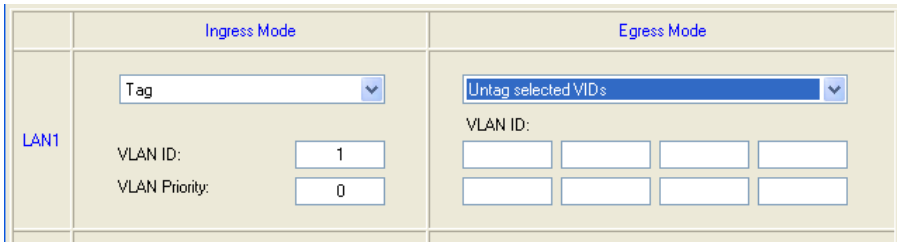


Figure 4-32. Untagging Selected VIDs

You may nominate up to eight VIDs for untagging; beyond simple range checking, there is no other validation.

Both **Provider Tagging** and **Provider Tagging without Filter** enable the provider parameters fields:

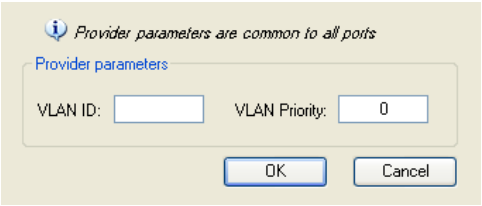


Figure 4-33. Provider Parameters

There is of course only one Provider VLAN ID. It is most likely yours, as the provider!

Filtered VLAN IDs enables you to filter and block only frames tagged with one of the user defined VIDs. You can define up to eight VIDs per port. Other frames are not modified and are forwarded transparently.

5. When you are finished, click OK to save your entries.

Configuring the QoS

The Quality of Service (QoS) feature is available for links using Intrepid Ultra Series Radio radios. To use the facility you must be familiar with the use of VLAN (802.1p) or Diffserv.

QoS is a technique for prioritization of network traffic packets during congestion.

Intrepid Ultra Series Radio links support two classification criteria: VLAN- or Diffserv-based.

Based upon the classification criterion chosen, received packets will be mapped into one of four quality groups: Real time, Near real time, Controlled load and Best effort.

You may partition the total link capacity across the four quality queues. The default weights as percentages are shown in *Table 4-1*.

Further, you may also limit the maximum information rate (MIR) for each queue per site.

Table 4-1. Default priorities and Allocation by VLAN ID and Diffserv

Quality Queue	Priority		REDAT %
	Diffserv	VLAN	
Real time	48–63	6–7	15
Near real time (responsive applications)	32–47	4–5	20
Controlled load	16–31	2–3	25
Best effort	0–15	0–1	40

Note

REDAT measures remaining Ethernet throughput after reduction of bandwidth used by TDM channels. Use the Link Budget Calculator to see how much remaining bandwidth is available for Ethernet.

You may set up QoS from either the Installation or Configuration wizards. Before doing so, set up for VLAN (see *Configuring VLANs* above) or Diffserv, depending on which you intend to use.

❋ **To configure QoS:**

1. Using either the Installation or Configuration wizards, navigate to the Services window and chose the QoS tab.

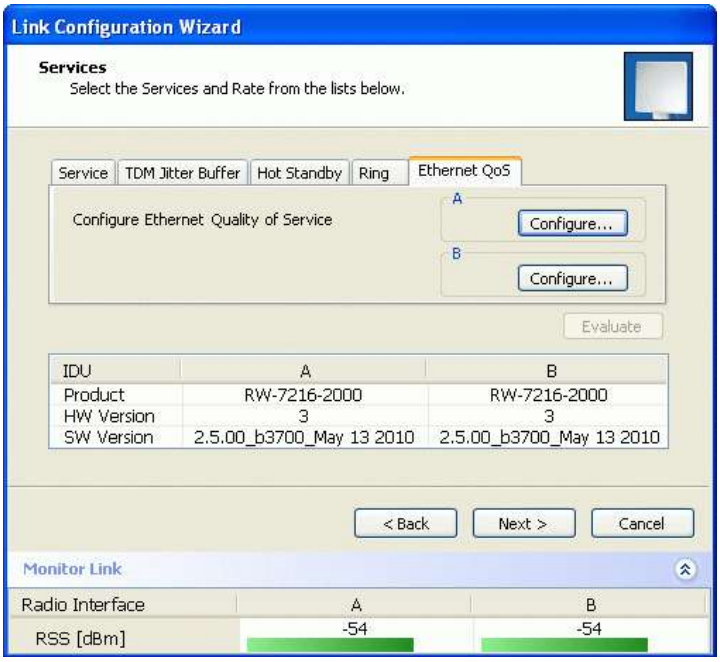


Figure 4-34. Services Window with QoS Selected

Note *Although QoS is a link-oriented feature, each site may have its own separate parameters.*

Click the **Configure** button for a site.

2. Select classification mode: 802.1p (VLAN) or Diffserv.

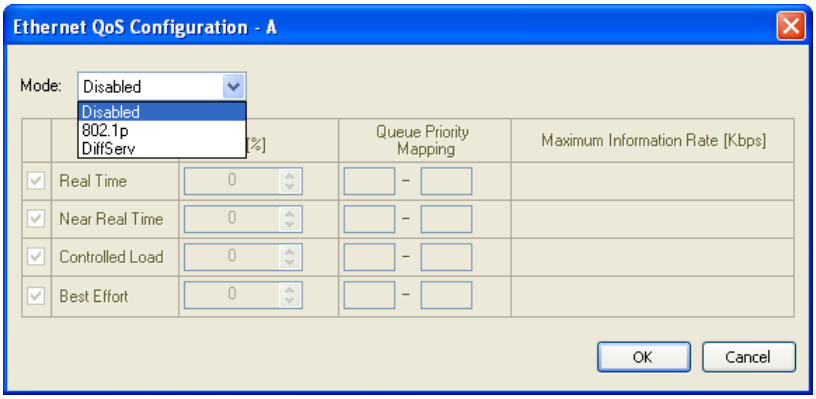


Figure 4-35. Selecting Classification Mode

3. Configure QoS parameters for selected classification mode.

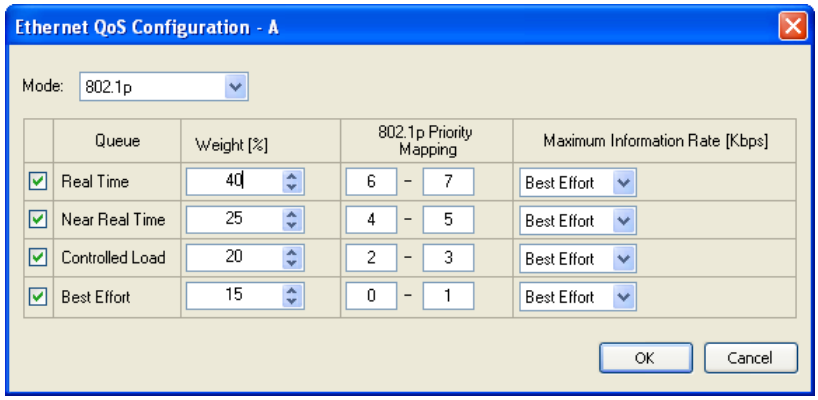


Figure 4-36. Configuring 802.1p Parameters

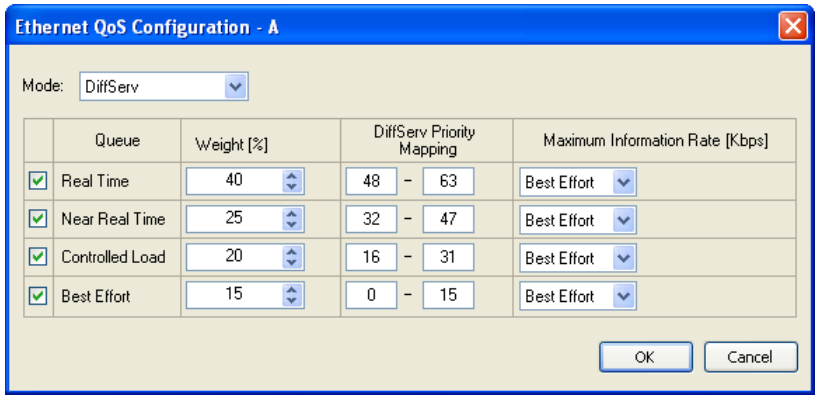
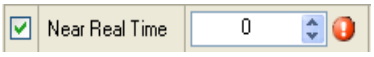


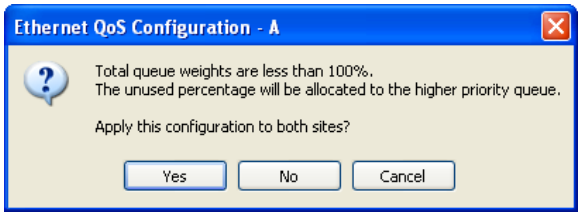
Figure 4-37. Configuring Diffserv Parameters

- If you over-book the Weight column, the last entered field will be reduced so that the total is 100%.
- No weight field may be left zero. If you do, you will not be able to proceed until it is set to something:

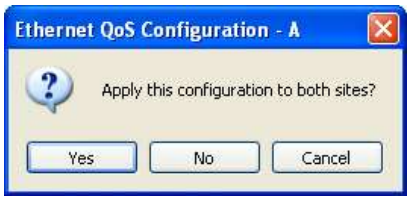


This reflects the implementation policy under which no checked queue may be completely starved. If you really do not want to use a queue under congestion, uncheck it.

- If you are under-booked, you will receive this notice:



- In any event, you may automatically apply the same settings to both link sites:



Choose a Maximum Information Rate (MIR) for each queue.

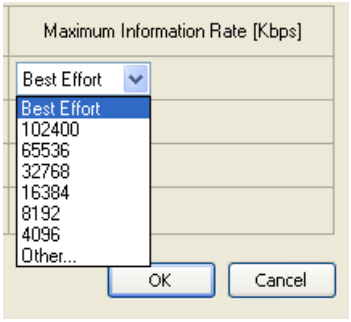


Figure 4-38. Selecting MIR

4. If you previously used Site > Ethernet > Maximum Information Rate to globally limit the site, then your choice in *Figure 4-38* will also be limited.
5. Click **OK** on the exit dialog to accept the settings. If you did not use these settings for the opposite site, you should configure it now.

✱ **To disable QoS:**

- Set the Mode to Disabled (see *Figure 4-35*).

4.5 Performing Additional Tasks

This section describes additional operations supported by the Intrepid Series Radio management software, including the following:

- Displaying inventory
- Changing passwords
- Setting date and time
- Configuring external alarm inputs
- Reinstalling the wireless link
- Configuring link security
- Muting the beeper
- Resetting the unit.

Displaying the Inventory

✱ **To view the inventory data:**

1. Click **Configuration** from the main menu.
2. Select which site to configure.

   The configuration dialog box opens.
3. Select **Inventory** (*Figure 4-39*).

Note

This screen is for viewing purposes only.

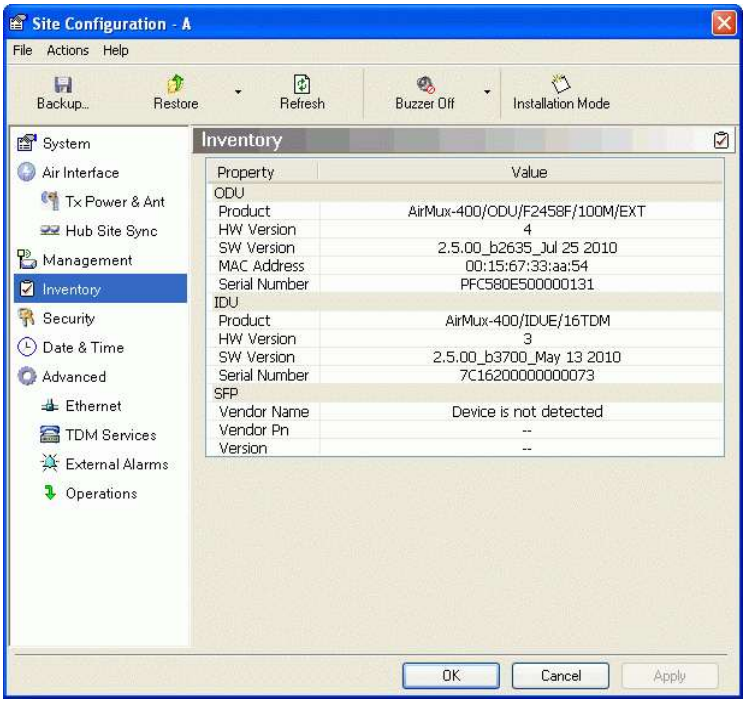


Figure 4-39. Inventory Screen

Changing Passwords

There are two passwords necessary to use the Intrepid Series Radio system. The first is encountered when running the management software, the second, the link Password is used for encryption purposes and is found when installing or configuring the link.

Changing the Management Password

✱ **To change the management password**

1. From the Tools menu, select Change Password
2. The Change Password dialog box appears.
3. Enter current password, and new password.
4. Click **OK** to confirm.

Changing the Link Password

Intrepid Series Radio Link is encrypted using Advanced Encryption System (AES) using a 128 bit dynamic key. During the installation process a Link Password must be set. An Initial encryption key is generated. Each time a link is established the Encryption key is validated. If the validation failed the link is established but no service or configuration is allowed. In this state the user can change the link password of each of the sites.

✱ **To change the link password:**

1. From the Configuration dialog box, select the **Security** tab
2. Click **Change** next to the Link Password field box.

   The Change Link Password dialog box appears.
3. Enter the current link password.

4. Enter the new password.
5. Enter the new password again in the Confirm box.

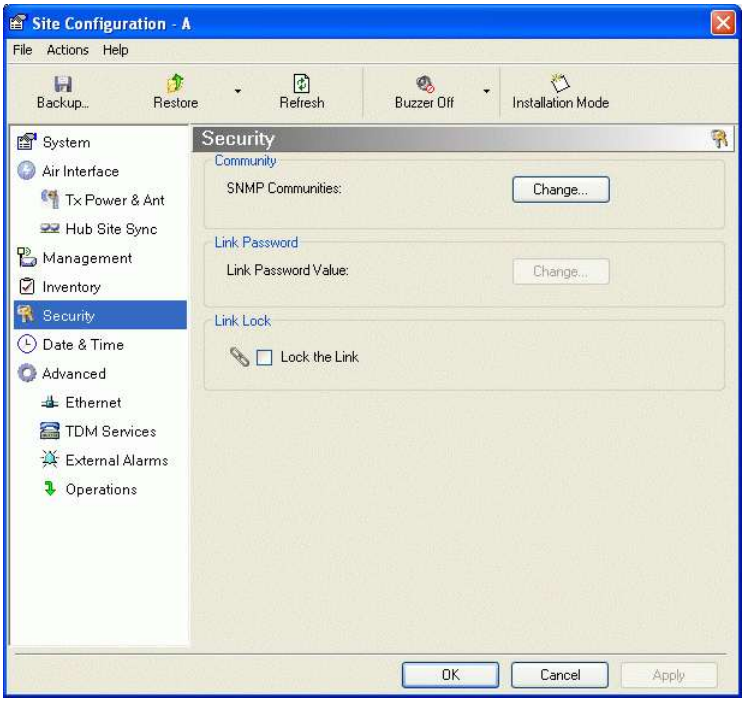


Figure 4-40. Security Screen

Restoring Link Password

In case of a forgotten link password, the user may enter the key password supplied with the product. The key password may be obtained from customer support after validation of the device MAC address. The user may change the link password of both sides of the link at any time using the Link Configuration Wizard.

✱ **To enter the key password:**

1. From the Configuration dialog box, select the **Security** tab.
2. Click **Change** next to the Link Password field box.

   The Change Link Password dialog box appears.
3. Click the **Forgot Link Password** button.

   The Key Link Password dialog box appears.
4. Type the key link password.

   A new link password may now be set.

Setting the Date and Time

The ODU maintains a date and time value. The date and time value can be synchronized with any Network Time Protocol (NTP) version 3 compatible server. (Windows XP is configured by default as a server).

On power-up the ODU configures the initial date and time using an NTP server. If the server IP is not configured or is not reachable, a default time is set.

When configuring the NTP server IP, you should also configure the offset from the Universal Coordinated Time (UTC). If there is no server available, you can either set the date and time, or you can set the manager workstation time. Note that manual setting is not recommended since reset, power up, or synchronization with an NTP server will override the setting.

Note

- *The NTP uses UDP port 123. If a firewall is configured between the ODU and the NTP server this port must be opened.*
  (Windows XP command w32tm /stripchart /computer:<server IP> can be used to check the NTP server connectivity).
- *It can take up to 8 minutes for the NTP to synchronize the ODU date and time.*

✱ **To set date and time:**

1. Click **Configuration** from the main menu.
2. Select which site to configure.

   The Configuration dialog box opens.
3. Select Date & Time (see *Figure 4-41*).

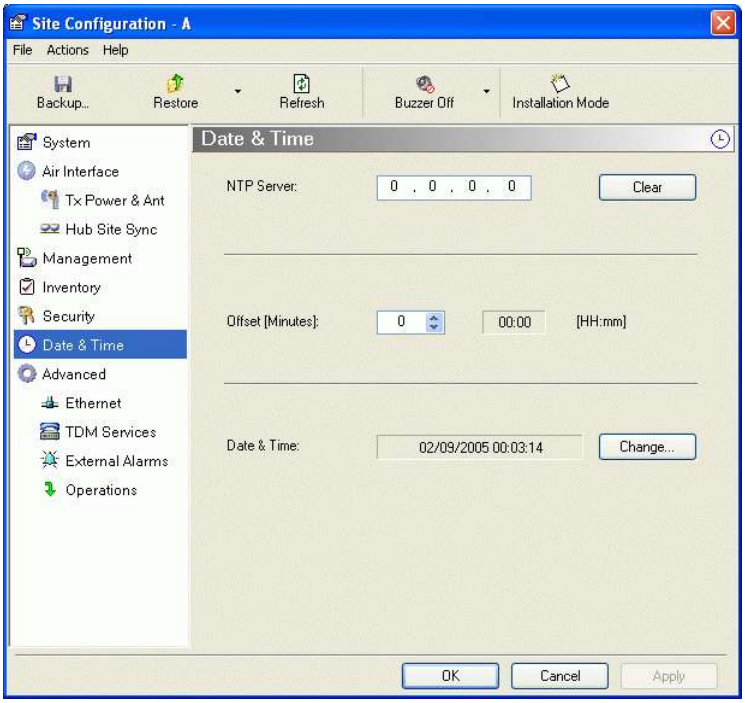


Figure 4-41. Date and Time, NTP Synchronization

4. If entering an address for the NTP Server, click **Clear**, and then enter the new address.
5. Set the Offset value (minutes ahead or behind the GMT).
6. To manually set the date and time, click **Change** (*Figure 4-42*) and edit the new values. The ODU time can be locked to a PC clock by checking the corresponding box appears on the Change screen.

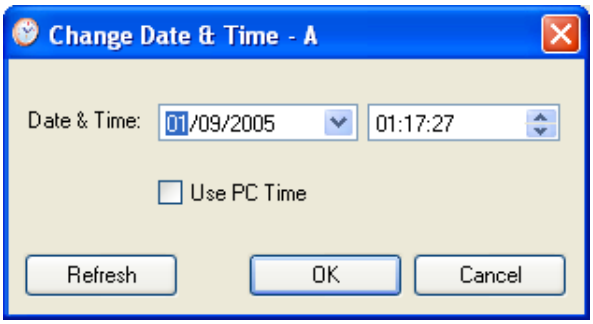


Figure 4-42. Manually Changing Date and Time

Locking the Link

Link Lock is a part of the security concept intended to meet a form of abuse encountered in the field. It is designed to prevent the situation where a remote ODU can be stolen and used as a "pirate" link to steal services or information. The Link Lock feature actually locks the local ODU to be synchronized ONLY to specific remote ODU. It is a site-oriented feature. The lock can only be set from a live link. It is based on MAC authentication and is site-oriented and activated on a per ODU basis. For example, if you lock the Site B ODU to the Site A ODU, you must still lock the Site A ODU to the Site B ODU to ensure complete two way locking.

Link Lock can only be removed when the link is unsynchronized. In such a case, an alarm is raised by the Link Manager.

✱ **To lock a link:**

1. Click **Configuration** from the main menu.
2. Select which site to configure.

   The Configuration dialog box opens.
3. Choose Security.

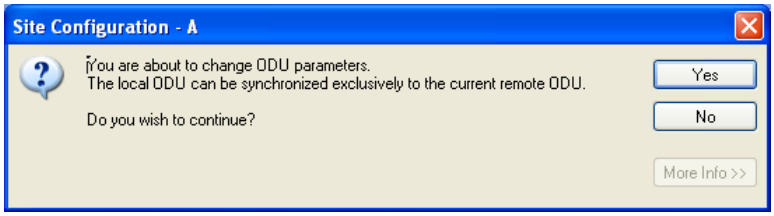
   The Security dialog box is displayed (*Figure 4-43*).

Figure 4-43. Security Configuration

4. Select the Link Lock checkbox.

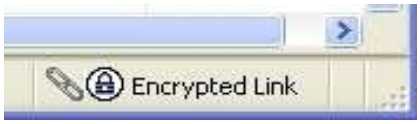
   Click **OK**.

5. You are asked to confirm the lock:



6. Click the **Yes** to confirm the link lock.

   The Lock the Link check box becomes unavailable and a link icon appears in the status bar on the bottom right of the Link Manager window.



7. Repeat the procedure for Site B.

✱ **To revert the link lock:**

- Reset ODU at either site to restore the link lock to its previous setting.

Muting the Buzzer

The ODU alignment tone becomes audible as soon as power is supplied, and continues until the ODUs are aligned and the link established.

It is possible to mute the tone during regular operation of the link. It must be enabled when performing the alignment procedure.

✱ **To mute the beeper:**

1. Click on **Configuration** in the Menu bar and select the relevant site.

   The Configuration dialog box opens.

2. In the Configuration dialog box, click the **Buzzer** button. The button toggles between on and off.

   The buzzer stops.

✱ **To restore the buzzer:**

1. Click **Configuration** in the Menu bar and select the relevant site.

The Configuration dialog box opens.

2. In the Configuration dialog box, click the **Buzzer** button. The button toggles between on and off.

   or

   Select **Auto** to have the buzzer beep only in install mode.

   The buzzer starts.

Setting External Alarm Inputs

The IDU has two external alarm inputs and two external alarm outputs in the form of dry-contact relays. The Alarm port is located on the front panel of the IDU-E or on the rear panel of IDU and is a 25-pin D-type female connector, see *Appendix A* for the pinout. The user enables or disables each of the alarms and can configure the text that appears in the alarm trap. The ODU sends the alarm within less than a second from actual alarm trigger.

✱ **To set the external alarm inputs:**

1. Open the Site Configuration Alarms configuration by clicking **Configuration > Advanced > External Alarms.**

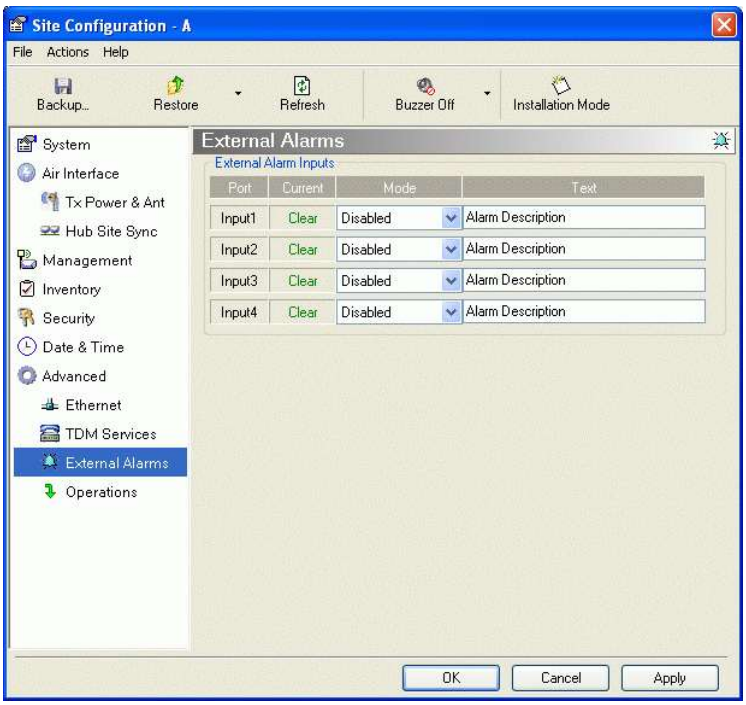


Figure 4-44. External Alarm Configuration

2. Enter a description of the alarms in the fields.
3. Click **Apply** to save.

Viewing Air Interface Status

You can view air interface details via the Air Interface dialog box.

To view air interface status:

Select a site to configure.

Select Air Interface.

The following screen is displayed, detailing air interface status.

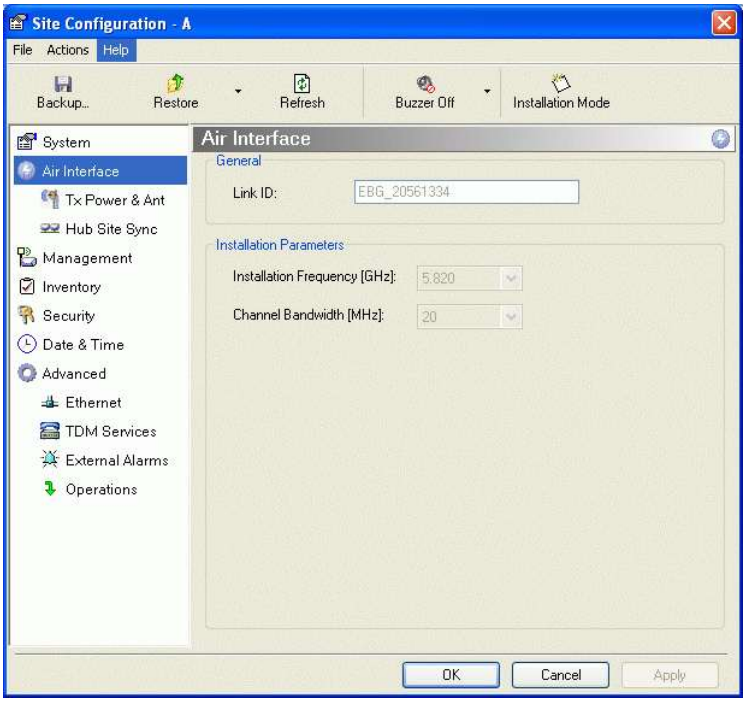


Figure 4-45. Air Interface Status

Viewing HSS Status

If Intrepid Series Radio operates in the HSS mode, you can view the current hub site synchronization status. See *Appendix G* for HSS configuration instructions.

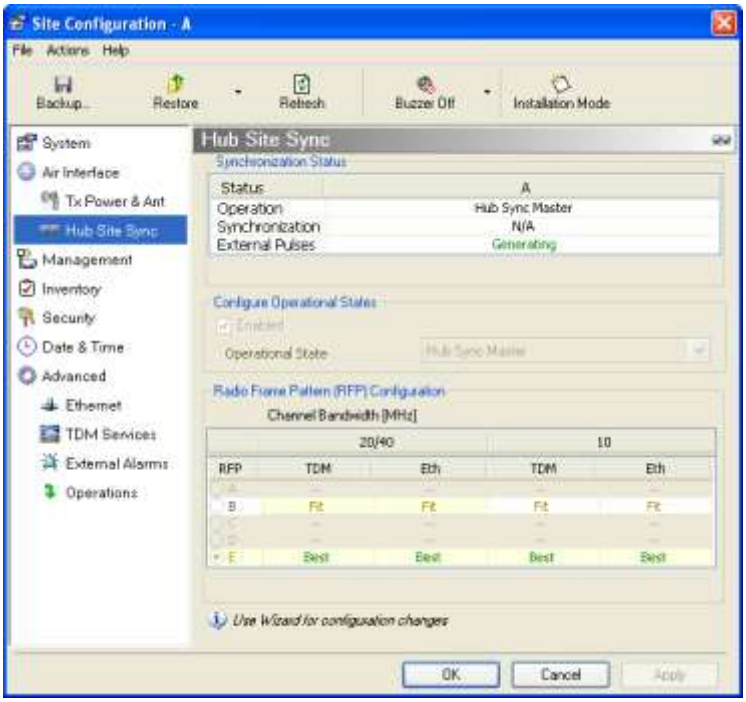


Figure 4-46. HSS Status Screen

Viewing TDM MHS Status

If Intrepid Series Radio is a part of the Managed Hot Standby (MHS) setup, you can view the current MHS status via the TDM Services screen. See *Appendix H* for MHS configuration instructions.

Figure 4-47. TDM Services (MHS) Status Screen

Managing Configuration Files

Saving the Intrepid Series Radio Configuration in a File

Link Manager allows you to backup the ODU software of both units of a link to the managing computer as binary files. Each site is backed up in a separate file. Backup files are matched to the MAC address of the site ODU. The default backup file name is constructed from the ODU IP address and the date as in the following example:

Backup of Site A as used in our examples:

192.168.1.101_1.12.2009.backup

If you perform more than one backup on a given date you will need to change the file name to something like this:

192.168.1.101_1.12.2009_00.backup

192.168.1.101_1.12.2009_01.backup

✱ **To save the configuration in a file:**

1. Click **Configuration** from the main menu.
2. Select which site to backup.

   The configuration dialog box opens.
3. Click **Backup**.
4. In the Save As dialog box, indicate in which folder and under what name configuration file is to be saved, and click **Save**.

Restoring a Configuration File

Backup files can be uploaded from the managing computer. You may choose a full software restore or configuration-only restore.

❋ **To restore a configuration file:**

1. From the **Configuration** menu, select the site to reconfigure.

   The Configuration dialog box opens.

2. Click **Restore**.

   The Full Restore and Configuration Restore options are displayed.

3. Select the desired restore mode.

   The standard Open file dialog box is displayed.

4. From the Open File dialog box, navigate to your backup storage area and choose file to upload and click **OK**.

Reinstalling the Link

It may be necessary to reinstall the link if the ODUs should need to be realigned.

Note *Activating the Installation Mode causes disruption in service for approximately 15 seconds.*

❋ **To reinstall the link:**

1. Click **Configuration** in the Menu bar and select any one of the sites.

   The Configuration dialog box opens.

2. Click the **Installation Mode** button in the Configuration dialog box.

   A message box asking if you want to enter install mode appears.

3. Click **Yes** to continue.

   Intrepid Series Radio enters install mode and the beeper starts beeping.

4. Realign the ODUs and complete the Installation wizard (see *Chapter2*).

Setting the Link Manager Interface Language

If Link Manager interface localizations are available, you can set its interface language to be other than default (English).

❋ **To select the Link Manager interface language:**

1. From the Advanced tab of the Preferences dialog box (Tools > Preferences), select the required interface language from the Interface Language drop-down box.
2. Click **OK** to finish.

Figure 4-48. Preferences Dialog Box, Advanced Tab

Resetting Intrepid Series Radio

Note

Resetting the link causes service disconnection.
In order to maintain the link configuration, reset the remote Intrepid Series Radio first.

❋ **To reset Intrepid Series Radio:**

1. From **Maintenance**, reset the remote Intrepid Series Radio.
2. From **Maintenance**, reset the local Intrepid Series Radio.

❋ **To reset to factory defaults:**

1. Click **Configuration** in the Menu bar and select any one of the sites.

   The Configuration dialog box opens.
2. Select **Operations** in the Configuration dialog box.

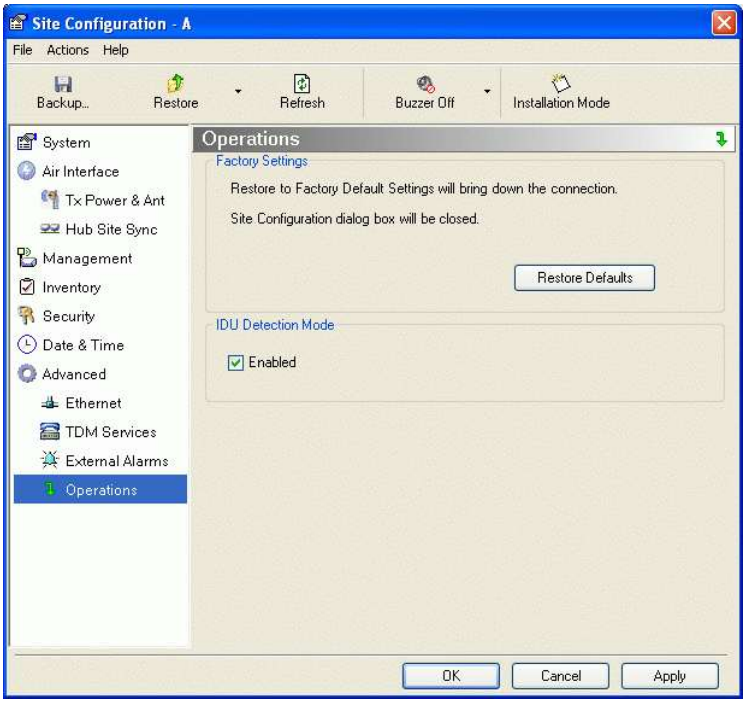


Figure 4-49. Restoring Defaults

3. To disable IDU detection, toggle the IDU Detection Mode check box.

   An ODU always tries to detect the IDU to which it is connected. IDU Detection is effected by an IDU responding to special ODU packets.

   If a PoE device is in use, the detection packets spread to the containing network and may cause flooding. In such a case, the IDU Detection feature should be disabled.

4. Click the **Restore Defaults** button.

   A message box asking if you want to restore factory default appears.

5. Click the check box if you want to keep the current IP settings.
6. Click **Yes** to continue.

Chapter 5

Monitoring and Diagnostics

This chapter describes the GE MDS Intrepid Series Radio diagnostic functions, which include:

- Monitoring performance
- Detecting problems
- Handling events
- Troubleshooting
- Replacing an IDU
- Running diagnostic loopbacks on TDM ports
- Frequently asked questions
- Technical support.

5.1 Monitoring Performance

GE MDS Intrepid Series Radio constantly monitors traffic over the radio link and collects the following statistics data:

- Site 1/Site 2 received traffic rate (in Mbps)
- Site 1/Site 2 received frames rate (in Mbps)
- Radio signal strength (in dBm)
- Error (blocks).

The statistics (monitor) log and event log can be saved as TXT files. New alarms are automatically added to the text file, as they enter the event log.

Viewing Performance Reports

The Performance Monitor Report displays performance views of each of the interfaces (see *Figure 5-1*) (Ethernet performance is not collected in PoE systems.) Several performance data are collected for each of the interfaces (ES, SES, and UAS), as well as Specific data per Interface type (e.g., TX and RX bytes for Ethernet). For the Air Interface, user defined thresholds data are collected. Refer to *Table 5-1* and *Table 5-2*.

Data is collected and selectively displayed based on three time intervals as selected by the **Interval** radio buttons:

- Current (t=0)
- 15 minutes Intervals
- Daily.

UAS – This parameter counts the time the air link was not providing any service. There are several possible reasons for this situation; one of the sites has a power failure, high interference, maintenance operation, etc.

Radio **BBER** Threshold – This parameter counts the seconds in which the radio performance is below a user specified threshold. The threshold is measured in percent. The threshold can be set from 0.1% up to 50%.

For links with Ethernet only service, 8% threshold is recommended and not 1% meaning that for 8% threshold, the recommended BBER value should be 0 if there are no problems during the 15 min interval. Since GE MDS Intrepid Series Radio provides a loss less Ethernet service, there is throughput degradation in case of interference. The degradation is proportional to the BBER.

The Radio RSS Threshold can also be used to indicate problems in the radio channel. The expected RSS can be verified by means of the Link Budget Calculator. A value of -5dB from the current RSS is recommended as a threshold.

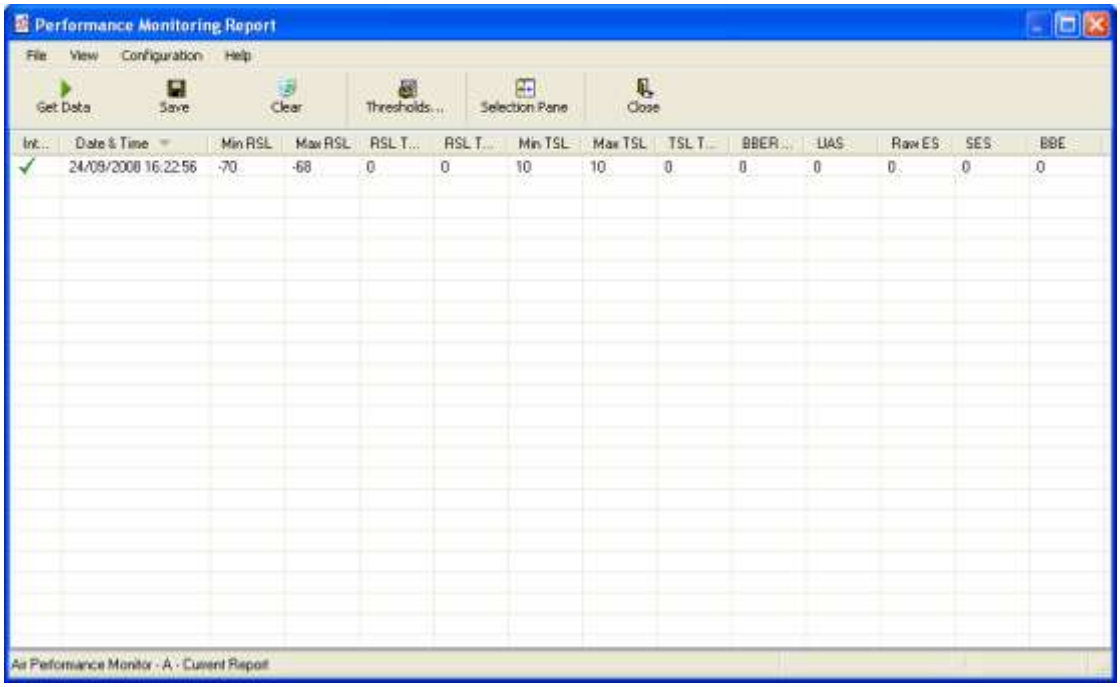


Figure 5-1. Performance Monitoring Report Window

Table 5-1. Performance Counters

Data type	Reported value	Explanation
Generic PM Data	UAS – Unavailable Seconds	Seconds in which the interface was out of service.
	ES – Error Second	The number of seconds in which there was at least an error block. Note that notation of an error block is different per interface.
	SES – Severe Error Second	The number of seconds in which the service quality is low (the actual BBER ratio varies per interface).
	BBE – Background Block Error	The number of error block in an interval.
	Integrity	A flag indicating that the data is valid. Note that the PM data is not valid if not all the values were stored. (Possible reasons are: clock changes within the interval and Power up reset)
Air Interface PM Data	Max RSL	The maximum of the receive signal level (measured in dBm).
	Min RSL	The minimum of the receive signal level (measured in dBm).
	Max TSL	The maximum of the transmit signal level (measured in dBm). (The transmit power is fixed. The value can be changed only by user configuration)
	Min TSL	The minimum of the transmit signal level (measured in dBm).
	RSL Threshold 1	This parameter counts the number of seconds in which the RSL is below the specified threshold.
	RSL Threshold 2	This parameter counts the number of seconds in which the RSL is below the specified threshold.
	TSL Threshold 1	This parameter counts the number of seconds in which the RSL is above the specified threshold.
	BBER Threshold	The BBER Threshold value counts the number of seconds in which the Background Block Error Ratio (BBER) exceeds the specified threshold.
Ethernet Interface PM Data	Received Bytes	The number of Mega bytes received in the specified port within the interval
	Transmitted Bytes	The number of Mega bytes received in the specified port within the interval.

Table 5-2. Action Of The Tool Bar Button Commands

Button	Action
Get Data	Uploads the selected report from the ODU.
Save	Saves the data in a CSV or Text format for additional analysis.
Clear	Removes the current data from the window.
Selection pane	Selects the site, interface, and interval to be displayed.

Button	Action
Threshold	Opens the threshold configuration dialog box (*Figure 5-2*) to set the Air Interface thresholds. Note that threshold change is effected immediately, but it does not change any historical data.
Close	Closes the Performance Monitor Report window.

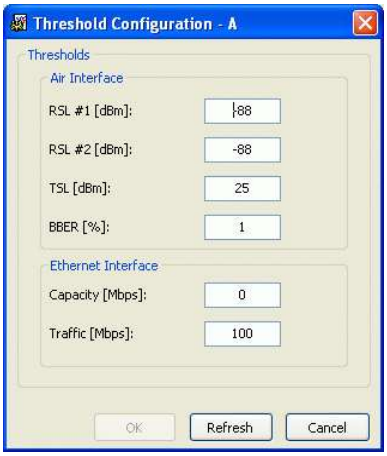


Figure 5-2. Threshold Configuration Dialog Box

RSL Thresholds

Two RSL Thresholds can be defined. They are used as an indicator of problems in the radio channel. You can check the RSS from the Link Budget Calculator results during installation. Values of -5dB and -8dB from the current RSS are typical.

TSL Threshold

A counter is maintained, of the number of second intervals during which Tx power exceeds this threshold.

BBER Threshold

The Background Block Error Ratio is measured as a percentage. The threshold can be set from 0.1% up to 50%.

For links with Ethernet only service, 8% threshold is recommended. If there are no problems during the interval, then for that threshold, the recommended BBER value should be 0. Since the system provides a lossless Ethernet service, there is throughput degradation in case of interference. The degradation is proportional to the BBER.

Ethernet Thresholds – Capacity

This is used as a basis for checking adherence to a Service Level Agreement. It is the number of seconds count that the link capacity falls below the threshold.

Ethernet Thresholds – Traffic

The number of seconds count that received traffic exceeded this threshold. It can be used to measure traffic peaks.

Saving the Monitor Log

✱ **To save the monitor log**:

1. From the **Tools** menu, choose **Preferences**.

   The Preferences dialog box appears (see *Figure 5-3*).

2. Click the **Monitor** Tab.
3. Select the file to save.
4. Click the check box to open the file for saving.
5. Click the ... button and in the Select File dialog box indicate in which folder and under what name the alarm log file is to be saved.
6. Set the time interval for adding data to the file.
7. Click **OK** to save the file.

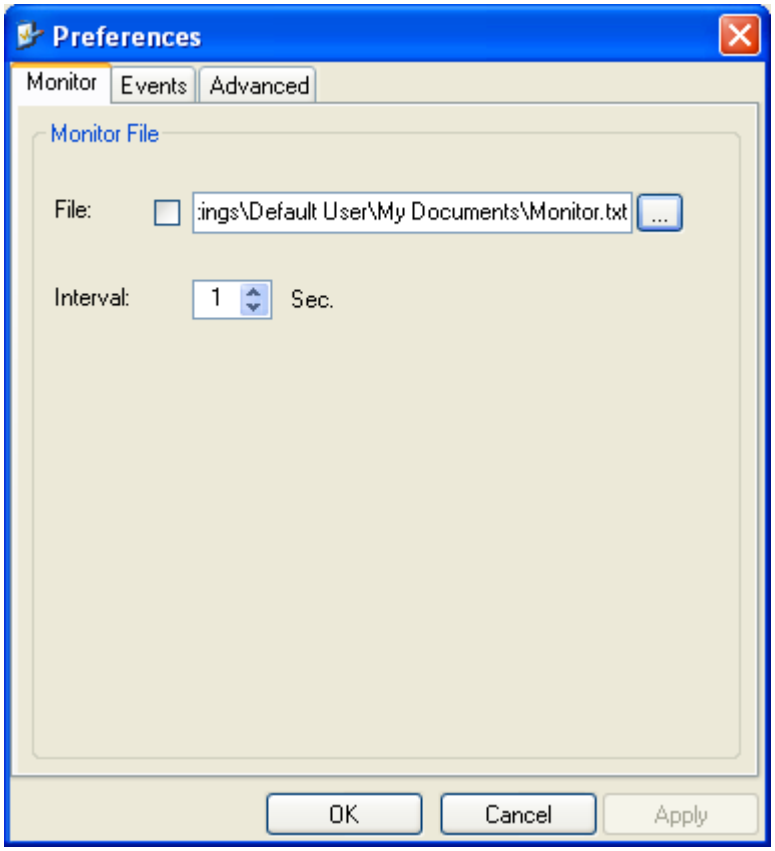


Figure 5-3. Preferences Dialog Box, Monitor Tab

5.2 Detecting Problems

GE MDS Intrepid Series Radio employs the following error and fault detection methods:

- Self-test
- LEDs

- Alarms and traps
- Statistic counters
- Link compatibility check
- Remote power fail indication
- Automatic link data collection.

Self-Test

GE MDS Intrepid Series Radio performs a hardware self-test upon turn-on. The self-test sequence checks the critical circuit functions of the device. The following error messages indicate hardware problems:

- BIT Failed (error code 256) – WAN adapter failure
- BIT Failed (error code 512) – EPROM failure.

LEDs

LEDs located on the front and rear panel panels of the IDU and ODU inform users about hardware failures; IDU-to-ODU, Ethernet and air link disruptions. For the detailed description of LEDs and their functions, refer to *Chapter 3*.

Alarms and Traps

GE MDS Intrepid Series Radio reports compatibility problems, fault conditions of the radio or user links by storing events in the event log and sending traps to the NMS. For the detailed description of the events and instructions on how to use the event log, see *Handling Events* below.

Statistic Counters

The air and service interface performance data is continuously collected during equipment operation. The collected data enables the system administrator to monitor the transmission performance, and thus the quality of service provided to users, for statistical purposes. For detailed description of the statistic counter, see *Monitoring Performance* above.

Link Compatibility Information

GE MDS Intrepid Series Radio indicates the version compatibility via software traps. As new hardware is added to existing networks compatibility issues may arise. An incompatibility issue is indicated to the user via a change of color of the Link Status box on the Main Menu screen. Trap messages in the Event Log indicate the problems or limitations and suggest upgrades when appropriate.

The following Link Status messages are given:

fullCompatibility - different software versions that are fully compatible. Message indicates that upgrade is available.

restrictedCompatibility - different software versions that operate correctly. However, new features are not supported

softwareUpgradeRequired - different software versions with limited operation. The link will operate as Ethernet only; a full service will not be available. The message is software upgrade required.

versionsIncompatibility - different software versions that are not compatible. User needs to perform local upgrades.

Table 5-3. Link Compatibility Trap Messages

Link State	Link State Text	Link Status Color	Site Description	Site Desc. Color	Link Status Color
fullCompatibility	Active	Green	SW Upgrade Available	Yellow	Green
restrictedCompatibility	Active - SW Version mismatch	Magenta (Same as authentication error)	SW Upgrade Recommended	Yellow	Magenta (Same as authentication error)
softwareUpgradeRequired	Active – SW Upgrade Required	Brown (Major)	SW Upgrade Required	Yellow	Brown (Major)
versionsIncompatibility	Not Active - SW Upgrade Required	Red	Local SW Upgrade Required	Yellow	Red

Remote Power Fail Indication

Remote power fail indication indicates to one side that the other side has had a power failure. The failed site sends a final trap indication about the power loss just before powering off.

A Dying-Gasp circuit identifies the power failure at a minimum interval of 20 milliseconds before the IDU crash, during that interval a message notifying the power failure is sent to the remote end.

Alarm output (dry contacts) indicates link loss due to power failure at the remote end.

5.3 Handling Events

GE MDS Intrepid Series Radio detects compatibility problems, fault conditions of the radio or user links, and initiates alarms to alert the user.

Note

To store the Event Log, first define the IP address, subnet mask, default gateway and trap address of the management PC, see Chapter 4 for details.

Alarms (traps) are displayed in the Event Log in the lower panel of the Main Menu screen. The event log may be saved as a TXT file.

The event log includes the following fields:

- Sequential number (ID)
- Date and time stamp
- Message
- Trap source
- IP address of the ODU that initiated alarm.

Table 5-4. GE MDS Intrepid Series Radio Trap Messages

Trap Message	Severity	Remedy
Cannot bind to trap service port. Port 162 is already in use by ProcessName (pid: ProcessId).	Warning	NMS will not catch any traps from target, some other application has grabbed this port
Device unreachable!	Error	Check connectivity to target
Connected to <site_name>	Information	
<site_name> Site will be reset.	Information	
Restore Factory Default Settings in process on Site <site_name>	Information	
Factory Settings: The process was not finished due to connection issues.	Warning	Check connection to the target ODU and repeat the reset
Reset: The process was not finished due to connection issues.	Warning	Check connection to the target ODU and repeat the reset
Cannot Write to Monitor file. There is not enough space on the disk.	Warning	Free some space on disk and retry
Windows Error: <error_ID>. Cannot Write to Monitor file.	Warning	Operating system error
TDM Counters were cleared for both sides	Information	
Identical IP addresses at <local_site_name> and <remote_site_name>	Warning	Set up a different IP to each site
The Product is not identified at the <local_site_name> site.	Warning	NMS is incompatible with the target release
The Product is not identified at the <remote_site_name> site.	Warning	
The Product is not identified at both sites.	Warning	

Trap Message	Severity	Remedy
Product Not Identified!	Warning	
The Manager identified a newer ODU release at the <remote_site_name> site.	Warning	ODU release is newer than NMS release. Wizards are not available. NMS will be used just for monitoring. Upgrade the NMS. (You will get this message as a pop up).
The Manager identified a newer ODU release at both sites.	Warning	
The Manager identified a newer ODU release at the <local_site_name> site.	Warning	
Newer Version identified at the <local_site_name> site.	Warning	ODU release is newer than NMS release. Wizards are not available. NMS will be used just for monitoring. Upgrade the NMS.
Newer Version identified at the <remote_site_name> site.	Warning	
Newer Version Identified!	Warning	

❋ **To view summary of saved alarms**

- From the Tools menu, choose **Active Alarm**.

  The Active Alarms Summary window opens. See *Table 5-5* for an explanation of the command buttons.

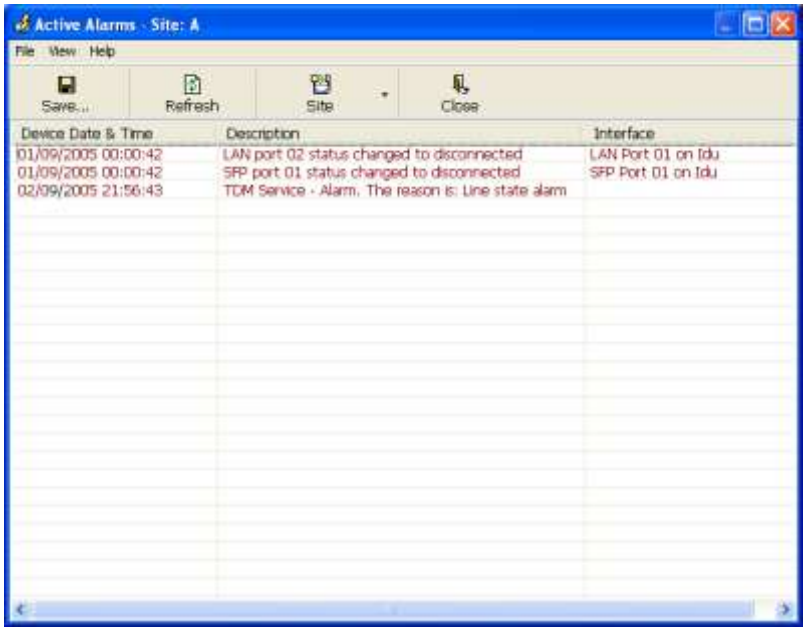


Figure 5-4. Active Alarms Summary

Table 5-5. Active Alarms Command Buttons

Command	Action
Save	Saves the alarms in CSV or text format for further analysis
Refresh	Reads the alarms from the ODU, and displays the alarms
Site	Selects site for the active alarms
Close	Closes the active alarm window

Viewing Recent Events

Each ODU stores the last 256 events.

✱ **To view the last 256 events:**

1. From the **Tools** menu, choose **Recent Events**.

   The Recent Event Screen is displayed.

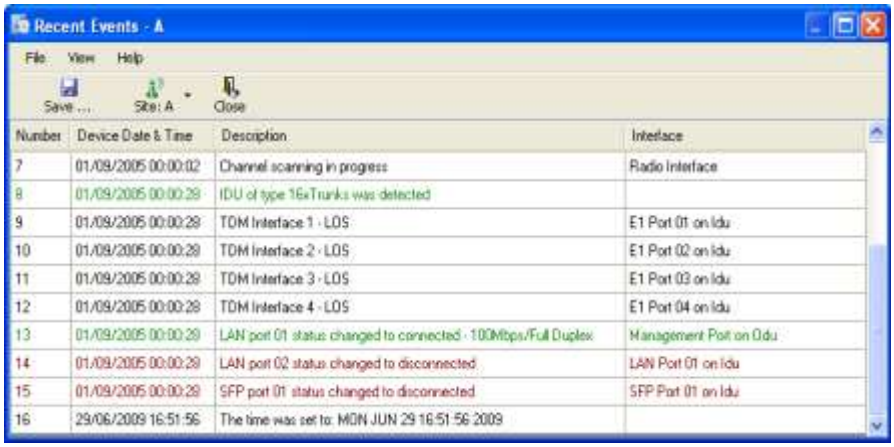


Figure 5-5. Recent Alarms List

2. Use the Site button to switch between sites A and B.
3. Use the Save button to store the events in a tab-delimited list.

Setting the Events Preferences

You can define a color that the traps are displayed in the monitor pane, according to severity of the event. The severity is predefined.

❋ **To set the trap color:**

1. From the **Tools** menu, choose **Preferences**.

   The Preferences dialog box appears.
2. Click the **Events** Tab (see *Figure 5-6*).
3. Select the Event priority type and click on the ... button.

   A color chart opens.
4. Select the desired color.
5. Repeat for all the trap types.

❋ **To set the trap background color:**

- Click **Background Color** to change the text background.

❋ **To reset the trap colors:**

- Click **Reset Settings** to return to the default color settings.

Saving the Events Log

❋ **To save the event log**:

1. From the **Tools** menu, choose **Preferences**.

   The Preferences dialog box appears (see *Figure 5-6*).
2. Click the **Events** Tab.
3. Select the file to save.
4. Click the check box to open the file for saving.
5. Click the ... button and in the Select File dialog box indicate in which folder and under what name the alarm log file is to be saved, and click **OK**.

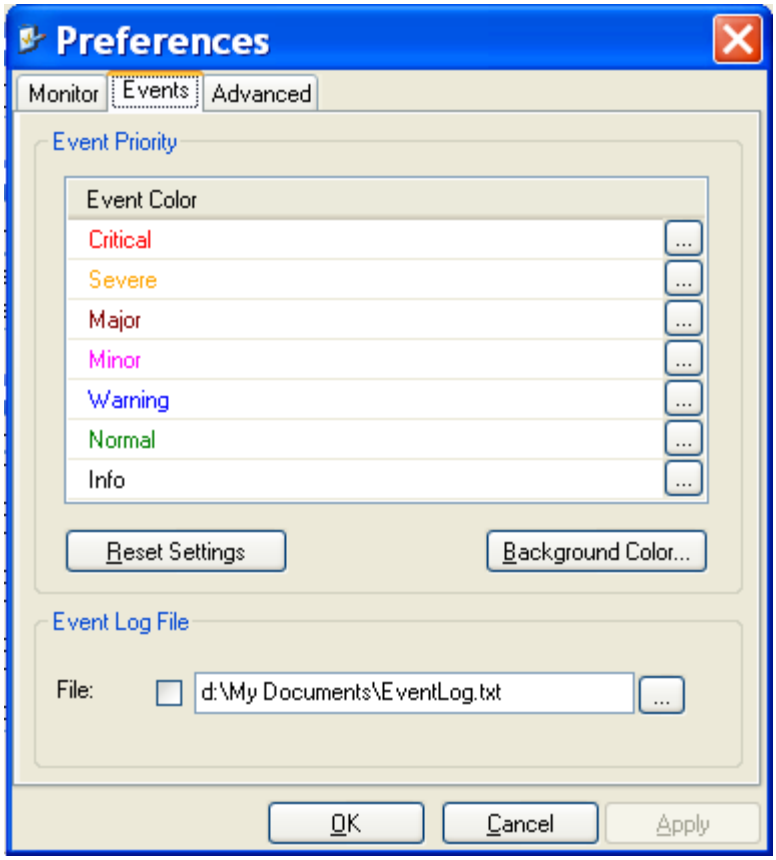


Figure 5-6. Preferences Dialog Box, Event Log Tab

Resetting the Monitoring and Alarm Preferences to Defaults

You can restore all Monitor and Events settings to their original value by using the Advanced Preferences feature.

✱ **To reset the monitoring and alarm preferences to defaults:**

1. From the Tools menu, choose **Preferences**.

   The Preferences dialog box appears.

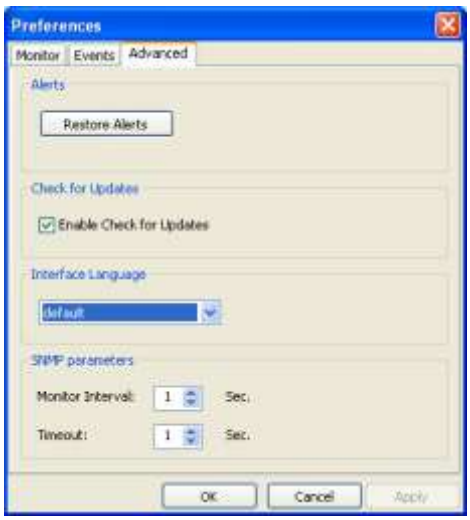


Figure 5-7. Preferences Dialog Box, Advanced Tab

2. Click the **Advanced** tab (see *Figure 5-7*).
3. Click the **Restore Alerts** button.
4. Confirm the operation by selecting **Yes**.

5.4 Collecting Unified Performance Information

The Get Diagnostic Information feature collects all the link and manager information which can be used for diagnostics.

In the event of needing to contact technical support send this file so as to speed up the assistance.

✱ **To get diagnostic information**

1. Click **Help** on the menu bar, select D**iagnostic Information**.

   The Get Link Information dialog box appears. See *Figure 5-8*.

2. Select or deselect the data options. If the file is to be sent to Technical Support leave all options checked.
3. Click **File Path** to get to the directory to save the file in.
4. Click **Start** to save the information.

   The file is saved as **Diagnostic Information.txt**

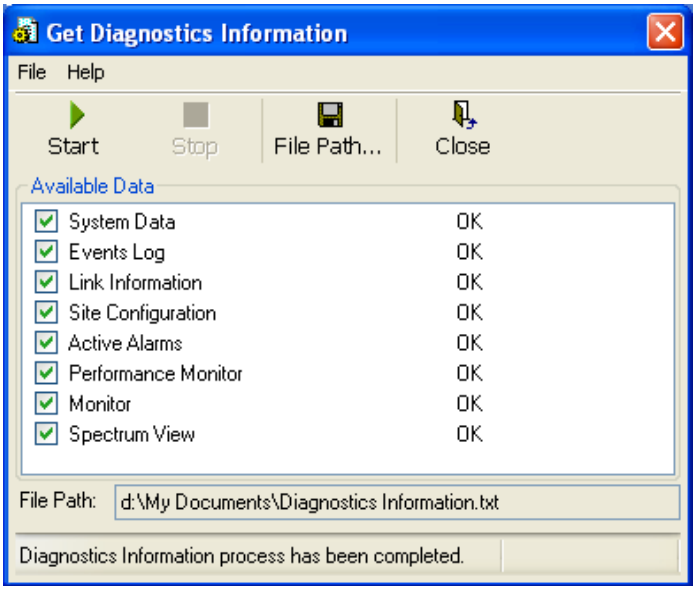


Figure 5-8. Get Diagnostic Information

5.5 Troubleshooting

Use *Table 5-7* and *Table 5-7* to diagnose any faults in the system.

Table 5-6. Troubleshooting

Symptom	Remedy
No power	Verify that AC power is connected to the IDU.
	Verify that the ODU cable is properly wired and connected.
No signal	Complete the installation procedure from the management software.
	Verify the antenna alignment. Check that the radio configuration of both sites is the same (channel and SSID).
Weak signal	Verify the antenna alignment, reconfigure the link.
	Verify the beeper sounds the Best Signal sequence.

The GE MDS Intrepid Series Radio LEDs show faults in the system or the link.

Table 5-7. Troubleshooting with GE MDS Intrepid Series Radio LEDs

LED	Status	Remedy
PWR	Off	Check that power is connected to the IDU
IDU	Red	Check that the IDU/ODU cable is properly wired and connected
ODU	Red	Check that the IDU/ODU cable is properly wired and connected
AIR I/F	Orange	Complete the installation procedure from the Airmux Manager
	Red	Check the antenna alignment. Check that the radio configuration of both site A and site B units are the same (Channel and Link ID)
SVC	Orange	Alarm detected at the Site B interface or local/remote loopback is active
	Red	Alarm detected at the Site A interface
	Off	Ethernet only IDU or E1/T1 service are not configured
HSS	Red	HSS is not operational due to improper signal detection. This ODU is not transmitting.
	Orange	HSS is operational. One of the following conditions apply: • This ODU is a master that is generating signals and detecting signals • This ODU is a master that is generating signals but detected improper sig-nals • This ODU is a client "Continue Tx" but is not detecting signals • This ODU is a client "Disable Tx" and is detecting signals from multiple sources All orange cases transmit.
STBY	Red	MHS mode Primary, Link state not active
	Orange	MHS mode Secondary, Link state is active

5.6 Replacing an ODU

Prior to any action verify that both ODUs have the same software version (**Configuration > Configure site > Inventory**). If one ODU has an old software version, perform a software

upgrade. It is important to configure the new ODU exactly the same as the old ODU to avoid configuration mismatches, which will disrupt the link.

An ODU may be replaced with a new ODU in one several ways.

- Use the backup
  If a backup of the configuration is available, restore that configuration using Configuration > Configure site > Restore.
- Manual Configuration
  The new ODU can be configured manually according to the link configuration, remember to use the same settings for SSID, channels, link password, IP addresses, and names.
- Restore Factory Setup
  From version 1.6xx the feature of Restore Factory Setup is available. Using this feature we recommend putting the remaining ODU back to factory setup Configuration>Configure site>Advance option, and then activate the second ODU reconfiguring the link from scratch.

Option number 3 is a recommended option to prevent configuration mismatches.

5.7 Running Diagnostic Loopback on TDM Interfaces

TDM port connection can be tested by running local and remote internal and external loopbacks.

Local External Loopback

A Local external loopback can be set to test the local E1/T1 port and its connection to local side user equipment. In this mode, data coming from the local user equipment is looped back to it. This loopback is initiated from a managing computer connected to the local unit.

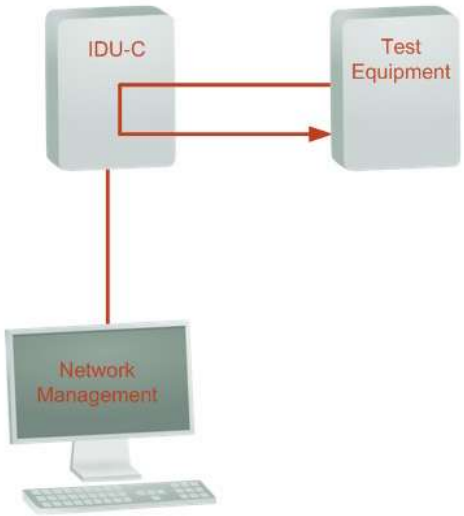


Figure 5-9. Local External Loopback

Remote Internal Loopback

A remote internal loopback can be set to test connection between the local and remote units and between the local E1/T1 port and its connection to the local user equipment. In this mode, data coming from the local user equipment is looped back at the remote side. This loopback is initiated from a managing computer connected to the local unit.

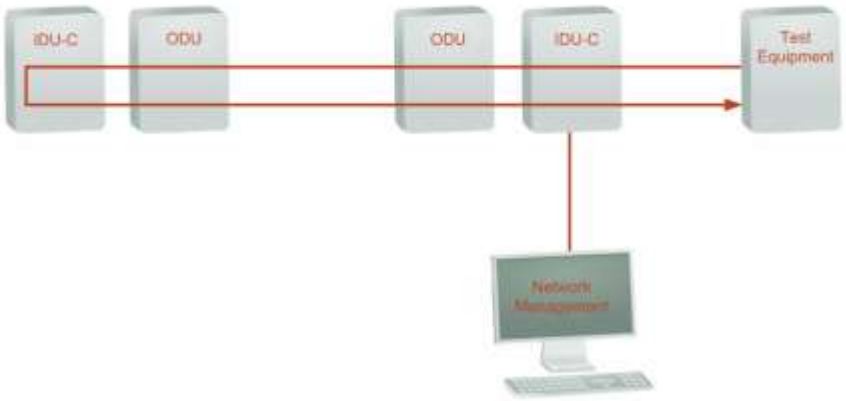


Figure 5-10. Remote Internal Loopback

Remote External Loopback

The remote unit can be set to an external loopback to test the remote E1/T1 port and its connection to the remote side user equipment. In this mode, data coming from the remote user equipment is looped back to it locally. This loopback is initiated by the managing computer connected to the local unit.

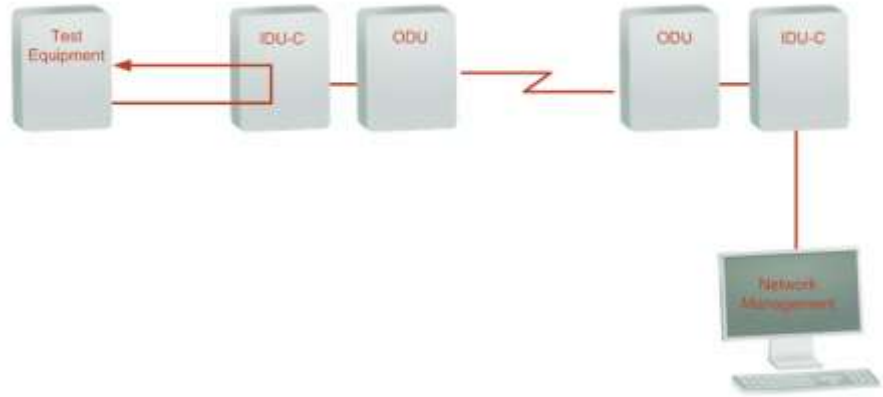


Figure 5-11. Remote External Loopback

Local Internal Loopback

The local unit can be set to close an internal loopback to test connection between the local and remote units and between the remote E1/T1 port and its connection to the remote user equipment. In this mode, data coming from the remote user equipment is looped back to it locally. This loopback is initiated by the managing computer connected to the local unit.

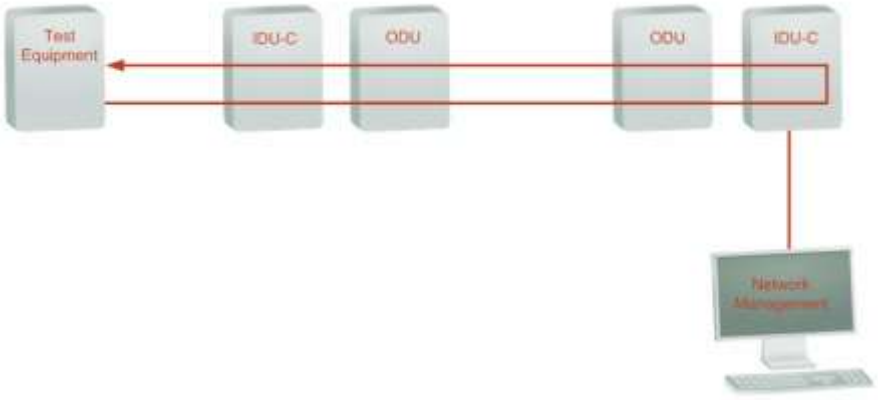


Figure 5-12. Local Internal Loopback

✱ **To run a diagnostic loopback:**

1. From the Maintenance menu, choose **Loopbacks...**

   or

   Right-click the TDM display in the main window.

   The Loopback dialog box is displayed.

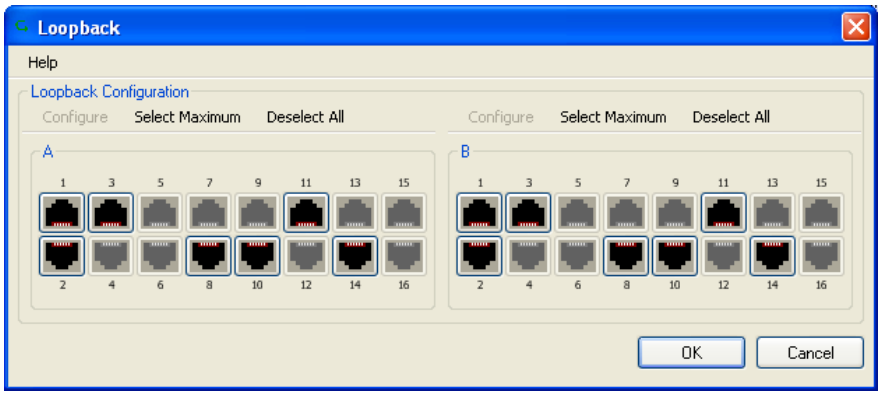


Figure 5-13. Loopback Dialog Box

2. Select TDM ports that you intend to test.

   Selected ports are indicated by blue frames around them. The Configure option from the Loopback Configuration becomes available.

3. Select **Configure** and choose a type of loopback to run:

   - Reverse – internal
   - Line – external.

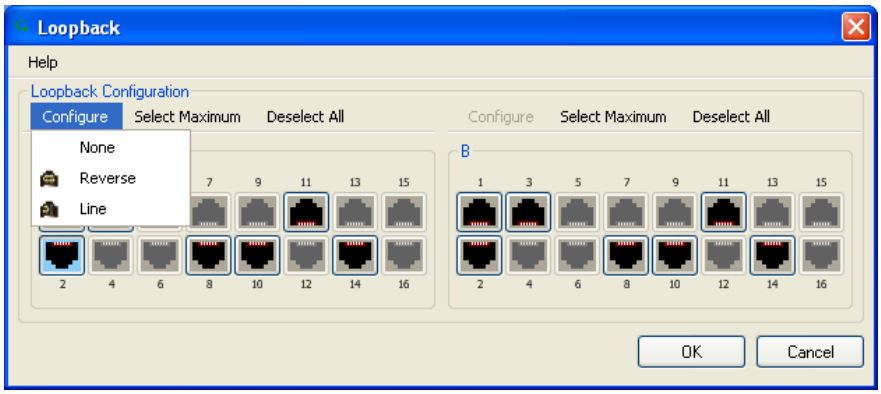


Figure 5-14. Selecting a Loopback Type

4. Click **OK** to activate a loopback.

   The Airmux Manager returns to the main screen. An active test is indicated by a loopback icon in a TDM port.

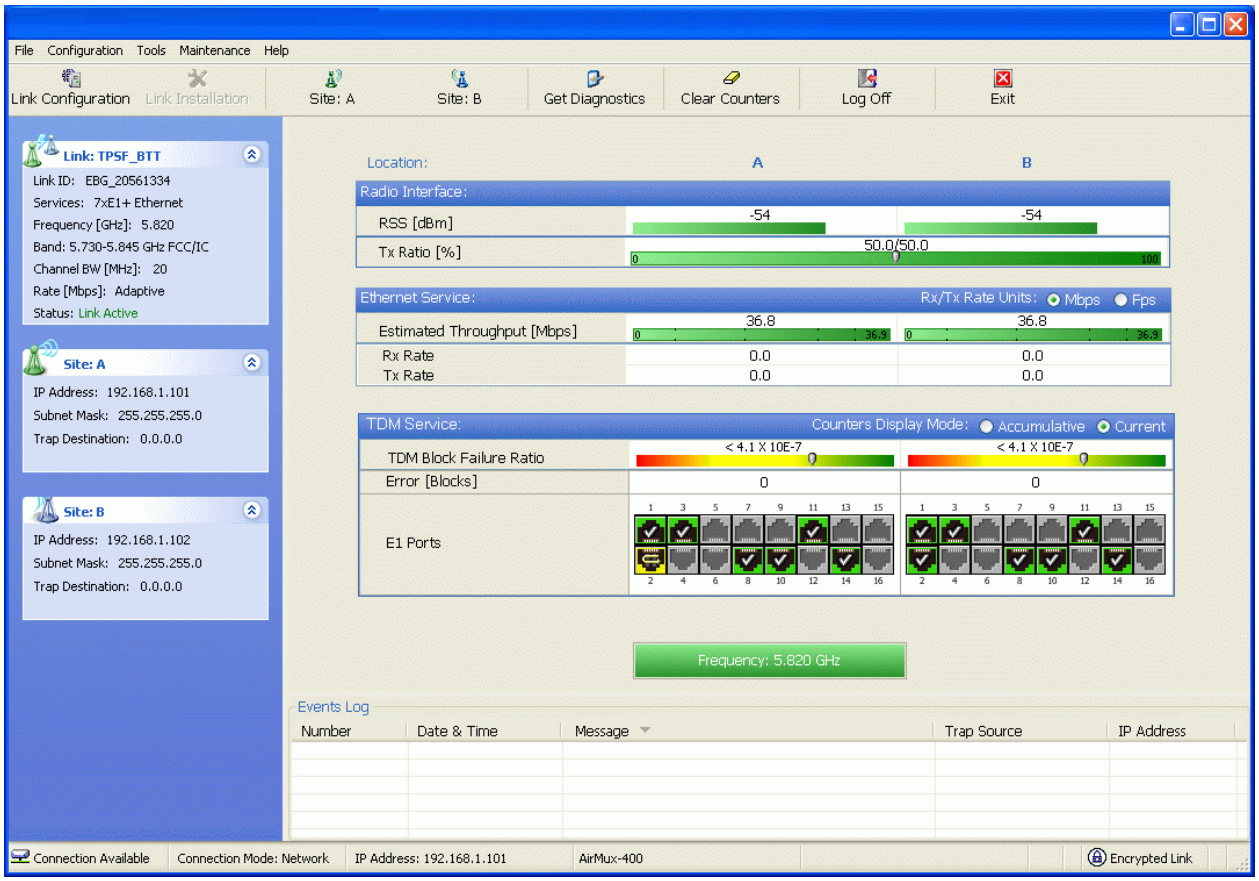


Figure 5-15. Airmux Manager Main Display with a Loopback Active on E1 Port 2

✱ **To deactivate a loopback:**

1. From the Loopback dialog box, select a TDM port with an active loopback.
2. Select **Configure** > **None** to deactivate a running loopback.
3. Click **OK** to finish.

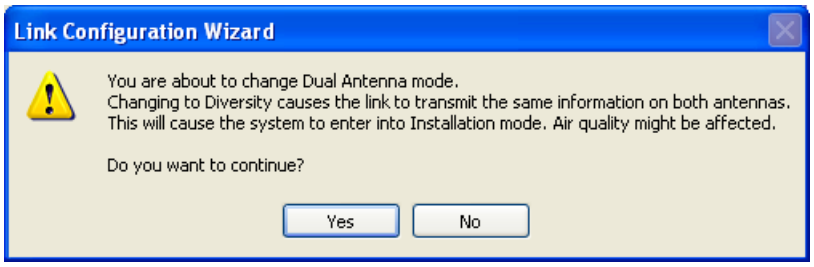
5.8 Checking Ethernet Throughput

GE MDS Intrepid Series Radio can be configured to estimate Ethernet throughput by filling frames over the air to maximum for 30 seconds. This mode should not influence service.

✱ **To check Ethernet throughput:**

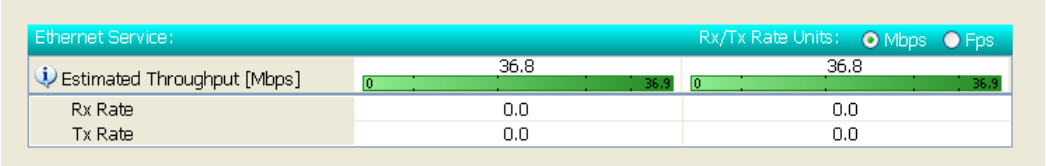
1. From the Main menu, select Maintenance > Estimated Eth. Throughput.

   A confirmation message is displayed



2. Click **Yes** to continue.

   The Ethernet services area changes appearance and the estimated throughput is displayed:



   At the end of 30 seconds, the display reverts to normal.

5.9 Frequently Asked Questions

Q: What performance issues will arise due to environmental conditions?

A: GE MDS Intrepid Series Radio is not sensitive to environmental conditions. However if heavy rain or snowfall is expected ensure the performance by allowing a higher fade margin in the link budget planning calculations.

Q: When using the GE MDS Intrepid Series Radio, what is the potential for interference between our system and other cellular or wireless network devices?

A: The GE MDS Intrepid Series Radio is a robust system. However since it operates in unlicensed band there maybe some interference. Nevertheless, the fact that we can manually set the frequency gives us the flexibility to find a clear channel. In addition each GE MDS Intrepid Series Radio link uses unique user configurable SSID code.

Q: What type of security is offered on GE MDS Intrepid Series Radio?

A: GE MDS Intrepid Series Radio has three levels of security:

1. AES hardware mechanism
2. Each unit uses a unique SSID link-specific code (up to 24 alphanumeric characters)

3. Proprietary protocol protects from eavesdropping from other systems.

Q: Can we use horizontal and vertical polarization on the same frequency to double the number of wireless links?

A: Installing two GE MDS Intrepid Series Radio systems in the same band with cross polarization provides 20–25 dB separations. Nevertheless, since there are reflections, the cross polarization separation is decreased and spatial separation is recommended.

Q: Could you add the frequency of 5.735 to the manual selection in order to increase the number of 20 MHz channels to six?

A: Currently the system provides fixed channels, with one manual frequency setting. The manual setting provides flexibility of spectrum selection, including 5.735 MHz.

Q: Can we manage GE MDS Intrepid Series Radio using SNMPc other than the supplied management software that comes with the units?

A: Yes. The GE MDS Intrepid Series Radio is SNMP-based. GE MDS Intrepid Series Radio can be managed when using other SNMP software after implementing RAD MIBs.

Q: Can GE MDS Intrepid Series Radio be managed and configured via Telnet?

A: Yes.

Q: Can I use GE MDS Intrepid Series Radio with any vendor's external antenna?

A: Yes. RAD supplies the GE MDS Intrepid Series Radio external ODU with an N-type typical connector. Any vendor's external antenna that can be cascaded to the external unit can be used without problem. Note that dB losses in the cascading cable between the external ODU and antenna should be taken into consideration. (In the supplied cascading cable of one meter there is 1 dB loss)

Q: Do we need to add external arrestors on GE MDS Intrepid Series Radio cables?

A: The GE MDS Intrepid Series Radio ODU includes arrestors and lightning protection. Therefore there is no need to add additional arrestors.

Q: Does GE MDS Intrepid Series Radio withhold any MAC Addresses?

A: The GE MDS Intrepid Series Radio is a layer 2 Bridge (VLAN transparent). The built-in switch contains a MAC address table with up to 2047 entries.

Q: Can I use any category 5e cable in order to connect the IDU and ODU?

A: The cable should be suitable for outdoor use (shielded Category 5e).

Q: What are the BER values expected in the GE MDS Intrepid Series Radio link?

A: 10-11 (according to BER sensitivity threshold)

Q: Does GE MDS Intrepid Series Radio use DSSS technique?

A: No, GE MDS Intrepid Series Radio uses the advanced OFDM technique.

5.10 Technical Support

Technical support for this product can be obtained from the local distributor from whom it was purchased.

For further information, please contact

Chapter 6

Software Upgrade

The Link Manager provides a Software Upgrade Utility (SWU) to upgrade the software (firmware) of installed ODUs in a network. The update files may be located anywhere accessible by the operator.

The SWU provides for prior backup of the current files prior to upgrade.

The default location of the software files is in the installation area, and can be used to restore factory defaults.

Software upgrades can be delivered to a single or multiple sites using Manager.

✱ **To upgrade software of an installed link:**

1. From the Tools menu of the Link Manager, select **Software Upgrade**.

   The Software Upgrade Tool dialog box is displayed.

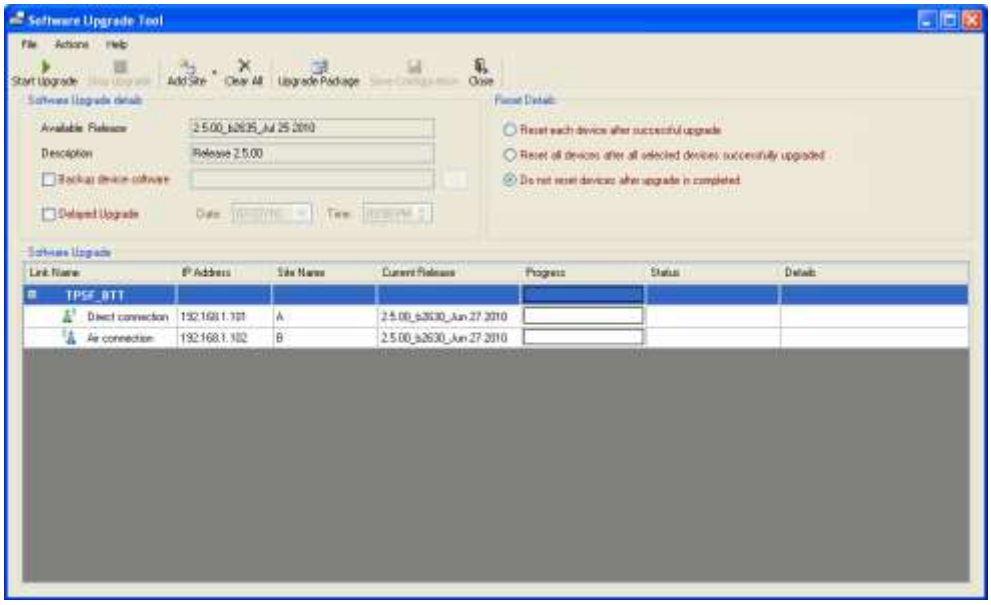


Figure 6-1. SWU Main Menu

In the Software Upgrade list, the SWU main menu shows the default sites belonging to the current link. The list may be empty if you are running the Manager "offline".

2. Click **Add Site** to add additional sites for upgrade.

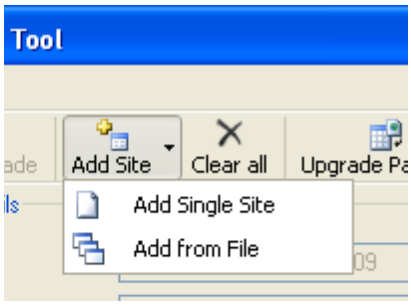


Figure 6-2. Adding Sites to Upgrade

3. Select **Add Single Site** to add one site only.

   The Add Site for Software Upgrade dialog box is displayed.

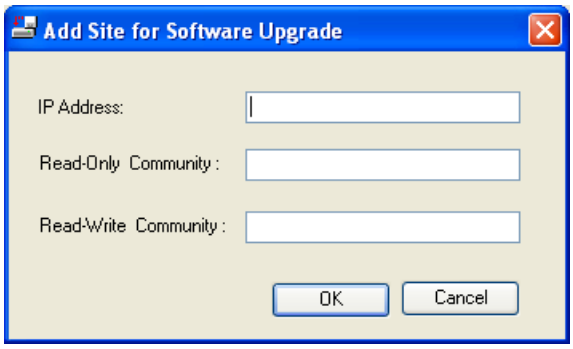


Figure 6-3. Add Site for Software Upgrade Dialog Box

4. Enter the IP address of the site, the community strings (default: **public** and **netman**, respectively) and then click **OK**.

   The site appears in the Software Upgrade list box. For example if we add the site at IP address 192.168.2.101, the SWU main window looks like this:

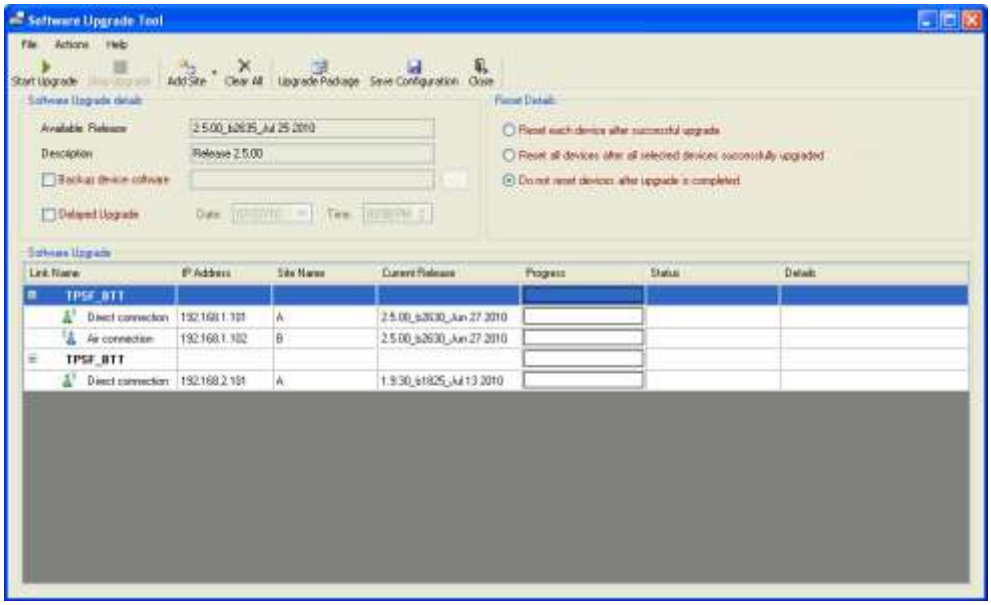


Figure 6-4. SWU Main Menu, Single Site Added for Upgrade

Note *You can clear the list by clicking the Clear All button.*

5. Add multiple sites from a prepared list using the **Add from File** option.

   The list has the following format:

   <IP address>,<Read-Only community>,<Read-Write community>

   For example:

   192.168.1.101,public,netman

   192.168.1.102,public,netman

   192.168.2.101,public,netman

   192.168.2.102,public,netman

6. Having created an update list, click **Upgrade Package** to choose the relevant SW files. The default files are located in the SWU subdirectory in the Manager installation area. They are currently named SWU_1k.swu and SWU_2k.swu. You may have to find them elsewhere, depending on your system.

7. You make limited changes to the list by right-clicking any line:

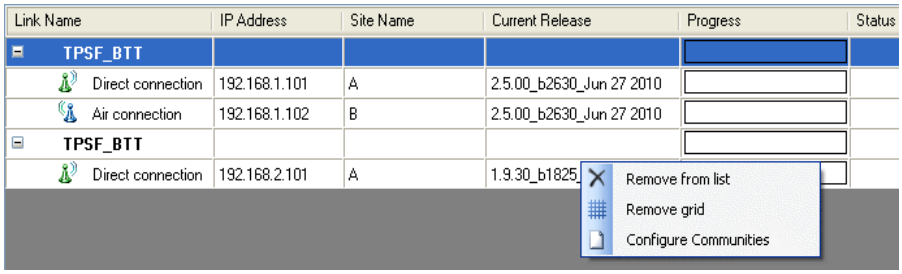


Figure 6-5. Software Upgrade Site Options

8. To back up your existing system, check **Backup device software**. Then click the ... button for a standard file dialog. The default location is the My Documents directory on the managing computer.

Note *The backup provides a fallback software version if the upgrade proves problematic.*

9. Check **Perform reset to each device after successful upgrade** to determine the sites that will be reset immediately after the upgrade.
   A reset involves a service interruption, but the software upgrade does not become effective until after the reset is carried out.

10. Click **Start Upgrade** to commence the process.

    The upgrade begins.
    The **Stop Upgrade** button becomes available. It can be used to interrupt the process.

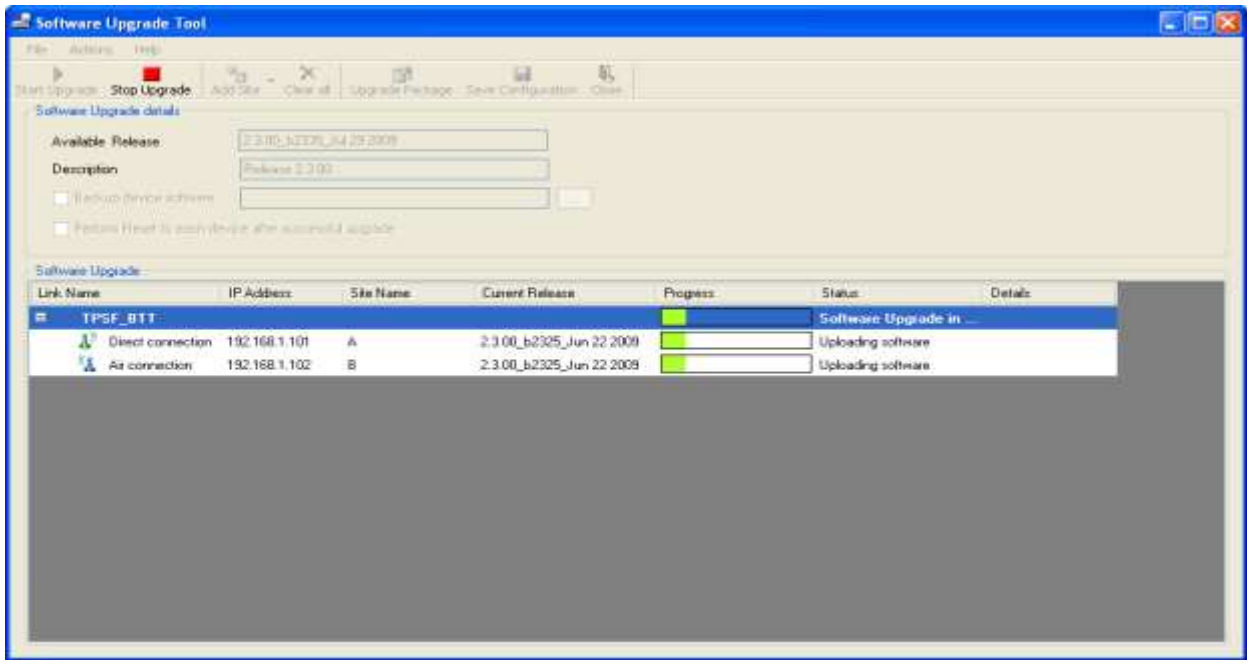


Figure 6-6. SWU Main Menu, Upgrade In Progress

Caution

If one or both sites fail to update, a warning notice is displayed.

If one site of a link updates but the other fails, you must correct the problem and update the second site as soon as possible. If you do not, following the next reset of the updated site, you will experience a link software mismatch which may affect service.

11. When the upgrade is finished, click **Close** to exit the software upgrade utility.

    If you requested a delayed upgrade, a notice like this will appear in the SWU title bar:

Note

All GSUs in a distributed site can be updated simultaneously. Use an IP list as described above.

Appendix A
Connection Data

A.1 ODU-IDU Cable

The ODU-IDU cable is standard CAT-5, four twisted pair 24 AWG FTP, terminated with RJ-45 connectors on both ends. It is covered by a cable gland on the ODU side for hermetic sealing.

Table A-1 shows the connector pinout.

Table A-1. ODU-IDU Cable Connector Pinout

IDU RJ-45	Wire Color	Function	ODU RJ-45
1 twisted	White/Green	Ethernet (RxN)	1
2 pair	Green	Ethernet (RxT)	2
3 twisted	White/Orange	Ethernet (TxT)	3
6 pair	Orange	Ethernet (TxN)	6
4 twisted	Blue	Power (+)	4
5 pair	White/Blue	Power (+)	5
7 twisted	White/Brown	Power (–)	7
8 pair	Brown	Power (–)	8

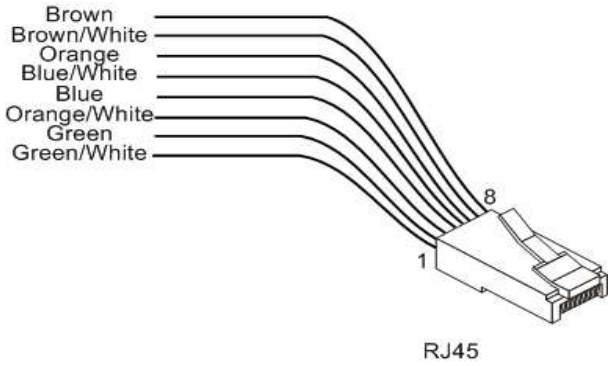


Figure A-1. RJ-45 Wiring for IDU-ODU Cable

A.2 LAN Port

The LAN 10/100BaseT interface terminates in an 8-pin RJ-45 connector, wired in accordance with *Table A-2*.

Table A-2. Fast Ethernet Connector Pinout

Pin	Signal	Function
1	TD (+)	Transmit Data (positive)
2	TD (–)	Transmit Data (negative)
3	RD (+)	Receive Data (positive)
6	RD (–)	Receive Data (negative)

A.3 TDM Ports

The E1/T1 interfaces terminate in balanced 8-pin RJ-45 connectors, wired in accordance with *Table A-3*.

Table A-3. E1/T1 Connector Pinout

Pin	Signal	Function
1	TxTip	Transmit Data Tip
2	TxRing	Transmit Data Ring
4	RxTip	Receive Data Tip
5	RxRing	Receive Data Ring

A.4 DC Power Terminal

IDU

DC power terminal of the IDU is a 3-pin connector, wired in accordance with *Table A-4*.

Table A-4. Terminal Block 3-pin -48 VDC Connector Pinout

Pin	Connection
Right	+
Center	Chassis
Left	–

PoE Unit

Power terminal of a -48 VDC PoE device is wired in accordance with *Table A-5*.

Table A-5. Terminal Block 2-pin -48 VDC Connector Pinout

Pin	Connection
Right	+
Left	–

A.5 Alarm Connector

The Alarm interface is a 25-pin D-type female connector. *Table A-6* lists the alarm connector pinout.

Table A-6. Alarm Connector (Dry Contact)

I/O	Description	Pin
Input 1	Positive	14
Input 1	Negative	15
Input 2	Positive	16
Input 2	Negative	17
Input 3	Positive	18
Input 3	Negative	19
Input 4	Positive	20
Input 4	Negative	21
Output 1	Normally Open	1
Output 1	Common	2
Output 1	Normally Closed	3
Output 2	Normally Open	4
Output 2	Common	5
Output 2	Normally Closed	6
Output 3	Normally Open	7
Output 3	Common	8
Output 3	Normally Closed	9

I/O	Description	Pin
Output 4	Normally Open	10
Output 4	Common	11
Output 4	Normally Closed	12

The following diagram describes how to connect external input and output alarms.

Note

- *Use an external current limit resistor to limit the current at the output relays to 1 Ampere. Such resistor is not required if the equipment connected to the IDU supports current limiting to 1 Amp.*
- *The voltage of the input alarm must be within the range of -10 to -50 VDC.*

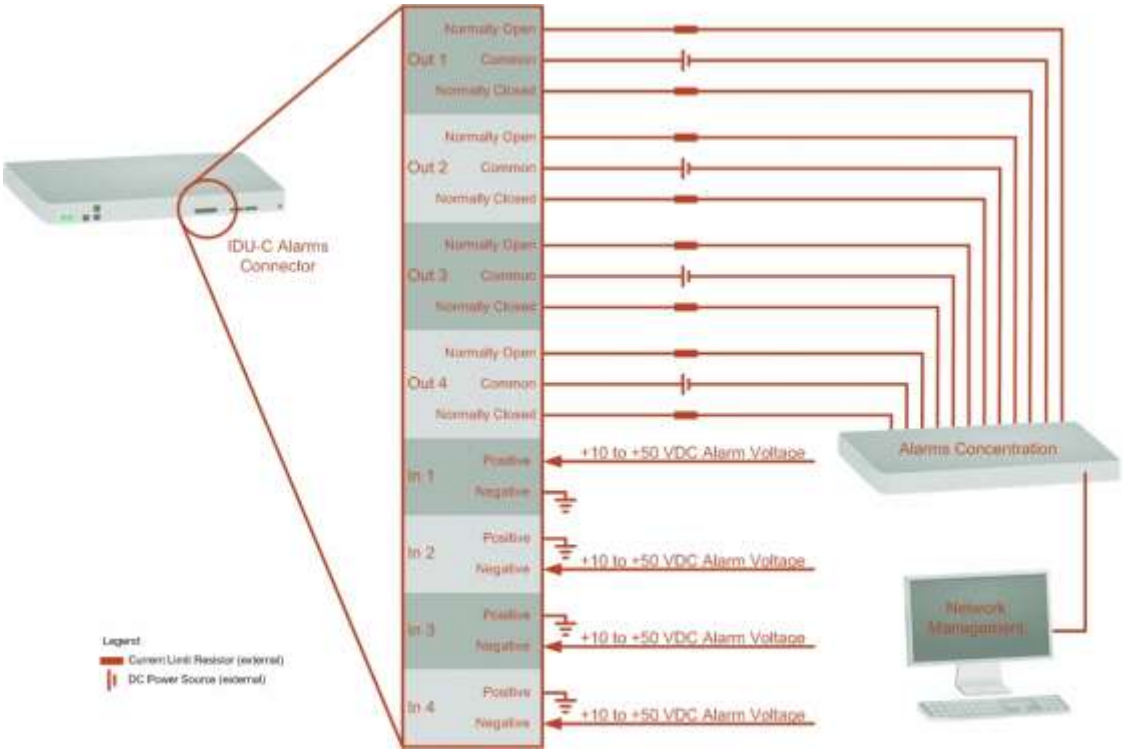


Figure A-2. Connecting External Alarm Equipment

Input Alarms

The input alarms are raised by events from external equipment, such as a fire warning, door open or air conditioner failure.

Output Alarms

Output alarms are generated through dry contact relays to indicate various system events according to the following table. An alarm is raised if at least one of the conditions is met.

Table A-7. Output Alarm Pinout

Alarm	Description	Alarm On Conditions	Alarm Off Condition
Output 1	Air interface alarm	Link is down Link in installation mode Link authentication problem	Link is up
Output 2	Equipment alarm	Built in Test (BIT) error No connection to the ODU Incompatible software	Both ODU and IDU are in operational state
Output 3	Service alarm at site B	N/A	Permanently off
Output 4	Power failure at site B	Link Loss due to power failure at Site B	Link is up or down without power failure indication within the last two seconds

A.6 Hot Standby Port

Hot standby port terminates in an RJ-11 connector wired in accordance with *Table A-8*.

Table A-8. STANDBY Connector Pinout

Pin	Connection
1	Alarm Out
2	Alarm In
3	Ground
4	Ground

A.1 ODU-to-HSS Unit Cable Wiring

ODUs are connected to HSS unit via a Cat. 5e cable with RJ-45 connectors wired in accordance with *Table A-9*.

Table A-9. ODU-to-HSS Unit Cable Wiring

ODU RJ-45 Pin	HSS Unit RJ-45	Pin Color
1	1	White/Green

ODU RJ-45 Pin	HSS Unit RJ-45	Pin Color
2	2	Green
3	3	White/Orange
6	6	Orange
4	4	Blue
5	5	White/Blue
7	7	White/Brown
8	8	Brown

Appendix B
Mast and Wall Installation

B.1 Mounting the ODU or O-PoE

The ODU or O-PoE can be mounted on a mast or a wall.

ODU Mounting Kit Contents

The ODU mounting kit includes the following items:

- One large clamp (*Figure B-1*)
- One small clamp (*Figure B-2*)
- One arm (see *Figure B-3*)
- Four screw hex head M8x40
- Two screw hex head M8x70
- Four washer flat M8
- Three washer spring M8
- Two M8 nuts.

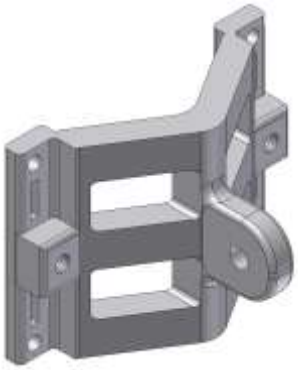


Figure B-1. Large Clamp

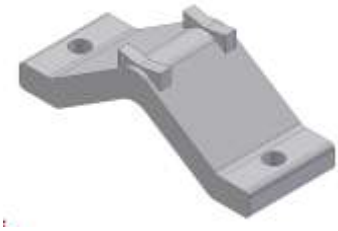
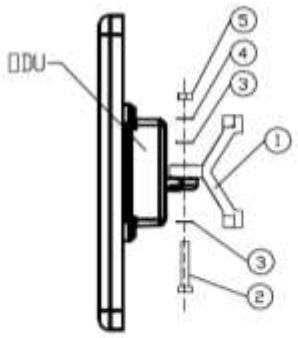


Figure B-2. Small Clamp

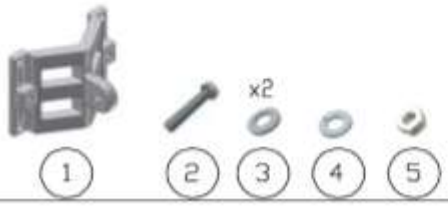
Figure B-3. Arm

Mounting Intrepid Series Radio on a Mast



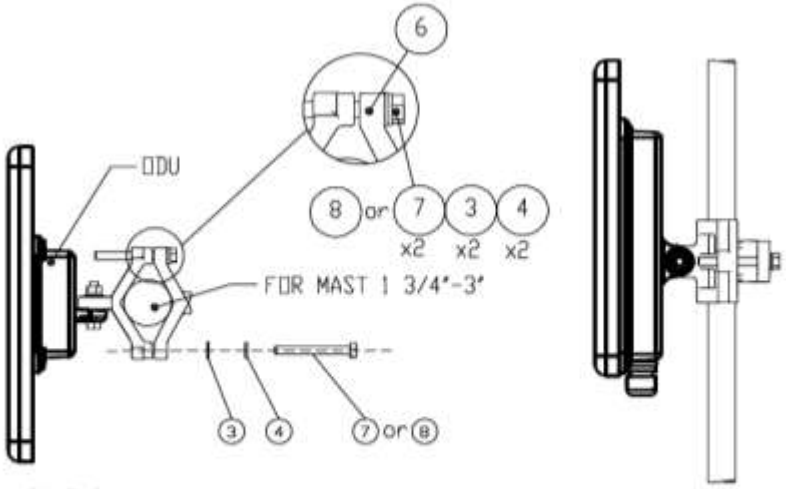
Installation Kit

ITEM	DESCRIPTION	QTY
1	Clamp	1
2	Screw hex head M8x40	1
3	Washer flat M8	4
4	Washer spring M8	3
5	Nut M8	1
6	Clamp	1
7	Screw hex head M8x40 (for 1 3/4" dia mast)	2
8	Screw hex head M8x70 (for greater size of mast)	2



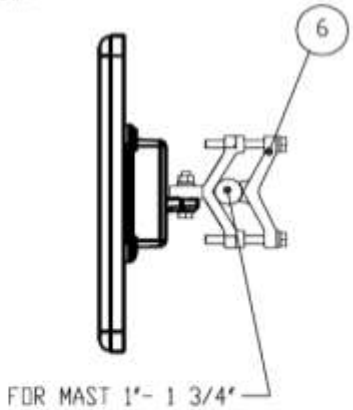
STEP 1

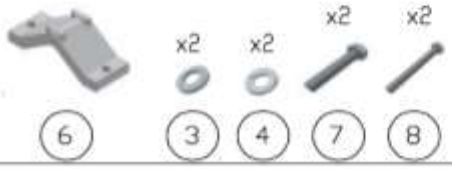
Attach item 1 to the base (mate knurled surfaces) using items 2 ,3 ,4 ,5 as shown Use tightening torque of 24 N/m.



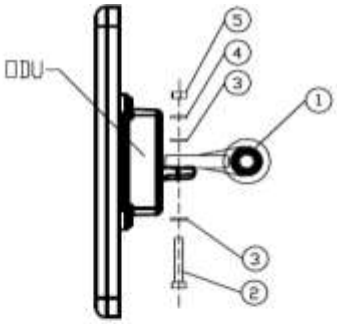
STEP 2

Tighten the antenna to the mast , using item 6, screws, and washers items 7 ,3 ,4 as shown. Use tightening torque of 14 N/m.



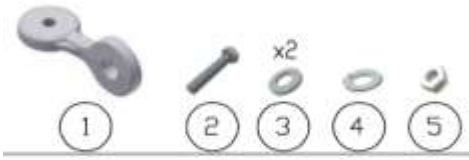


Mounting Intrepid Series Radio on a Wall

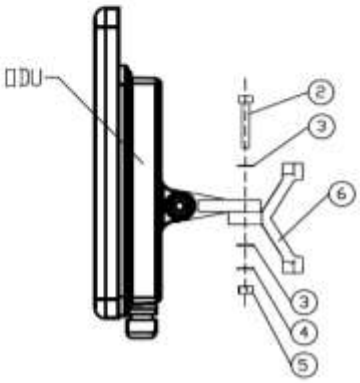


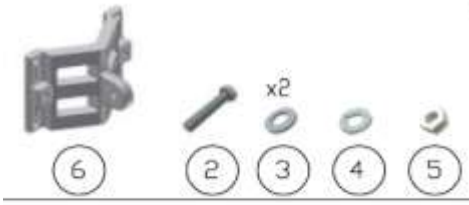
Installation Kit

ITEM	DESCRIPTION	QTY
1	Arm	1
2	Screw hex head M8x40	2
3	Washer flat M8	4
4	Washer spring M8	2
5	Nut M8	2
6	Base wall	1



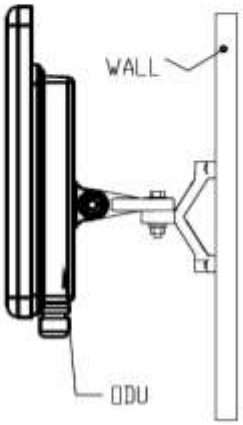
STEP 1
Attach item 1 to the base
(mate knurled surfaces)
using items 2, 3, 4, 5 as shown.
Use tightening torque of 24 N/m.





STEP 2
Attach item 6 to the arm
(mate knurled surfaces)
using items 2 ,3 ,4 ,5 as shown.
Use tightening torque of 24 N/m.

STEP 3
Install ant. to wall
(hardware supplied by customer)



B.2 Mounting an External Antenna

The optional external antenna can be mounted on a mast. The external antenna mounting kit includes the following items:

- Twelve flat washers
- Eight spring washers
- Eight hex nuts
- Four bolts
- One U-bracket
- One pivoting bracket
- Two metal strap clamps.

❋ **To install external antenna on the mast:**

1. Attach the U-bracket to the back of the antenna using four flat washers, four spring washers and four hex nuts.
2. Attach the pivoting bracket to the U-bracket using eight flat washers, four spring washers, four hex nuts and four bolts.
3. Pass both strap clamps through the vertical slots in the pivoting bracket.
4. Attach the antenna to the mast using the two strap clamps.
5. Adjust the required tilt using the angular scale and tighten all bolts and nuts at the required position.

B.3 Mounting a Connectorized ODU Horizontally

An ODU may be mounted horizontally as shown below.

❋ **To mount an ODU horizontally:**

1. To ensure your warranty rights for horizontally installed ODUs, make sure that the four ports ANT1, ANT2, HSS and ODU are firmly secured or moisture sealed with the supplied caps.
2. Verify that cables are connected using a “water nose” below.

Figure B-4. Mounted ODUs with Correct "Water Nose"

3. Do **not** do this:

Figure B-5. Incorrectly Mounted ODU (No "Water Nose")

Note *If you attach an external PoE device close to the ODU, the same considerations apply.*

Appendix C

Link Budget Calculator

The Link Budget Calculator is a utility for calculating the expected performance of the Intrepid Series Radio wireless link and the possible configurations for a specific link range.

The utility allows you to calculate the expected RSS of the link, and find the type of services and their effective throughput as a function of the link range and deployment conditions.

C.1 Initiating the Link Budget Calculator

The Link Budget Calculator is supplied on the Manager CD. It may be run directly from the CD or from the Manager application.

❋ **To run the Link Budget Calculator directly from the CD:**

1. Insert the Link Manager CD into the drive on the managing computer. In the window which opens, click the Link Budget Calculator option.

❋ **To run the Link Budget Calculator from the Link Manager:**

- Choose Help > Link Budget Calculator from the main menu of the Link Manager.

  The Link Budget Calculator window is displayed (*Figure C-1*).

Note *Allow running scripts when activating the Link Budget Calculator in Internet Explorer.*

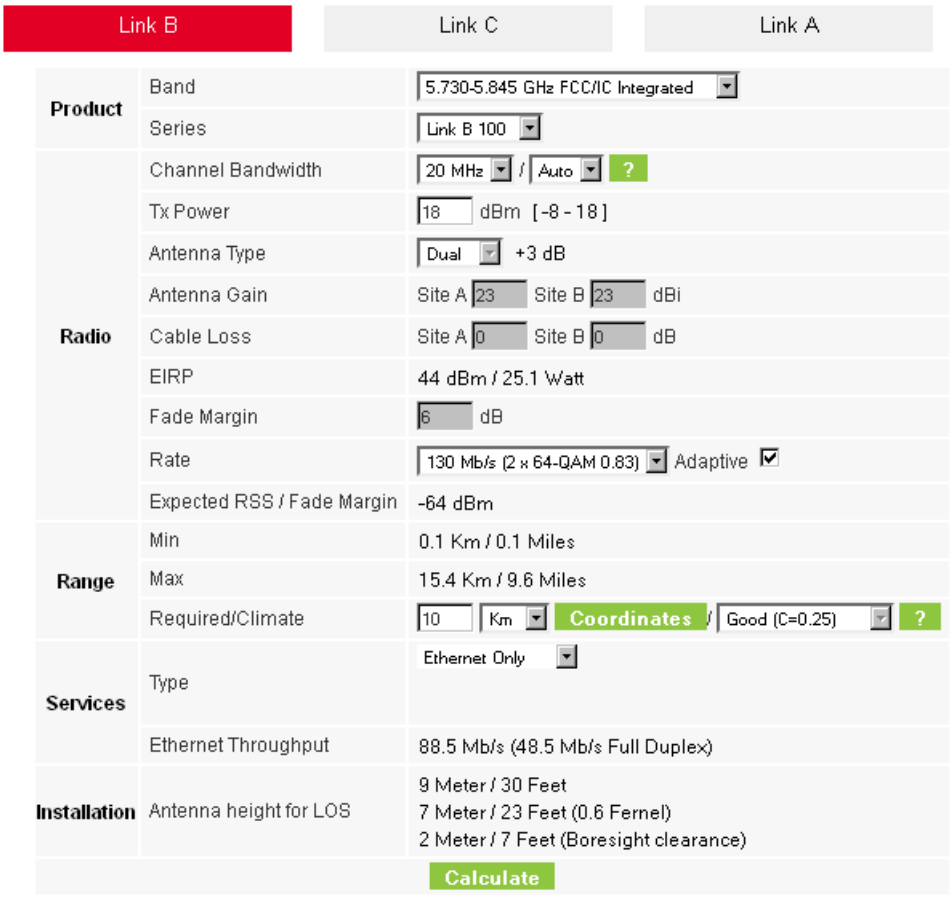


Figure C-1. Link Budget Calculator

Use **Link B, 100** for Intrepid Ultra(100 FD/200 Agg) and **Link B, 50B** for Intrepid (25FD /50 Agg)

Link Budget Calculator Parameters

You are required to enter or choose the following parameters. Depending on the product, some of the parameters have a default value that cannot be changed.

- Product (or regulation and band)
- Series (Intrepid Series Radio)
    - Use **Link B, 100** for Intrepid Ultra(100 FD/200 Agg) & **Link B, 50B** for Intrepid (25FD/50 Agg)
- Channel bandwidth
- Tx power (maximum Tx power per modulation is validated)
- Antenna type (cannot be changed for ODU with integrated antenna)
- Antenna gain per site (cannot be changed for integrated antenna)
- Cable loss per site (cannot be changed for integrated antenna)
- Required fade margin
- Rate (and adaptive check box)
- Service type (Ethernet Only, Ethernet + E1s, Ethernet + T1s)
- Required range.

For each product (or regulation and band) the calculator stores the following data required for link budget calculations:

- Maximum transmit power (per modulation)
- Receiver sensitivity (per modulation) for Ethernet service and for TDM services at various BER
- Maximum linear input power (used to calculate minimum distance)
- Antenna gain and cable loss for ODU with integrated antenna
- Available channel bandwidths.

Calculations

EIRP

$$EIRP = TxPower + AntennaGain_{SiteA} - CableLoss_{SiteA}$$

Expected RSS and Fade Margin

$$ExpectedRSS = EIRP - PathLoss + AntennaGain_{SiteB} - CableLoss_{SiteB}$$

where:

- Site A is the transmitting site
- Site B is the receiving site
- PathLoss is calculated according to the free space model,

$$PathLoss = 32.45 + 20 \times \log_{10}(frequency_{MHz}) + 20 \times \log_{10}(RequiredRange_{Km})$$

$$ExpectedFadeMargin = Sensitivity - ExpectedRSS$$

where Sensitivity is dependent on air-rate.

Min and Max Range

MinRange is the shortest range for which $ExpectedRSS \le MaxInputPower$ per air-rate.

MaxRange (with Adaptive checked) is the largest range for which $ExpectedRSS \ge Sensitivity$, at the highest air-rate for which this relationship is true. In a link with adaptive rate this will be the actual behavior.

MaxRange (for a given air-rate) is the largest range for which $ExpectedRSS \ge Sensitivity + RequiredFadeMargin$.

Service

The Ethernet throughput is calculated according to internal product algorithms.

Availability

The Service Availability calculation is based on the Vigants Barnett method which predicts the downtime probability based on a climate factor (C factor).

$$Availability = 6 \times 10^{-7} \times Cfactor \times frequency_{GHz} \times (RequiredRange_{KM})^3 \times 10^{\frac{-ExpectedFadeMargin}{10}}$$

Antenna Height

The recommended antenna height required for line of sight is calculated as the sum the Fresnel zone height and the boresight height. See *About the Fresnel Zone* below.

The Fresnel zone height is calculated as: $\sqrt{\frac{2 \times \frac{300}{frequency_{GHz}} \times \left[\frac{ExpectedRange}{2}\right]^2}{\frac{ExpectedRange}{2} + \frac{ExpectedRange}{2}}}$

The boresight clearance height is calculated as: $\sqrt{R^2_{Maean} + \left[\frac{ExpectedRange}{2}\right]^2} - R_{Maean}$

where $R_{Mean} = 6367.4425Km$.

C.2 Using the Link Budget Calculator

✱ **To use the Link Budget Calculator for Intrepid Series Radio:**

1. Choose a product from the drop-down list (or choose a Regulation and Band):

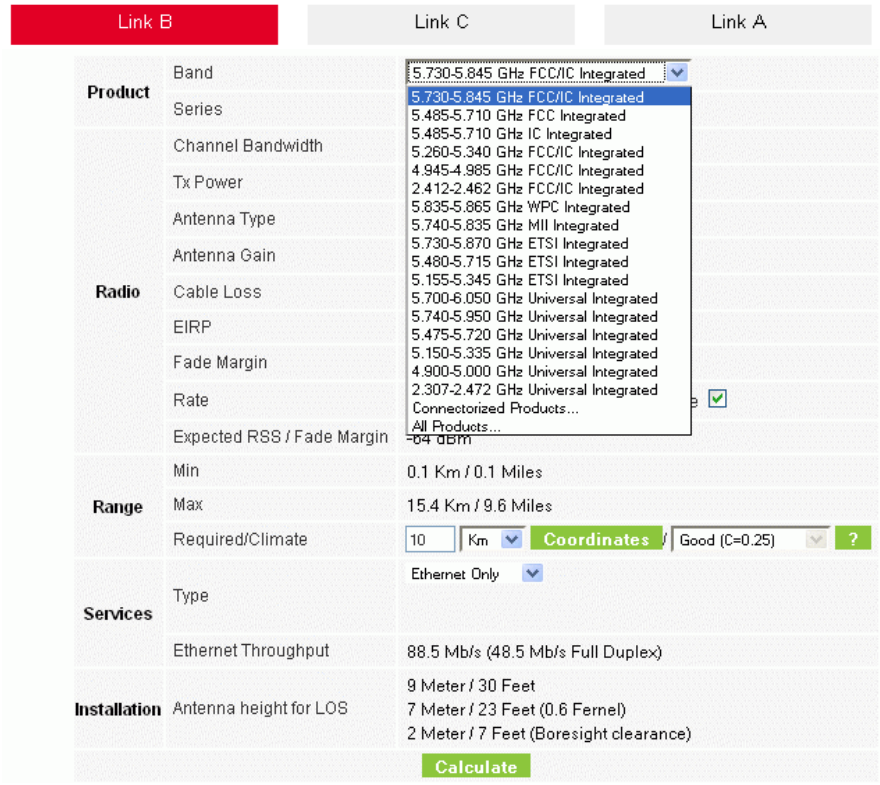


Figure C-2. Selecting a Product

Use **Link B, 100** for Intrepid Ultra (100 FD/200 Agg) and **Link B, 50B** for Intrepid (25FD /50 Agg)

2. Select product series.

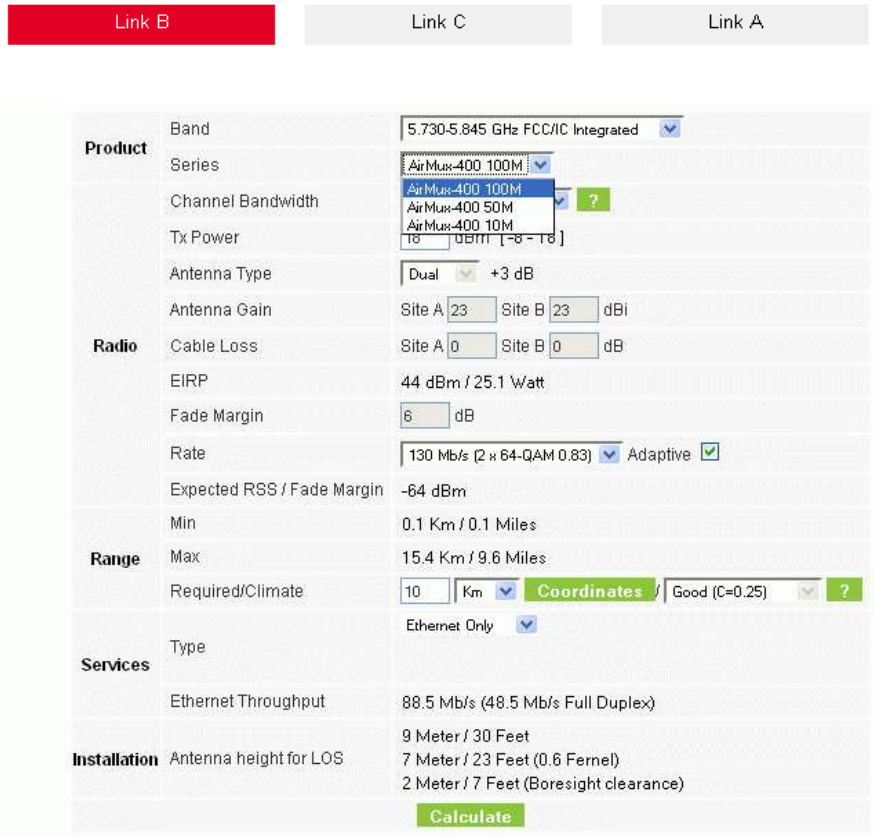


Figure C-3. Selecting Product Series

Select the channel bandwidth

Figure C-4. Selecting Channel Bandwidth

3. For a collocated link choose the RFP. Use the Help button to the right of the RFP selection box for help. For collocated Intrepid Series Radio devices, use RFP B or E.

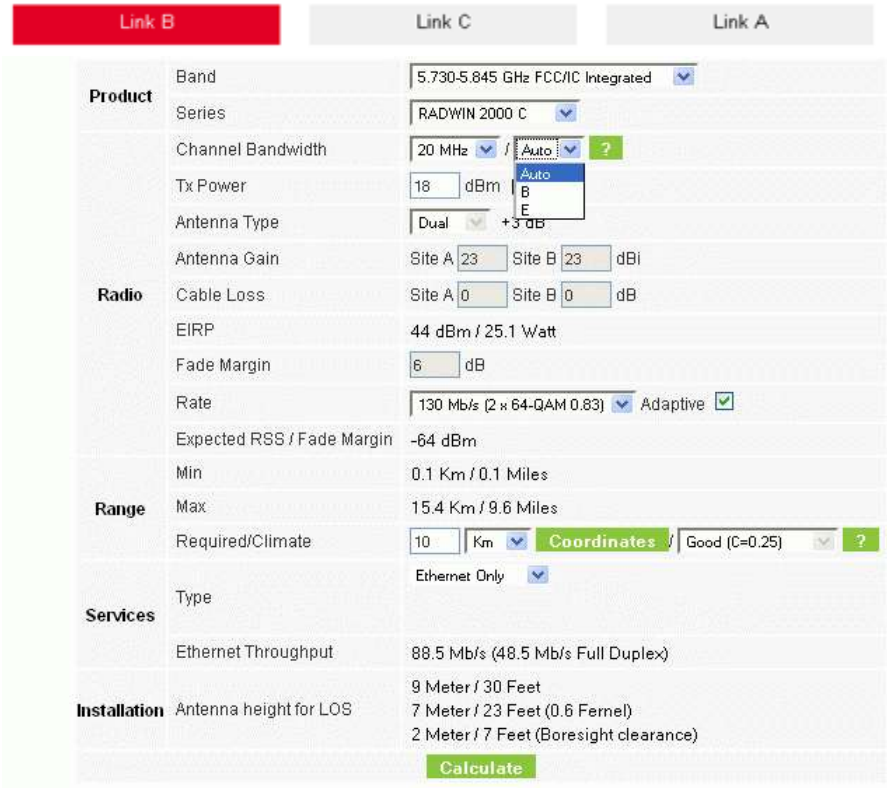


Figure C-5. Selecting the RFP

Use **Link B, 100** for Intrepid Ultra (100 FD/200 Agg) and **Link B, 50B** for Intrepid (25FD /50 Agg)

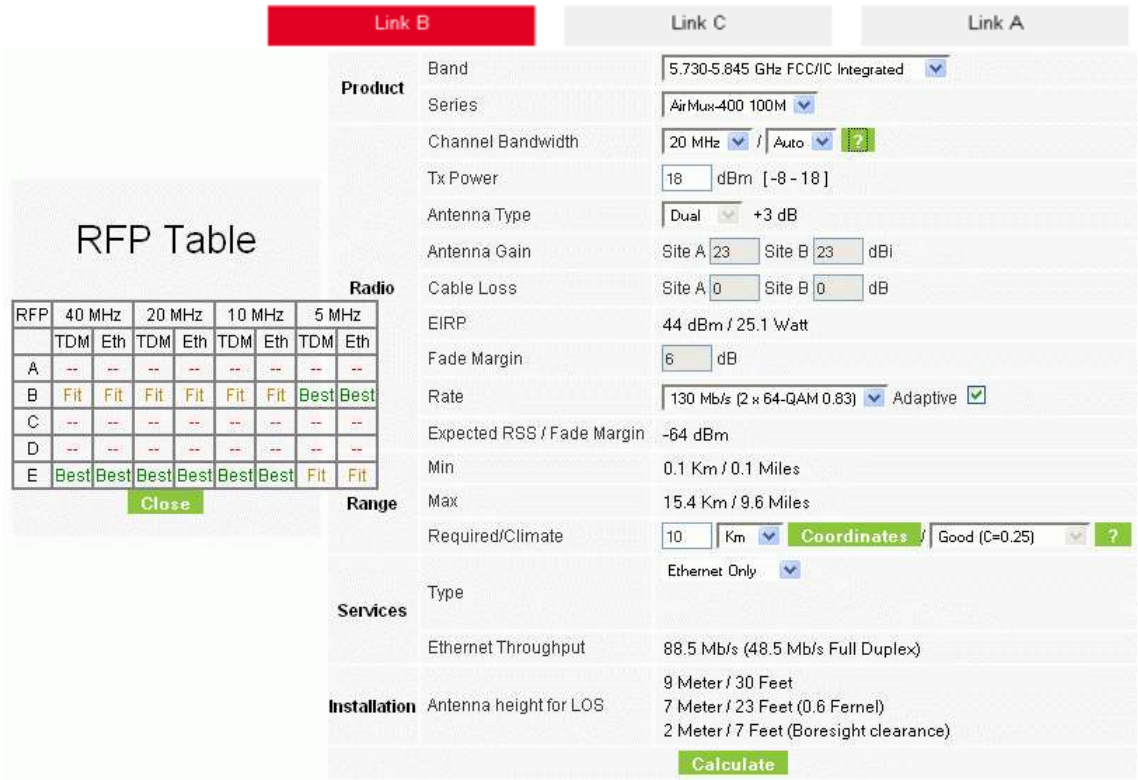


Figure C-6. RFP Selection Guide

4. Enter the radio details.

Note *If you choose Adaptive Rate, then the Rate list becomes unavailable as well as the Climate factor list. Both of these quantities are calculated.*

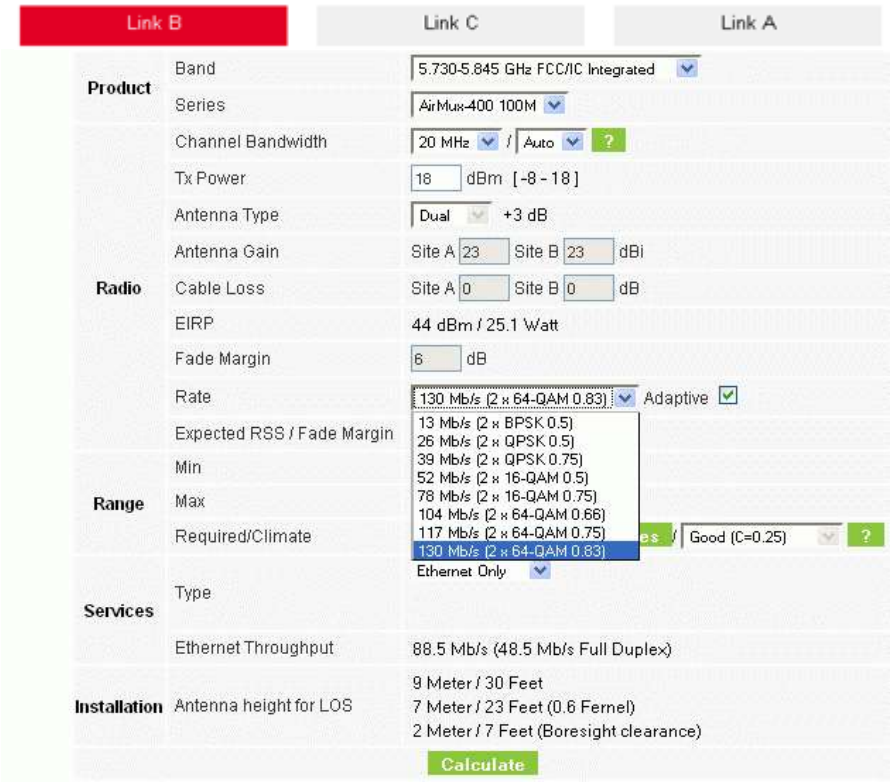


Figure C-7. Selecting the Rate

Use **Link B, 100** for Intrepid Ultra (100 FD/200 Agg) and **Link B, 50B** for Intrepid (25FD /50 Agg)

The **Rate** shown, defines the air-interface rate in Mbps. The system operates in TDD mode and has the overhead of the air-interface protocol Thus, the actual Ethernet throughput is provided by the **Ethernet Rate**.

Note *For a given air rate, Ethernet throughput decreases with increasing range due to propagation delay.*

The Fade margin is the minimum required for LOS conditions. For degraded link conditions, a larger Fade margin should be used.

The EIRP is given in dBm and Watts.

Note *If you choose Adaptive Rate, then the Rate list is unavailable as is the Climate factor list. Both of these quantities are calculated.*

5. If the required range between the two link sites is known, you may enter it directly. Alternatively, you can click **Coordinates** to enter the latitude and longitude of each site in the link, in which case the distance between them will be calculated and displayed.

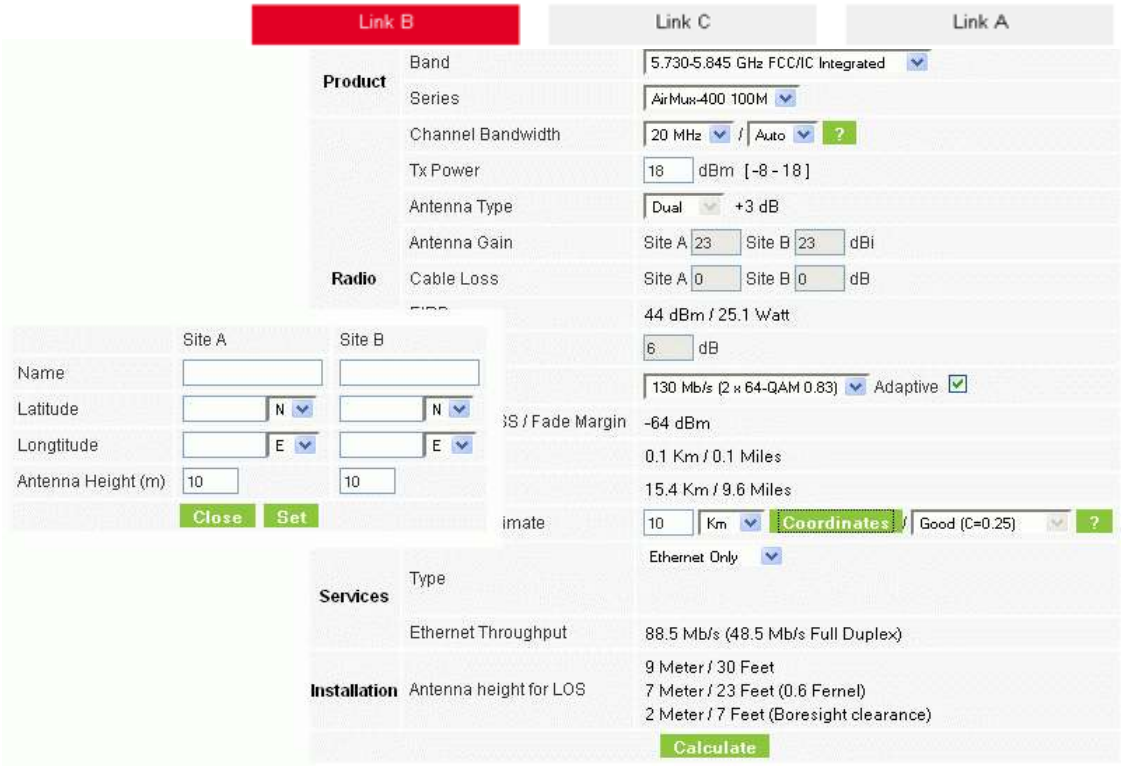
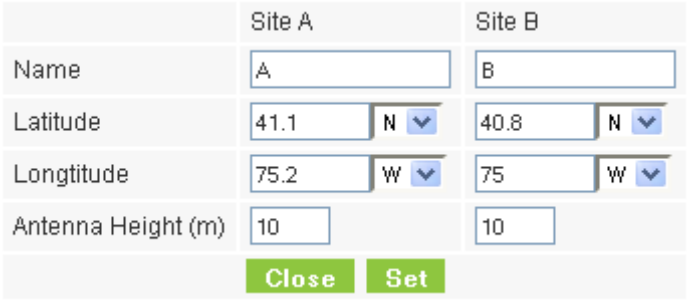


Figure C-8. Calculating Distance from Site Coordinates

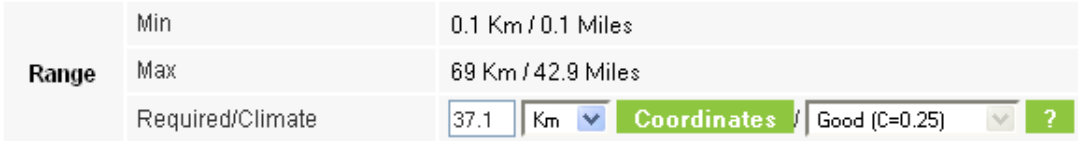
Use **Link B, 100** for Intrepid Ultra (100 FD/200 Agg) and **Link B, 50B** for Intrepid (25FD /50 Agg)

For example:

- Enter the following coordinates and press **Set.**



The following range is calculated and displayed:



6. Select climatic C Factor value from a drop-down list of Climactic C Factor values located to the right of the green Coordinates button.

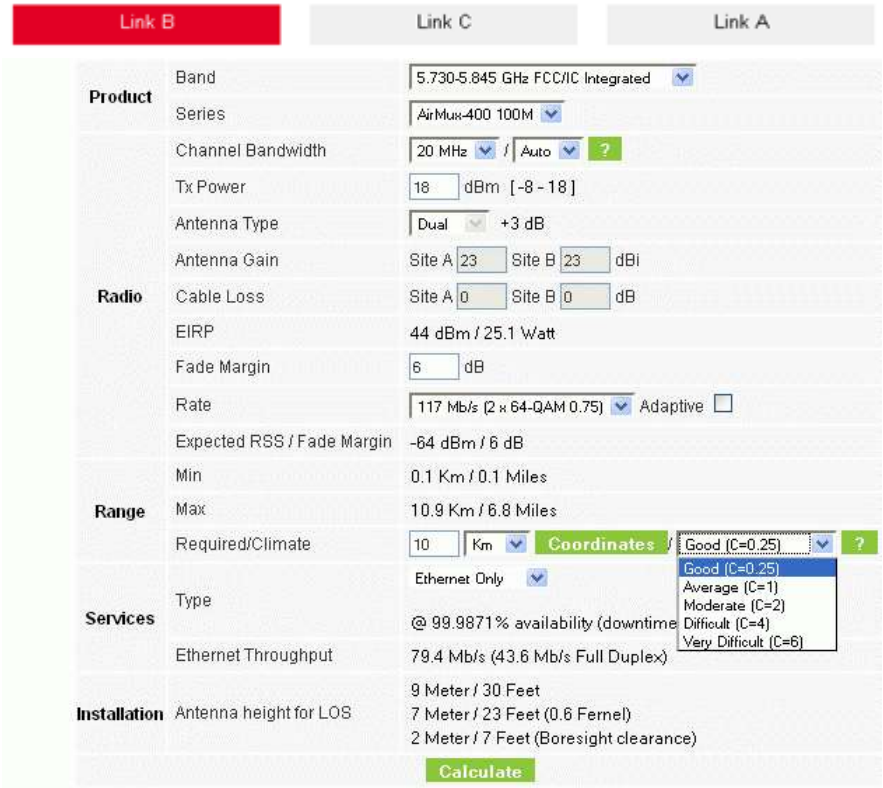


Figure C-9. Selecting Climate Factor

Use **Link B, 100** for Intrepid Ultra (100 FD/200 Agg) and **Link B, 50B** for Intrepid (25FD /50 Agg)

7. For climate factors descriptions, click **?** to the right of the drop-down list.

Figure C-10. Climate Factors Description

Figure C-11 displays world map with the climate factor contours.

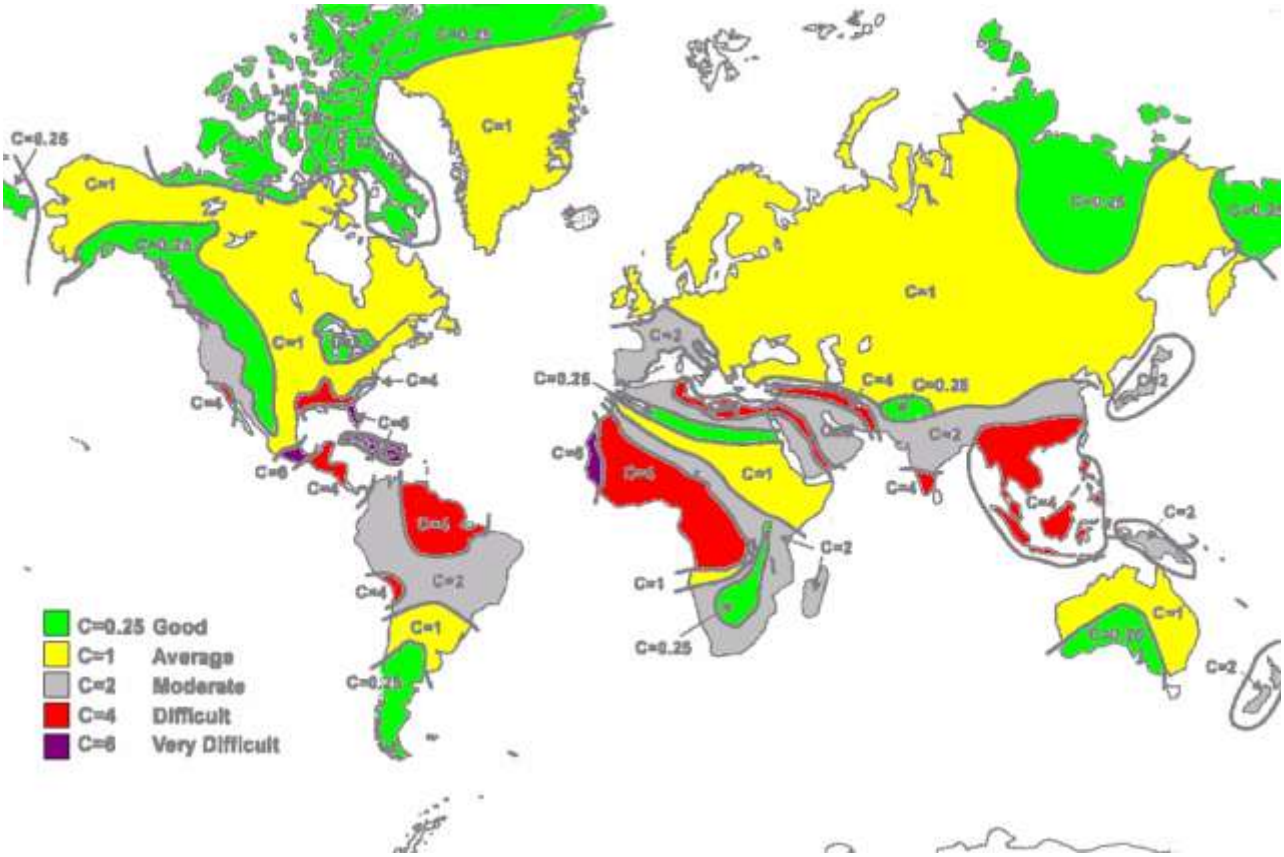


Figure C-11. World Map with Climate Factor Contours

8. Click **Calculate** to obtain the required performance estimate.

Note *Placing the cursor in any other calculated field also updates the calculated results.*

	Expected RSS / Fade Margin	-68 dBm / 15 dB
Range	Min	0.2 Km / 0.1 Miles
	Max	109.4 Km / 68 Miles
	Required/Climate	37.1 Km Coordinates / Good (C=0.25) ?
Services	Type	Ethernet Only @ 99.9092% availability (downtime 477 min/year)
	Ethernet Throughput	21.2 Mb/s (11.6 Mb/s Full Duplex)
Installation	Antenna height for LOS	40 Meter / 131 Feet 13 Meter / 43 Feet (0.6 Fernel) 27 Meter / 89 Feet (Boresight clearance)
		Calculate

Figure C-12. Calculation Results

The Expected Performance parameters are calculated and displayed:

- **Expected RSS** – the expected RSS that the Manager shows when the Intrepid Series Radio ODUs are optimally aligned.
- **Services Type** – max number of T1 or E1 trunks if "Max Trunks" is selected

- **Ethernet Rate** – maximum throughput available for the chosen parameter combination
- **Antenna height for LOS** – the minimum antenna height required for line-of-sight operation. It is the sum of the height required for boresight clearance due to the Earth's curvature plus the height required to clear the Fresnel zone.

If the expected performance is not suitable for your application, try different parameters and repeat the calculation.

C.3 About the Fresnel Zone

The Fresnel zone is an elliptically shaped conical zone of electromagnetic energy that propagates from the transmitting antenna to the receiving antenna. It is always widest in the middle of the path between the two antennas.

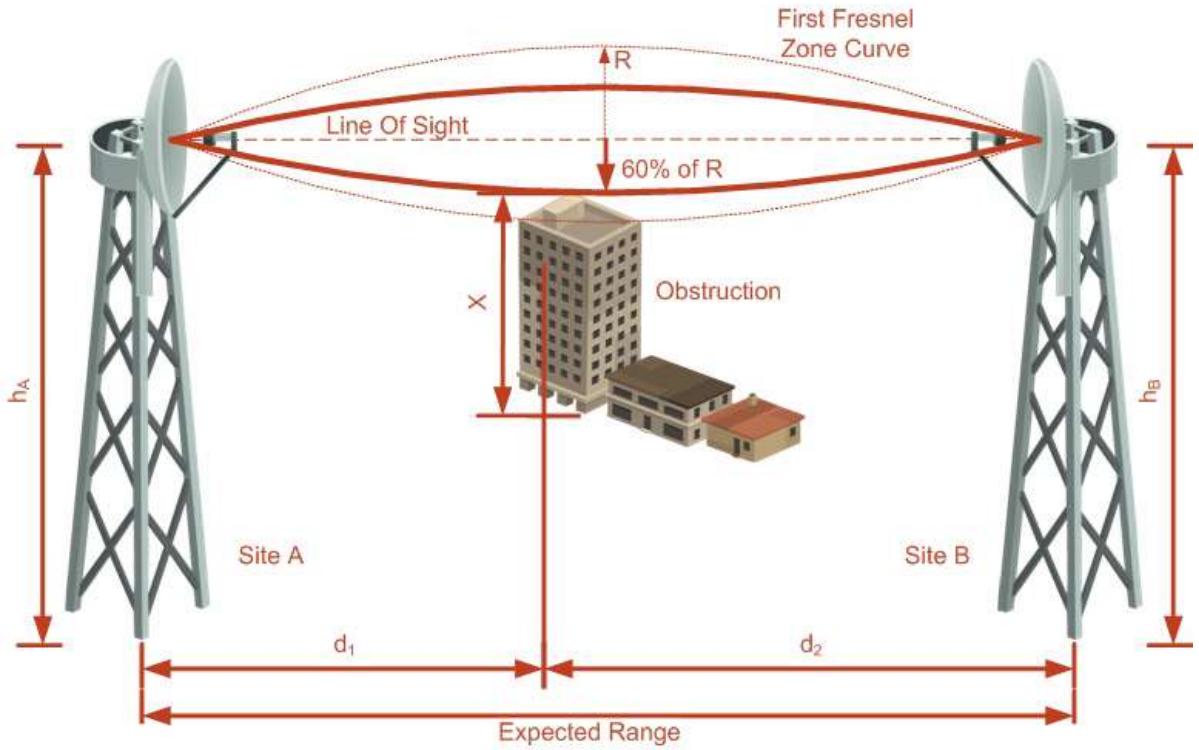


Figure C-13. Fresnel Zone

Fresnel loss is the path loss occurring from multi-path reflections from reflective surfaces such as water, and intervening obstacles such as buildings or mountain peaks within the Fresnel zone.

Radio links should be designed to accommodate obstructions and atmospheric conditions, weather conditions, large bodies of water, and other reflectors and absorbers of electromagnetic energy.

The Fresnel zone provides us with a way to calculate the amount of clearance that a wireless wave needs from an obstacle to ensure that the obstacle does not attenuate the signal.

There are infinitely many Fresnel zones located coaxially around the center of the direct wave. The outer boundary of the first Fresnel zone is defined as the combined path length of all paths, which are half wavelength (1/2 λ) of the frequency transmitted longer than the direct path. If the total path distance is one wavelength (1 λ) longer than the direct path, then the outer boundary is said to be two Fresnel zones. Odd number Fresnel zones reinforce the direct wave path signal; even number Fresnel zones cancel the direct wave path signal.

The amount of the Fresnel zone clearance is determined by the wavelength of the signal, the path length, and the distance to the obstacle. For reliability, point-to-point links are designed to have at least 60% of the first Fresnel zone clear to avoid significant attenuation.

The concept of the Fresnel zone is shown in *Figure C-13* above. The top of the obstruction does not extend far into the Fresnel zone, leaving 60% of the Fresnel zone clear; therefore, the signal is not significantly attenuated.

Appendix D

Lightning Protection and Grounding Guidelines

This appendix describes how to achieve best protection against electric shock and lightning.

Warning

100% protection is neither implied nor possible.

Note

This appendix is at best a guide. The actual degree of lightning protection required depends on local conditions and regulations.

D.1 Protection Elements

Lightning protection system consists of the following components:

- Grounding for the antenna coax cable
- Grounding for each IDU and ODU
- External primary surge suppressor units and grounding for the outdoor cable
- Internal ESD protection circuits over the power/telecom lines.

D.2 Grounding for Antenna Cable

A grounding kit must be connected to the coax antenna cable and reliably grounded as shown in *Figure D-1*. The grounding kit is an Andrew Type 223158-2 (www.andrew.com).

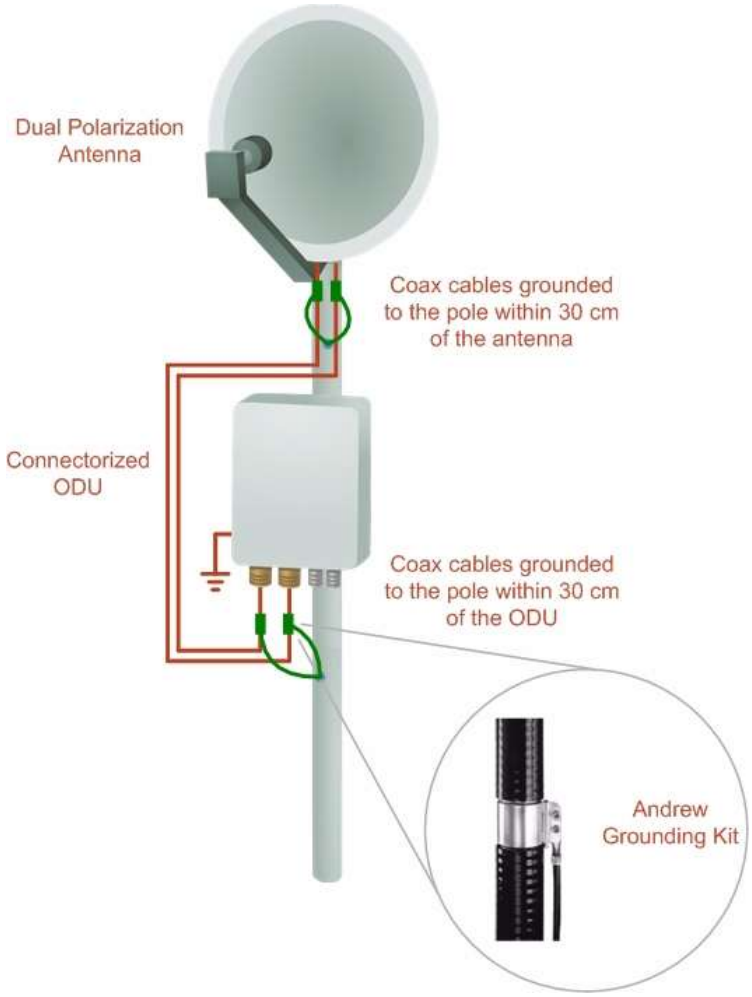


Figure D-1. Grounding Antenna Cables

D.3 Grounding for Outdoor/Indoor Units

ODU and IDU of the Intrepid system must be grounded.

ODU Grounding

Intrepid uses a shielded CAT-5e cable to interconnect the outdoor (ODU) and indoor (IDU) units. However, this shielding does not provide a good lightning discharge path, since it cannot tolerate the high lightning current surges.

To provide an alternate lightning discharge path, the ODU and antenna grounding posts should be connected to ground point by a 10 AWG short copper wire. The device must be permanently connected to ground.

IDU Grounding

The IDUs grounding post should be connected to the internal ground point, using a grounding wire of at least 10 AWG. The grounding wire should be connected to a grounding rod or the building grounding system. The device must be permanently connected to ground.

D.4 External Lightning Surge Suppressors and Grounding

A grounding kit and surge arrestor unit must be located near the ODU and properly grounded as illustrated below.

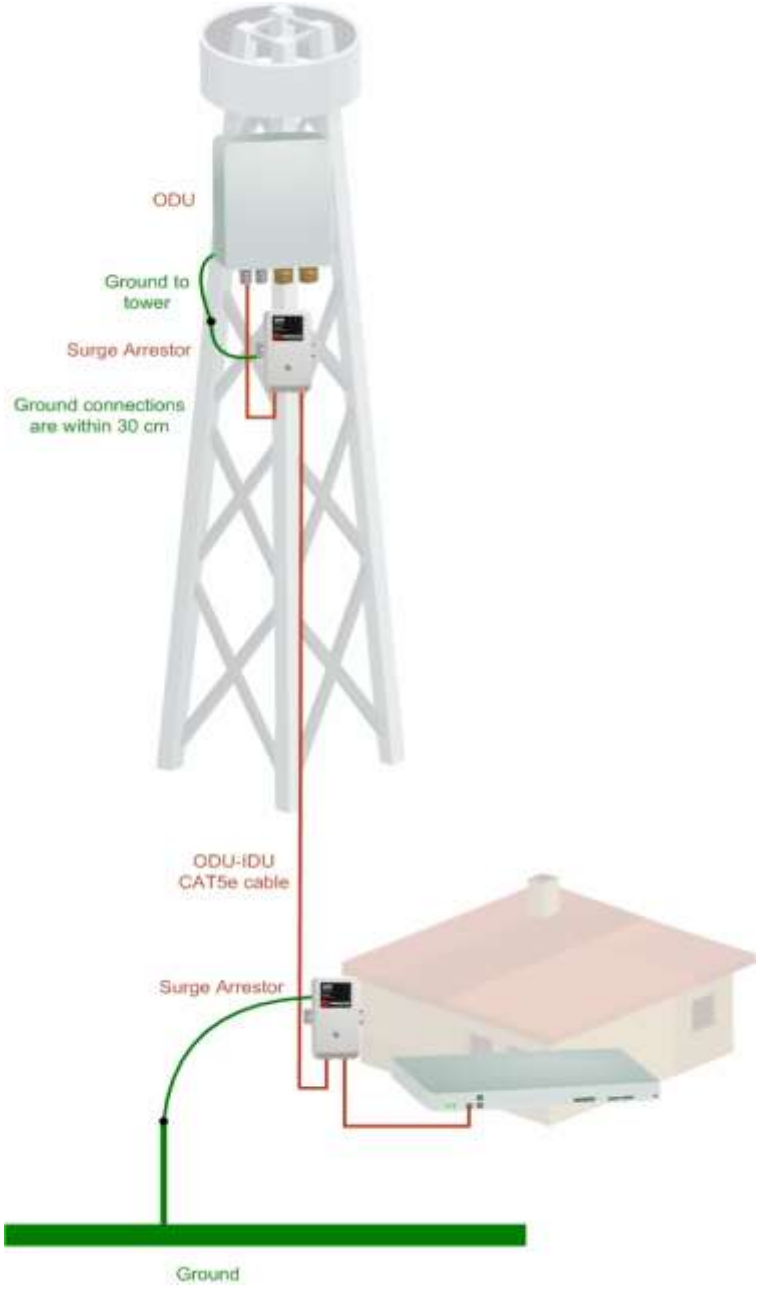


Figure D-2. Grounding a Typical Pole Installation

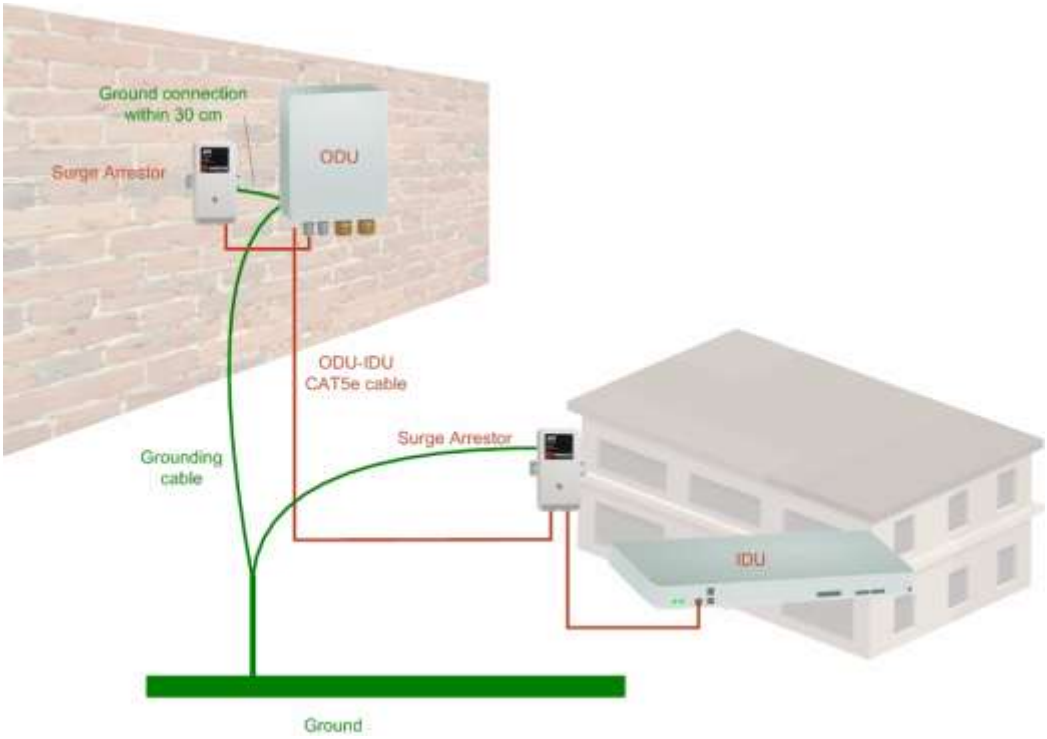


Figure D-3. Grounding a Typical Wall Installation

The next figure illustrates a close-up of the rear of grounded ODU:

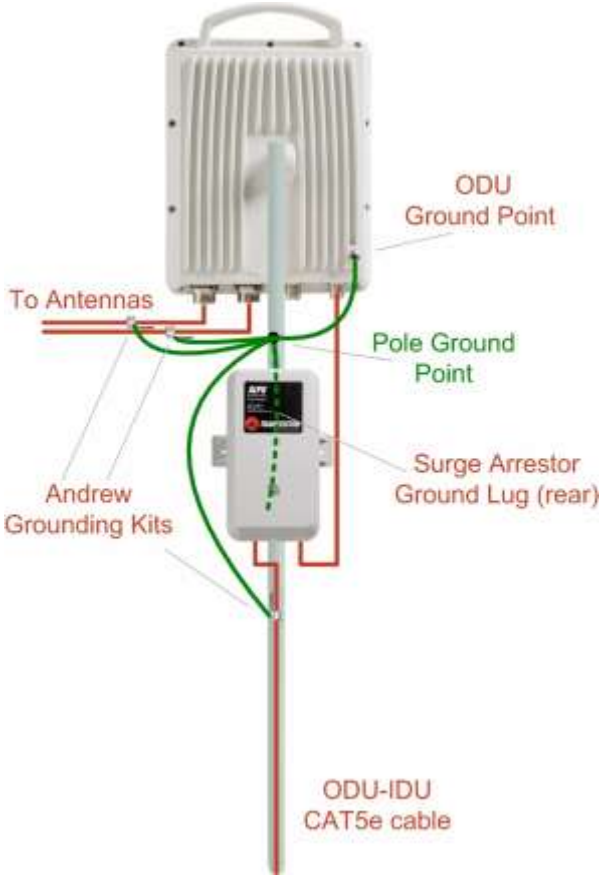


Figure D-4. ODU Surge Suppressor and Grounding

The Transtector protection circuits shown in *Figure D-5* below, utilize silicon avalanche diode technology. The unit consists of an outdoor-rated NEMA 3R type enclosure with easy mounting flanges, ground stud attachment and easy wiring.

The ALPU-POE features RJ-45 protection circuits for the ODU-IDU data pairs (pins 1, 2 and 3, 6) and DC power (pins 4, 5 and 6, 7 with the pairs bonded).

The unit is designed to be wall-mounted. An optional set of bracket is available to allow a wide range of pole mount applications. A dedicated ground stud is provided inside the unit that must be bonded to the nearest grounding system (or master ground bar) for proper surge protection.

The system wiring is installed with RJ-45 type connectors that can feed directly into the chassis without having to cut, splice or route through awkward strain relief holes.

Figure D-5. Surge Suppressor

✱ **To mount the lightning protection devices:**

1. Mount the device as close to the ODU as possible. Mount the unit so that the cable connectors are at the bottom (to prevent water from penetrating), with the strain reliefs facing the ground.
2. Remove the cover by unscrewing the front of the unit.
3. Mount the unit to an outside surface using the two mounting holes.
4. Connect the ODU-IDU cable using the RJ-45 jack.
5. Connect one cable between the ODU and the suppressor using an RJ-45 jack.
6. Connect the suppressor's ground stud to a grounding point. Use the appropriate wire gauge and type, keeping the wire as short as possible, less than 1m (3 feet), between the stud and the site grounding point.
7. Replace the cover.

Note *There may also be regulatory requirements to cross bond the ODU-IDU CAT-5e cable at regular intervals up the mast. This may be as frequent as every 10 meters (33 feet).*

A second Surge Arrestor Unit should be mounted at the building entry point and must be grounded, as shown in *Figure D-3* above.

❋ **To mount the lightning protection at the building entry point:**

1. Mount the device outside the building, located as near as possible to the entrance of the CAT-5e ODU-IDU cable. Mount the unit so that the cable connectors are at the bottom (to prevent water from penetrating), with the strain reliefs facing the ground.
2. Remove the cover by unscrewing the front of the unit.
3. Mount the unit to an outside surface using the two mounting holes.
4. Connect the ODU-IDU cable using the RJ-45 jack.
5. Connect one cable between the IDU and the suppressor using an RJ-45 jack.
6. Connect the suppressor's ground stud to a grounding point. Use the appropriate wire gauge and type, keeping the wire as short as possible, less than 1m (3'), between the stud and the site grounding point.
7. Replace the cover

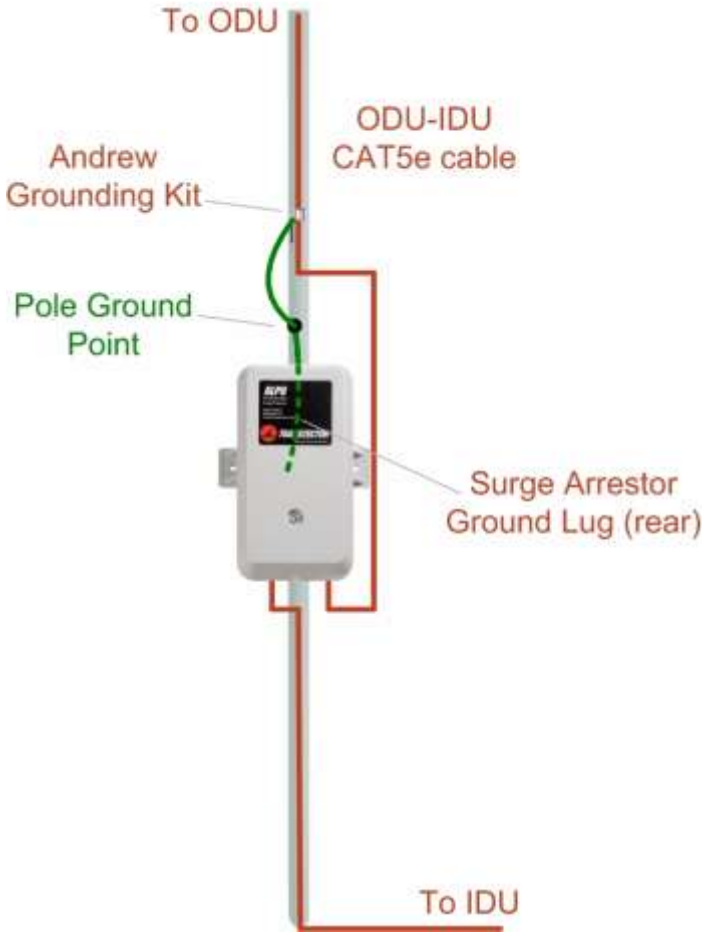


Figure D-6. Surge Suppressor and Grounding at Building Entry Point

Appendix E
MIB Reference

Intrepid's MIB is a set of APIs that enables external applications to control equipment.

The MIB is divided into public and a private API groups:

- Public: RFC-1213 (MIB II) variables, RFC-1214 (MIB II) System and Interfaces sections
- Private: Controlled by GE and supplements the public group.

This appendix describes the public and private MIB used by GE for Intrepid

E.1 Interface API

Control Method

The Link Manager application provides all the means to configure and monitor an Intrepid Series Radio link, communicating with the SNMP agent in each ODU. Each SNMP agent contains data on each of the IDUs and ODUs in the link. Both agents communicate with each other over the air using a proprietary protocol.

Note *Each ODU has a single MAC address and a single IP address.*

To control and configure the device using the MIB, you should adhere to the following rules:

- The connection for control and configuration is to the local site, over any SNMP/UDP/IP network.
- All parameters should be consistent between both of the ODUs. Note that inconsistency of air parameters can break the air connection. To correct air parameters inconsistency you must reconfigure each of the ODUs.
- Common practice is to configure the remote site first and then to configure the local site.
- For some of the configuration parameters additional action must be taken before the new value is loaded. Refer to the operation in the parameters description.
- Some of the MIB parameters values are product dependent. It is strongly recommend using the Airmux Manager application for changing these values. Setting wrong values may cause indeterminate results.

Community String

To control a link, all SNMP requests must go to the local site IP address.

E.2 Private MIB Structure

Figure E-1 illustrates the sections in the private MIB and its location in the MIB tree.

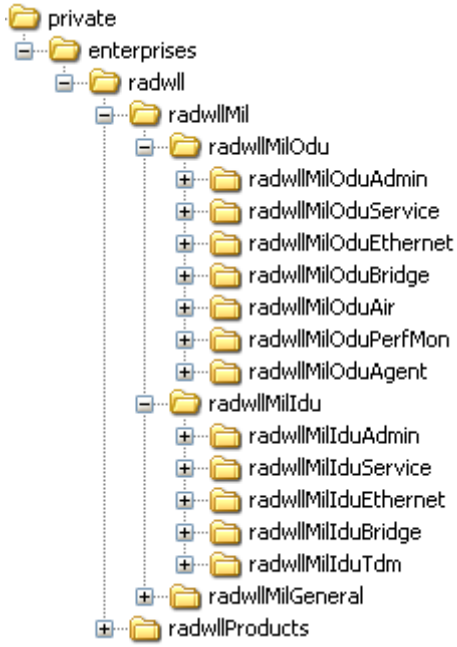
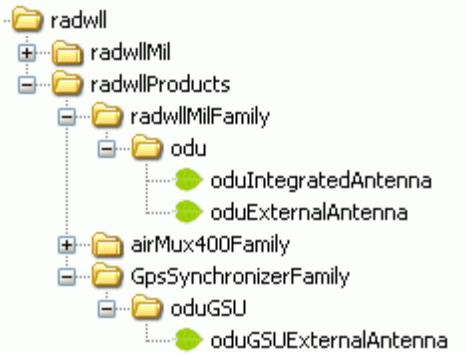


Figure E-1. Top Level Sections of the Private MIB

The products MIB section contains the definition of the Object IDs for the two form factors of the ODU, Integrated Antenna and Connectorized (referred in the MIB as **external antenna**):



The ODU MIB contains the sections: Admin, Service, Ethernet, Bridge, Air, PerfMon and Agent.

The IDU MIB contains the sections: Admin, Service, Ethernet, Bridge and TDM.

The GpsSynchronizerFamily MIB defines the GSU.

The general MIB include a single generic parameter that is used by all traps as a trap description parameter.

E.3 MIB Parameters

The following section describes all of the MIB parameters. The MIB parameters follow the following naming convention:

<airmux400><Section 1>…<Section n><Parameter Name>

For each of the configuration and control parameters (parameters with read-write access), the "Description" column describes when the new value is effective. It is recommended that you perform the appropriate action to make the values affective immediately after any change. Where a change is required on both sides of the link, it is recommended that you change both sides of the link first and then perform the action.

Table E-1. Supported RFC 1213 Variables

Name	OID	Type	Access	Description
ifIndex	.1.3.6.1.2.1.2.2.1.1.x	Integer	RO	A unique value for each interface.Its value ranges between 1 and the value of ifNumber.The value for each interface must remain constant at least from one re-initialization of the entity's network management system to the next re-initialization.
ifDescr	.1.3.6.1.2.1.2.2.1.2	DisplayString	RO	A textual string containing information about the interface.This string should include the name of the manufacturer, the product name and the version of the hardware interface.
ifType	.1.3.6.1.2.1.2.2.1.3	Integer	RO	The type of interface, distinguished according to the physical/link protocol(s) immediately `below' the network layer in the protocol stack.
ifSpeed	.1.3.6.1.2.1.2.2.1.5	Gauge	RO	An estimate of the interface's current bandwidth in bits per second. For interfaces which do not vary in bandwidth or for those where no accurate estimation can be made, this object should obtain the nominal bandwidth.

Name	OID	Type	Access	Description
ifPhysAddress	.1.3.6.1.2.1.2.2.1.6	Phys-Address	RO	The interface's address at the protocol layer immediately `below' the network layer in the protocol stack. For interfaces which do not have such an address (e.g., a serial line), this object should contain an octet string of zero length.
ifAdminStatus	.1.3.6.1.2.1.2.2.1.7	Integer	RW	The desired state of the interface. The testing(3) state indicates that no operational packets can be passed.
ifOperStatus	.1.3.6.1.2.1.2.2.1.8	Integer	RO	The current operational state of the interface. The testing(3) state indicates that no operational packets can be passed.
ifInOctets	.1.3.6.1.2.1.2.2.1.10.x	Counter	RO	The total number of octets received on the interface, including framing characters.
ifInUcastPkts	.1.3.6.1.2.1.2.2.1.11.x	Counter	RO	The number of subnetwork-unicast packets delivered to a higher-layer protocol.
ifInNUcastPkts	.1.3.6.1.2.1.2.2.1.12.x	Counter	RO	The number of non-unicast (i.e., subnetwork- broadcast or subnetwork-multicast) packets delivered to a higher-layer protocol.
ifInErrors	.1.3.6.1.2.1.2.2.1.14.x	Counter	RO	The number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol.
ifOutOctets	.1.3.6.1.2.1.2.2.1.16.x	Counter	RO	The total number of octets transmitted out of the interface, including framing characters.
ifOutUcastPkts	.1.3.6.1.2.1.2.2.1.17.x	Counter	RO	The total number of packets that higher-level protocols requested to be transmitted to a subnetwork-unicast address, including those that were discarded or not sent.

Name	OID	Type	Access	Description
ifOutNUcastPkts	.1.3.6.1.2.1.2.2.1.18.x	Counter	RO	The total number of packets that higher-level protocols requested be transmitted to a non- unicast (i.e., a subnetwork-broadcast or subnetwork-multicast) address, including those that were discarded or not sent.

Note *x is the interface ID.*

Table E-2. Private MIB Parameters

Name	OID	Type	Access	Description
radwllMilOduAdmProductType	1.3.6.1.4.1.4458.1000.1.1.1	DisplayString	RO	ODU configuration description.
radwllMilOduAdmHwRev	1.3.6.1.4.1.4458.1000.1.1.2	DisplayString	RO	ODU Hardware Version.
radwllMilOduAdmSwRev	1.3.6.1.4.1.4458.1000.1.1.3	DisplayString	RO	ODU Software Version.
radwllMilOduAdmLinkName	1.3.6.1.4.1.4458.1000.1.1.4	DisplayString	RW	Link Name. A change is effective immediately.
radwllMilOduAdmResetCmd	1.3.6.1.4.1.4458.1000.1.1.5	Integer	RW	Reset Command. A set command with a value of 3 will cause a device reset. The read value is always 0.
radwllMilOduAdmAddres	1.3.6.1.4.1.4458.1000.1.1.6	IpAddress	RW	ODU IP address. A change is effective after reset. The parameter is kept for backward compatibility. Using the alternative parameter: radwllMilOduAdmIpParamsCnfg is recommended.
radwllMilOduAdmMask	1.3.6.1.4.1.4458.1000.1.1.7	IpAddress	RW	ODU Subnet Mask. A change is effective after reset. The parameter is kept for backward compatibility. Using the alternative parameter: radwllMilOduAdmIpParamsCnfg is recommended.
radwllMilOduAdmGateway	1.3.6.1.4.1.4458.1000.1.1.8	IpAddress	RW	ODU default gateway. A change is effective after reset. The parameter is kept for backward compatibility. Using the alternative parameter: radwllMilOduAdmIpParamsCnfg is recommended.
radwllMilOduAdmBroadcast	1.3.6.1.4.1.4458.1000.1.1.10	Integer	RW	This parameter is reserved for the Manager application provided with the product.
radwllMilOduAdmHostsTable			N/A	Trap destinations table. Each trap destination is defined by an IP address and a UDP port. Up to 10 addresses can be configured.
radwllMilOduAdmHostsEntry			N/A	Trap destinations table entry. INDEX { radwllMilOduAdmHostsIndex }

Name	OID	Type	Access	Description
radwllMilOduAdmHostsIndex			RO	Trap destinations table index.
radwllMilOduAdmHostsIp	1.3.6.1.4.1.4458.1000.1.1.12.1.2	IpAddress	RW	Trap destination IP address. A change is effective immediately.
radwllMilOduAdmHostsPort	1.3.6.1.4.1.4458.1000.1.1.12.1.3	Integer	RW	UDP port of the trap destination. A change is effective immediately.
radwllMilOduBuzzerAdminState	1.3.6.1.4.1.4458.1000.1.1.13	Integer	RW	This parameter controls the activation of the buzzer while the unit is in install mode. A change is effective immediately. The valid values are: disabled (0) enabledAuto (1) enabledConstantly(2).
radwllMilOduProductId	1.3.6.1.4.1.4458.1000.1.1.14	DisplayString	RO	This parameter is reserved for the Manager application provided with the product.
radwllMilOduReadCommunity	1.3.6.1.4.1.4458.1000.1.1.15	DisplayString	RW	Read Community String. This parameter always returns ***** when retrieving its value. It is used by the Manager application to change the Read Community String. The SNMP agent accepts only encrypted values.
radwllMilOduReadWriteCommunity	1.3.6.1.4.1.4458.1000.1.1.16	DisplayString	RW	Read/Write Community String. This parameter always returns ***** when retrieving its value. It is used by the Manager application to change the Read/Write Community String. The SNMP agent accepts only encrypted values.
radwllMilOduTrapCommunity	1.3.6.1.4.1.4458.1000.1.1.17	DisplayString	RW	Trap Community String. This parameter is used by the Manager application to change the Trap Community String. The SNMP agent accepts only encrypted values.
radwllMilOduAdmSnmpAgentVersion	1.3.6.1.4.1.4458.1000.1.1.18	Integer	RO	Major version of the SNMP agent.
radwllMilOduAdmRemoteSiteName	1.3.6.1.4.1.4458.1000.1.1.19	DisplayString	RO	Remote site name. Returns the same value as sysLocation parameter of the remote site.
radwllMilOduAdmSnmpAgentMinorVersion	1.3.6.1.4.1.4458.1000.1.1.20	Integer	RO	Minor version of the SNMP agent.
radwllMilOduAdmLinkPassword	1.3.6.1.4.1.4458.1000.1.1.21	DisplayString	RW	Link Password. This parameter always returns ***** when retrieving its value. It is used by the Manager application to change the Link Password. The SNMP agent accepts only encrypted values.
radwllMilOduAdmSiteLinkPassword	1.3.6.1.4.1.4458.1000.1.1.22	DisplayString	RW	Site Link Password. This parameter always returns ***** when retrieving its value. It is used by the Manager application to change the Link Password of the site. The SNMP agent accepts only encrypted values.
radwllMilOduAdmDefaultPassword	1.3.6.1.4.1.4458.1000.1.1.23	Integer	RO	This parameter indicates if the current Link

Name	OID	Type	Access	Description
				Password is the default password.
radwllMilOduAdmConnectionType	1.3.6.1.4.1.4458.1000.1.1.24	Integer	RO	This parameter indicates if the Manager application is connected to the local ODU or to the remote ODU over the air. A value of 'unknown' indicates community string mismatch.
radwllMilOduAdmBackToFactorySettingsCmd	1.3.6.1.4.1.4458.1000.1.1.25	Integer	RW	Back to factory settings Command. A change is effective after reset. The read value is always 0.
radwllMilOduAdmIpParamsCnfg	1.3.6.1.4.1.4458.1000.1.1.26	DisplayString	RW	ODU IP address Configuration. The format is: <IP_Address>|<Subnet_Mask>|<Default_Gateway>|
radwllMilOduAdmVlanID	1.3.6.1.4.1.4458.1000.1.1.27	Integer	RW	VLAN ID. Valid values are 1 to 4094. Initial value is 0 meaning VLAN unaware.
radwllMilOduAdmVlanPriority	1.3.6.1.4.1.4458.1000.1.1.28	Integer	RW	VLAN Priority. 0 is lowest priority 7 is highest priority.
radwllMilOduAdmSN	1.3.6.1.4.1.4458.1000.1.1.29	DisplayString	RO	ODU Serial Number
radwllMilOduAdmProductName	1.3.6.1.4.1.4458.1000.1.1.30	DisplayString	RO	This is the product name as it exists at EC
radwllMilOduAdmActivationKey	1.3.6.1.4.1.4458.1000.1.1.31	DisplayString	RW	Activates a general key.
radwllMilOduAdmRmtPermittedOduType	1.3.6.1.4.1.4458.1000.1.1.32	DisplayString	RW	Mobile Application: permitted partner OduType.
radwllMilOduAdmCpuID	1.3.6.1.4.1.4458.1000.1.1.33	Integer	RO	CPU ID
radwllMilOduSrvMode	1.3.6.1.4.1.4458.1000.1.2.1	Integer	RW	System mode. The only values that can be set are installMode and slaveMode; normalMode reserved to the Manager application provided with the product. A change is effective after link re-synchronization.
radwllMilOduSrvBridging	1.3.6.1.4.1.4458.1000.1.2.3	Integer	RO	Bridging Mode. Valid values are: disabled (0) enabled (1).
radwllMilOduSrvRingLinkMode	1.3.6.1.4.1.4458.1000.1.2.4.1	Integer	RW	Mode of the link regarding ring topology.
radwllMilOduSrvRingTopologySupported	1.3.6.1.4.1.4458.1000.1.2.4.2	Integer	RO	Ring Topology options are: supported not supported
radwllMilOduSrvRingVlanIdTable			N/A	Ring VLAN IDs table.
radwllMilOduSrvRingVlanIdEntry			N/A	VLAN ID of the internal ring messages. Valid values are 1 to 4094. Initial value is 0 meaning VLAN unaware. INDEX { radwllMilOduSrvRingVlanIdIndex }
radwllMilOduSrvRingVlanIdIndex	1.3.6.1.4.1.4458.1000.1.2.4.3.1.1	Integer	RO	Index of VLAN ID of the internal ring messages.
radwllMilOduSrvRingVlanId	1.3.6.1.4.1.4458.1000.1.2.4.3.1.2	Integer	RW	VLAN ID of the internal ring messages. Valid values are 1 to 4094. Initial value is 0 meaning

Name	OID	Type	Access	Description
				VLAN unaware.
radwllMilOduSrvRingEthStatus	1.3.6.1.4.1.4458.1000.1.2.4.4	Integer	RO	Represents the Ethernet service blocking state of a Rings link
radwllMilOduSrvRingMaxAllowedTimeFromLastRpm	1.3.6.1.4.1.4458.1000.1.2.4.5	Integer	RW	Defines the minimal time (in ms) required for determination of ring failure.
radwllMilOduSrvRingWTR	1.3.6.1.4.1.4458.1000.1.2.4.6	Integer	RW	Defines the minimal time (in ms) required for ring recovery.
radwllMilOduSrvQoSMode	1.3.6.1.4.1.4458.1000.1.2.5.1	Integer	RW	Mode of QoS feature.
radwllMilOduSrvQoSConfTable			N/A	QoS configuration table.
radwllMilOduSrvQoSConfEntry			N/A	QoS configuration table. INDEX { radwllMilOduSrvQoSConfIndex }
radwllMilOduSrvQoSConfIndex	1.3.6.1.4.1.4458.1000.1.2.5.2.1.1	Integer	RO	Index of QoS Configuration.
radwllMilOduSrvConfVlanQGroups	1.3.6.1.4.1.4458.1000.1.2.5.2.1.2	Integer	RO	Frames classification according to VLAN Priority IDs.
radwllMilOduSrvConfDiffservQGroups	1.3.6.1.4.1.4458.1000.1.2.5.2.1.3	Integer	RO	Frames classification according to Diffserv.
radwllMilOduSrvConfQueMir	1.3.6.1.4.1.4458.1000.1.2.5.2.1.4	Integer	RW	Desired Private MIR.
radwllMilOduSrvConfQueWeight	1.3.6.1.4.1.4458.1000.1.2.5.2.1.5	Integer	RW	QoS queueu's weights in percent.
radwllMilOduSrvQoSVlanQGroupsSetStr	1.3.6.1.4.1.4458.1000.1.2.5.3	DisplayString	RW	Frames classification according to VLAN IDs string for set.
radwllMilOduSrvQoSDiffservQGroupsSetStr	1.3.6.1.4.1.4458.1000.1.2.5.4	DisplayString	RW	Frames classification according to Diffserv IDs string for set.
radwllMilOduSrvQoSMaxRTQuePercent	1.3.6.1.4.1.4458.1000.1.2.5.5	Integer	RO	Maximal percent for RT & NRT queues.
radwllMilOduEthernetRemainingRate	1.3.6.1.4.1.4458.1000.1.3.1	Integer	RO	Current Ethernet bandwidth in bps.
radwllMilOduEthernetIfTable			N/A	ODU Ethernet Interface table.
radwllMilOduEthernetIfEntry			N/A	ODU Ethernet Interface table entry. INDEX { radwllMilOduEthernetIfIndex }
radwllMilOduEthernetIfIndex	1.3.6.1.4.1.4458.1000.1.3.2.1.1	Integer	RO	ODU Ethernet Interface Index.
radwllMilOduEthernetIfAddress	1.3.6.1.4.1.4458.1000.1.3.2.1.5	DisplayString	RO	ODU MAC address.
radwllMilOduEthernetIfAdminStatus	1.3.6.1.4.1.4458.1000.1.3.2.1.6	Integer	RW	Required state of the interface.
radwllMilOduEthernetIfOperStatus	1.3.6.1.4.1.4458.1000.1.3.2.1.7	Integer	RO	Current operational state of the interface.
radwllMilOduEthernetIfFailAction	1.3.6.1.4.1.4458.1000.1.3.2.1.8	Integer	RW	Failure action of the interface.
radwllMilOduEthernetNumOfPorts	1.3.6.1.4.1.4458.1000.1.3.3	Integer	RO	Number of ODU network interfaces.
radwllMilOduBridgeBasePortTable			N/A	ODU Bridge Ports table.
radwllMilOduBridgeBasePortEntry			N/A	ODU Bridge Ports table entry. INDEX { radwllMilOduBridgeBasePortIndex }
radwllMilOduBridgeBasePortIndex			RO	ODU Bridge Port Number.

Name	OID	Type	Access	Description
radwllMilOduBridgeBaseIfIndex			RO	IfIndex corresponding to ODU Bridge port.
radwllMilOduBridgeTpMode	1.3.6.1.4.1.4458.1000.1.4.4.101	Integer	RW	ODU bridge mode. A change is effective after reset. Valid values: hubMode (0) bridgeMode (1).
radwllMilOduBridgeTpPortTable			N/A	ODU Transparent Bridge Ports table.
radwllMilOduBridgeTpPortEntry			N/A	ODU Transparent Bridge Ports table entry. INDEX { radwllMilOduBridgeTpPortIndex }
radwllMilOduBridgeTpPortIndex			RO	ODU Transparent Bridge Port Number.
radwllMilOduBridgeTpPortInFrames	1.3.6.1.4.1.4458.1000.1.4.4.3.1.3	Counter	RO	Number of frames received by this port.
radwllMilOduBridgeTpPortOutFrames	1.3.6.1.4.1.4458.1000.1.4.4.3.1.4	Counter	RO	Number of frames transmitted by this port.
radwllMilOduBridgeTpPortInBytes	1.3.6.1.4.1.4458.1000.1.4.4.3.1.101	Counter	RO	Number of bytes received by this port.
radwllMilOduBridgeTpPortOutBytes	1.3.6.1.4.1.4458.1000.1.4.4.3.1.102	Counter	RO	Number of bytes transmitted by this port.
radwllMilOduBridgeConfigMode	1.3.6.1.4.1.4458.1000.1.4.4.102	Integer	RO	ODU bridge configuration mode
radwllMilOduAirFreq	1.3.6.1.4.1.4458.1000.1.5.1	Integer	RW	Installation Center Frequency. Valid values are product dependent. A change is effective after link re-synchronization.
radwllMilOduAirDesiredRate	1.3.6.1.4.1.4458.1000.1.5.2	Integer	RW	Deprecated parameter actual behavior is read-only. Required Air Rate. For Channel Bandwidth of 20 10 5 MHz divide the value by 1 2 4 respectively.
radwllMilOduAirSSID	1.3.6.1.4.1.4458.1000.1.5.3	DisplayString	RW	Reserved for the Manager application provided with the product.
radwllMilOduAirTxPower	1.3.6.1.4.1.4458.1000.1.5.4	Integer	RW	Required Transmit power in dBm . This is a nominal value while the actual transmit power includes additional attenuation. The min and max values are product specific. A change is effective immediately.
radwllMilOduAirSesState	1.3.6.1.4.1.4458.1000.1.5.5	Integer	RO	Current Link State. The value is active (3) during normal operation.
radwllMilOduAirMstrSlv	1.3.6.1.4.1.4458.1000.1.5.6	Integer	RO	This parameter indicates if the device was automatically selected into the radio link master or slave. The value is undefined if there is no link.
radwllMilOduAirResync	1.3.6.1.4.1.4458.1000.1.5.8	Integer	RW	Setting this parameter to 1 will cause the link to restart the synchronization process.
radwllMilOduAirRxPower	1.3.6.1.4.1.4458.1000.1.5.9.1	Integer	RO	Received Signal Strength in dBm.
radwllMilOduAirTotalFrames	1.3.6.1.4.1.4458.1000.1.5.9.2	Counter	RO	Total Number of received radio frames.
radwllMilOduAirBadFrames	1.3.6.1.4.1.4458.1000.1.5.9.3	Counter	RO	Total number of received radio frames with CRC error.

Name	OID	Type	Access	Description
radwllMilOduAirCurrentRate	1.3.6.1.4.1.4458.1000.1.5.9.4	Integer	RO	Deprecated parameter. Actual rate of the air interface in Mbps. For Channel Bandwidth of 20 10 5 MHz divide the value by 1 2 4 respectively.
radwllMilOduAirCurrentRateIdx	1.3.6.1.4.1.4458.1000.1.5.9.5	Integer	RO	Index of current air rate.
radwllMilOduAirTxPower36	1.3.6.1.4.1.4458.1000.1.5.10	Integer	RW	Deprecated parameter. Actual behavior is read-only.
radwllMilOduAirTxPower48	1.3.6.1.4.1.4458.1000.1.5.11	Integer	RW	Deprecated parameter. Actual behavior is read-only.
radwllMilOduAirCurrentTxPower	1.3.6.1.4.1.4458.1000.1.5.12	Integer	RO	Current Transmit Power in dBm. This is a nominal value while the actual transmit power includes additional attenuation.
radwllMilOduAirMinFrequency	1.3.6.1.4.1.4458.1000.1.5.13	Integer	RO	Minimum center frequency in MHz.
radwllMilOduAirMaxFrequency	1.3.6.1.4.1.4458.1000.1.5.14	Integer	RO	Maximum center frequency in MHz.
radwllMilOduAirFreqResolution	1.3.6.1.4.1.4458.1000.1.5.15	Integer	RO	Center Frequency resolution. Measured in MHz if value < 100 otherwise in KHz.
radwllMilOduAirCurrentFreq	1.3.6.1.4.1.4458.1000.1.5.16	Integer	RO	Current Center Frequency. Measured in MHz if center frequency resolution value < 100 otherwise in KHz.
radwllMilOduAirNumberOfChannels	1.3.6.1.4.1.4458.1000.1.5.17	Integer	RO	Number of channels that can be used.
radwllMilOduAirChannelsTable			N/A	Table of channels used by automatic channels selection (ACS).
radwllMilOduAirChannelsEntry			N/A	ACS channels table entry. INDEX { radwllMilOduAirChannelsIndex }
radwllMilOduAirChannelsIndex	1.3.6.1.4.1.4458.1000.1.5.18.1.1	Integer	RO	Channel Index.
radwllMilOduAirChannelsFrequency	1.3.6.1.4.1.4458.1000.1.5.18.1.2	Integer	RO	Channel frequency in MHz.
radwllMilOduAirChannelsOperState	1.3.6.1.4.1.4458.1000.1.5.18.1.3	Integer	RW	Channel state. Can be set by the user. Automatic Channel Selection uses channels that are AirChannelsOperState enabled and AirChannelsAvail enabled. A change is effective after link re-synchronization. Valid values: disabled (0) enabled (1).
radwllMilOduAirChannelsAvail	1.3.6.1.4.1.4458.1000.1.5.18.1.4	Integer	RO	Channel state. Product specific and cannot be changed by the user. Automatic Channel Selection uses channels that are AirChannelsOperState enabled and AirChannelsAvail enabled. Valid values: disabled (0) enabled (1).
radwllMilOduAirChannelsDefaultFreq	1.3.6.1.4.1.4458.1000.1.5.18.1.5	Integer	RO	Default channel's availability for all CBWs. The valid values are: forbidden (0) available (1).
radwllMilOduAirDfsState	1.3.6.1.4.1.4458.1000.1.5.19	Integer	RO	Radar detection state. Valid values: disabled (0)

Name	OID	Type	Access	Description
				enabled (1).
radwllMilOduAirAutoChannelSelectionState	1.3.6.1.4.1.4458.1000.1.5.20	Integer	RO	Deprecated parameter. Indicating Automatic Channel Selection availability at current channel bandwidth. Valid values: disabled (0) enabled (1).
radwllMilOduAirEnableTxPower	1.3.6.1.4.1.4458.1000.1.5.21	Integer	RO	Indicating Transmit power configuration enabled or disabled.
radwllMilOduAirMinTxPower	1.3.6.1.4.1.4458.1000.1.5.22	Integer	RO	Minimum Transmit power in dBm.
radwllMilOduAirMaxTxPowerTable			N/A	Table of Maximum transmit power per air rate in dBm.
radwllMilOduAirMaxTxPowerEntry			N/A	Maximum Transmit power table entry. INDEX { radwllMilOduAirMaxTxPowerIndex }
radwllMilOduAirMaxTxPowerIndex	1.3.6.1.4.1.4458.1000.1.5.23.1.1	Integer	RO	Air interface rate index.
radwllMilOduAirMaxTxPower	1.3.6.1.4.1.4458.1000.1.5.23.1.2	Integer	RO	Maximum Transmit power in dBm.
radwllMilOduAirChannelBandwidth	1.3.6.1.4.1.4458.1000.1.5.24	Integer	RW	Channel bandwidth in KHz. A change is effective after reset.
radwllMilOduAirChannelBWTable			N/A	Channel Bandwidths table.
radwllMilOduAirChannelBWEntry			N/A	Channel Bandwidth table entry. INDEX { radwllMilOduAirChannelBWIndex }
radwllMilOduAirChannelBWIndex	1.3.6.1.4.1.4458.1000.1.5.25.1.1	Integer	RO	Channel Bandwidth index.
radwllMilOduAirChannelBWAvail	1.3.6.1.4.1.4458.1000.1.5.25.1.2	Integer	RO	Channel Bandwidth availability product specific. Options are: Not supported supported with manual channel selection supported with Automatic Channel Selection.
radwllMilOduAirChannelsAdminState	1.3.6.1.4.1.4458.1000.1.5.25.1.3	DisplayString	RO	Channels' availability per CBW.
radwllMilOduAirChannelBWHSSATDDConflictPerCBW	1.3.6.1.4.1.4458.1000.1.5.25.1.4	Integer	RO	Indication for possible Link drop per CBW due to conflict between HSS and ATDD.
radwllMilOduAirChannelBWMinRatioForSupporting	1.3.6.1.4.1.4458.1000.1.5.25.1.5	Integer	RO	Minimal TX ratio that may be used by the HSM and still enable proper operation of the aforementioned CBW.
radwllMilOduAirChannelBWMaxRatioForSupporting	1.3.6.1.4.1.4458.1000.1.5.25.1.6	Integer	RO	Maximal TX ratio that may be used by the HSM and still enable proper operation of the aforementioned CBW.
radwllMilOduAirRFD	1.3.6.1.4.1.4458.1000.1.5.26	Integer	RO	Current radio frame duration in microseconds.
radwllMilOduAirRatesTable			N/A	Air Rate indexes table for current channel bandwidth.
radwllMilOduAirRatesEntry			N/A	Air Rate indexes table entry. INDEX { radwllMilOduAirRatesIndex }
radwllMilOduAirRatesIndex	1.3.6.1.4.1.4458.1000.1.5.27.1.1	Integer	RO	Air Rate index.

Name	OID	Type	Access	Description
radwllMilOduAirRatesAvail	1.3.6.1.4.1.4458.1000.1.5.27.1.2	Integer	RO	Air Rate availability depending on air interface conditions.
radwllMilOduAirDesiredRateIdx	1.3.6.1.4.1.4458.1000.1.5.28	Integer	RW	Required Air Rate index. 0 reserved for Adaptive Rate. A change is effective immediately after Set operation to the master side while the link is up.
radwllMilOduAirLinkDistance	1.3.6.1.4.1.4458.1000.1.5.29	Integer	RO	Link distance in meters. A value of -1 indicates an illegal value and is also used when a link is not established.
radwllMilOduAirLinkWorkingMode	1.3.6.1.4.1.4458.1000.1.5.30	Integer	RO	Link working mode as a result of comparing versions of both sides of the link. Possible modes are: Unknown - no link Normal - versions on both sides are identical with full compatibility with restricted compatibility or versions on both sides are different with software upgrade or versions incompatibility.
radwllMilOduAirMajorLinkIfVersion	1.3.6.1.4.1.4458.1000.1.5.31	Integer	RO	Major link interface version
radwllMilOduAirMinorLinkIfVersion	1.3.6.1.4.1.4458.1000.1.5.32	Integer	RO	Minor link interface version
radwllMilOduAirHssDesiredOpState	1.3.6.1.4.1.4458.1000.1.5.40.1	Integer	RW	Required Hub Site Synchronization operating state.
radwllMilOduAirHssCurrentOpState	1.3.6.1.4.1.4458.1000.1.5.40.2	Integer	RO	Current Hub Site Synchronization operating state.
radwllMilOduAirHssSyncStatus	1.3.6.1.4.1.4458.1000.1.5.40.3	Integer	RO	Hub Site Synchronization sync status.
radwllMilOduAirHssExtPulseStatus	1.3.6.1.4.1.4458.1000.1.5.40.4	Integer	RO	Hub Site Synchronization external pulse detection status. In GSS mode: if generating then 1PSP is auto generated by the GSS Unit. if generatingAndDetecting then 1PSP is generated by GPS satellites signal.
radwllMilOduAirHssExtPulseType	1.3.6.1.4.1.4458.1000.1.5.40.5	Integer	RO	Hub Site Synchronization external pulse type.
radwllMilOduAirHssDesiredExtPulseTyp e	1.3.6.1.4.1.4458.1000.1.5.40.6	Integer	RW	Hub Site Synchronization required external pulse type. Valid values for read write: {typeA(2) typeB(3) typeC(4) typeD(5) typeE(6)}. Valid value for read only: {notApplicable(1)}.
radwllMilOduAirHssRfpTable			N/A	ODU Radio Frame Patterns (RFP) Table.
radwllMilOduAirHssRfpEntry			N/A	ODU RFP Table entry. INDEX { radwllMilOduAirHssRfpIndex }
radwllMilOduAirHssRfpIndex	1.3.6.1.4.1.4458.1000.1.5.40.7.1.1	Integer	RO	ODU RFP Table index. The index represent the Radio Frame Pattern: typeA(2) typeB(3) typeC(4) typeD(5) typeE(6).
radwllMilOduAirHssRfpEthChannelBW5 MHz	1.3.6.1.4.1.4458.1000.1.5.40.7.1.2	Integer	RO	Represents the compatibility of Ethernet service under Channel BW of 5MHz in the specific Radio Frame Pattern.

Name	OID	Type	Access	Description
radwllMilOduAirHssRfpTdmChannelBW5MHz	1.3.6.1.4.1.4458.1000.1.5.40.7.1.3	Integer	RO	Represents the compatibility of TDM service under Channel BW of 5MHz in the specific Radio Frame Pattern.
radwllMilOduAirHssRfpEthChannelBW10MHz	1.3.6.1.4.1.4458.1000.1.5.40.7.1.4	Integer	RO	Represents the compatibility of Ethernet service under Channel BW of 10MHz in the specific Radio Frame Pattern.
radwllMilOduAirHssRfpTdmChannelBW10MHz	1.3.6.1.4.1.4458.1000.1.5.40.7.1.5	Integer	RO	Represents the compatibility of TDM service under Channel BW of 10MHz in the specific Radio Frame Pattern.
radwllMilOduAirHssRfpEthChannelBW20MHz	1.3.6.1.4.1.4458.1000.1.5.40.7.1.6	Integer	RO	Represents the compatibility of Ethernet service under Channel BW of 20MHz in the specific Radio Frame Pattern.
radwllMilOduAirHssRfpTdmChannelBW20MHz	1.3.6.1.4.1.4458.1000.1.5.40.7.1.7	Integer	RO	Represents the compatibility of TDM service under Channel BW of 20MHz in the specific Radio Frame Pattern.
radwllMilOduAirHssRfpEthChannelBW40MHz			RO	Represents the compatibility of Ethernet service under Channel BW of 40MHz in the specific Radio Frame Pattern.
radwllMilOduAirHssRfpTdmChannelBW40MHz			RO	Represents the compatibility of TDM service under Channel BW of 40MHz in the specific Radio Frame Pattern.
radwllMilOduAirHssRfpStr	1.3.6.1.4.1.4458.1000.1.5.40.8	DisplayString	RO	Hub Site Synchronization supported patterns
radwllMilOduAirHSSHsmID	1.3.6.1.4.1.4458.1000.1.5.40.9	Integer	RO	A unique ID which is common to the HSM and all its collocated ODUs
radwllMilOduAirHssTime	1.3.6.1.4.1.4458.1000.1.5.40.10.0	DisplayString	RO	Hub Site Synchronization GPS time
radwllMilOduAirHssLatitude	1.3.6.1.4.1.4458.1000.1.5.40.11.0	DisplayString	RO	Hub Site Synchronization GPS Latitude
radwllMilOduAirHssNSIndicator	1.3.6.1.4.1.4458.1000.1.5.40.12.0	DisplayString	RO	Hub Site Synchronization GPS N/S Indicator
radwllMilOduAirHssLongitude	1.3.6.1.4.1.4458.1000.1.5.40.13.0	DisplayString	RO	Hub Site Synchronization GPS Longitude
radwllMilOduAirHssEWIndicator	1.3.6.1.4.1.4458.1000.1.5.40.14.0	DisplayString	RO	Hub Site Synchronization GPS E/W Indicator
radwllMilOduAirHssNumSatellites	1.3.6.1.4.1.4458.1000.1.5.40.15.0	DisplayString	RO	Hub Site Synchronization GPS Number of satellites
radwllMilOduAirHssAltitude	1.3.6.1.4.1.4458.1000.1.5.40.16.0	DisplayString	RO	Hub Site Synchronization GPS Altitude
radwllMilOduAirHssRfpPhase	1.3.6.1.4.1.4458.1000.1.5.40.17.0	Integer	RW	Hub Site Synchronization GPS RFP phase
radwllMilOduAirLockRemote	1.3.6.1.4.1.4458.1000.1.5.41	Integer	RW	This parameter enables locking the link with a specific ODU. The following values can be set: Unlock (default) - The ODU is not locked on a specific remote ODU. Unlock can only be performed when the link is not connected. Lock - The ODU is locked on a specific remote ODU. Lock can only be performed when the link is active.

Name	OID	Type	Access	Description
radwllMilOduAirAntennaGain	1.3.6.1.4.1.4458.1000.1.5.42	Integer	RW	Current Antenna Gain in 0.1 dBi resolution. User defined value for external antenna. Legal range: MinAntennaGain<AntennaGain<MaxAntennaGain.
radwllMilOduAirFeederLoss	1.3.6.1.4.1.4458.1000.1.5.43	Integer	RW	Current Feeder Loss in 0.1 dBm resolution. User defined value for external antenna.
radwllMilOduAirMaxAntennaGain	1.3.6.1.4.1.4458.1000.1.5.44	Integer	RO	Maximum allowed Antenna Gain in 0.1 dBi resolution.
radwllMilOduAirMinAntennaGain	1.3.6.1.4.1.4458.1000.1.5.45	Integer	RO	Minimum allowed Antenna Gain in 0.1 dBi resolution.
radwllMilOduAirMaxEIRP	1.3.6.1.4.1.4458.1000.1.5.46	Integer	RO	Maximum EIRP value as defined by regulation in 0.1 dBm resolution.
radwllMilOduAirAntennaGainConfigSupport	1.3.6.1.4.1.4458.1000.1.5.47	Integer	RO	Antenna Gain Configurability options are product specific: supported not supported.
radwllMilOduAirAntennaType	1.3.6.1.4.1.4458.1000.1.5.48	Integer	RW	External Antenna Type: Monopolar or Bipolar.
radwllMilOduAirRssBalance	1.3.6.1.4.1.4458.1000.1.5.49	Integer	RO	RSS balance. Relation between RSS in radio 1 and RSS in radio 2.
radwllMilOduAirTotalTxPower	1.3.6.1.4.1.4458.1000.1.5.50	Integer	RO	Total Transmit Power in dBm. This is a nominal value While the actual transmit power includes additional attenuation.
radwllMilOduAirInstallFreqAndCBW	1.3.6.1.4.1.4458.1000.1.5.51	DisplayString	RW	Installation frequency Channel BW.
radwllMilOduAirDFStype	1.3.6.1.4.1.4458.1000.1.5.52	Integer	RO	DFS regulation type.
radwllMilOduAirComboSubBandTable			N/A	ODU Multi-band Sub Bands Table.
radwllMilOduAirComboSubBandEntry			N/A	ODU Multi-band Sub Bands Table entry. INDEX { radwllMilOduAirComboSubBandIndex }
radwllMilOduAirComboSubBandIndex	1.3.6.1.4.1.4458.1000.1.5.53.1.1.1	Integer	RO	ODU Multi-band sub bands table index.
radwllMilOduAirComboSubBandId	1.3.6.1.4.1.4458.1000.1.5.53.1.1.2	DisplayString	RO	Represents the Multi-band sub band ID.
radwllMilOduAirComboSubBandDescription	1.3.6.1.4.1.4458.1000.1.5.53.1.1.3	DisplayString	RO	Multi-band sub band description.
radwllMilOduAirComboSubBandInstallFreq	1.3.6.1.4.1.4458.1000.1.5.53.1.1.4	Integer	RO	Represents the Multi-band sub band installation frequency in KHz.
radwllMilOduAirComboSubBandAdminState	1.3.6.1.4.1.4458.1000.1.5.53.1.1.5	Integer	RO	Represents the Multi-band sub band administrative state.
radwllMilOduAirComboSubBandInstallationAllowed	1.3.6.1.4.1.4458.1000.1.5.53.1.1.6	Integer	RO	Reflects if the Multi-band sub band allowes installtion.
radwllMilOduAirComboFrequencyBandId	1.3.6.1.4.1.4458.1000.1.5.53.1.1.7	Integer	RO	Reflects the frequency band Id.
radwllMilOduAirComboNumberOfSubB	1.3.6.1.4.1.4458.1000.1.5.53.2	Integer	RO	Represents the number of Multi-band sub

Name	OID	Type	Access	Description
ands				bands.
radwllMilOduAirComboSwitchSubBand	1.3.6.1.4.1.4458.1000.1.5.53.3	DisplayString	RW	Switch sub band operation with a given sub band ID. The get operation retrieves the current sub band ID.
radwllMilOduAirInternalMaxRate	1.3.6.1.4.1.4458.1000.1.5.54	Integer	RO	Max Ethernet throughput of the site (in Kpbs).
radwllMilOduAirCapacityDirection	1.3.6.1.4.1.4458.1000.1.5.55	Integer	RW	Capacity direction of the site.
radwllMilOduAirSpectrumAnalysisOperState	1.3.6.1.4.1.4458.1000.1.5.56.1	Integer	RW	Spectrum Analysis operation state. The configurable values are Spectrum Analysis Stop Start and Restart. Not Supported value indicates that the feature is not supported on the device. Not Supported is not a configurable state.
radwllMilOduAirRxPowerAntennaA	1.3.6.1.4.1.4458.1000.1.5.56.2	Integer	RO	Received Signal Strength in dBm of Antenna A.
radwllMilOduAirRxPowerAntennaB	1.3.6.1.4.1.4458.1000.1.5.56.3	Integer	RO	Received Signal Strength in dBm of Antenna B.
radwllMilOduAirNumberOfSpectrumChannels	1.3.6.1.4.1.4458.1000.1.5.56.4	Integer	RO	Represents the number of Spectrum Channels.
radwllMilOduAirSpectrumChannelTable			N/A	ODU Spectrum Analysis Channel Table.
radwllMilOduAirSpectrumChannelTableEntry			N/A	ODU Spectrum Analysis Channel Table entry. INDEX { radwllMilOduAirSpectrumChannelIndex }
radwllMilOduAirSpectrumChannelIndex	1.3.6.1.4.1.4458.1000.1.5.56.5.1.1	Integer	RO	ODU Spectrum Channel index.
radwllMilOduAirSpectrumChannelFrequency	1.3.6.1.4.1.4458.1000.1.5.56.5.1.2	Integer	RO	ODU Spectrum Channel frequency in MHz.
radwllMilOduAirSpectrumChannelScanned	1.3.6.1.4.1.4458.1000.1.5.56.5.1.3	Integer		read-only
radwllMilOduAirSpectrumChannelScanningTimestamp	1.3.6.1.4.1.4458.1000.1.5.56.5.1.4	TimeTicks	RO	Channel last scan timestamp in hundredths of a second since device up time. If the channel was not scanned than the return value will be 0.
radwllMilOduAirSpectrumChannelLastNFAntennaA	1.3.6.1.4.1.4458.1000.1.5.56.5.1.5	Integer	RO	Normalized Noise Floor value in dBm - of Antenna A - (including 2 neighbor frequencies).
radwllMilOduAirSpectrumChannelLastNFAntennaB	1.3.6.1.4.1.4458.1000.1.5.56.5.1.6	Integer	RO	Normalized Noise Floor value in dBm - of Antenna B - (including 2 neighbor frequencies).
radwllMilOduAirSpectrumChannelAverageNFAntennaA	1.3.6.1.4.1.4458.1000.1.5.56.5.1.7	Integer	RO	Average normalized Noise Floor value in dBm - of Antenna A - over all dwells.
radwllMilOduAirSpectrumChannelAverageNFAntennaB	1.3.6.1.4.1.4458.1000.1.5.56.5.1.8	Integer	RO	Average normalized Noise Floor value in dBm - of Antenna B - over all dwells.
radwllMilOduAirSpectrumChannelMaxNFAntennaA	1.3.6.1.4.1.4458.1000.1.5.56.5.1.9	Integer	RO	Max normalized Noise Floor value in dBm - of Antenna A - over all dwells.
radwllMilOduAirSpectrumChannelMax	1.3.6.1.4.1.4458.1000.1.5.56.5.1.10	Integer	RO	Max normalized Noise Floor value in dBm - of

Name	OID	Type	Access	Description
NFAntennaB				Antenna B - over all dwells.
radwllMilOduAirSpectrumChannelCACPerformed	1.3.6.1.4.1.4458.1000.1.5.56.5.1.11	Integer	RO	read-only
radwllMilOduAirSpectrumChannelLastCACTimestamp	1.3.6.1.4.1.4458.1000.1.5.56.5.1.12	TimeTicks	RO	Last CAC performed timestamp in hundredths of a second since device up time. If no CAC has performed on the channel the return value will be 0.
radwllMilOduAirSpectrumChannelRadarDetected	1.3.6.1.4.1.4458.1000.1.5.56.5.1.13	Integer	RO	read-only
radwllMilOduAirSpectrumChannelRadarDetectionTimestamp	1.3.6.1.4.1.4458.1000.1.5.56.5.1.14	TimeTicks	RO	Last Radar Detection timestamp in hundredths of a second since device up time. If no Radar has detected on the channel the return value will be 0.
radwllMilOduAirSpectrumChannelAvailable	1.3.6.1.4.1.4458.1000.1.5.56.5.1.15	Integer	RO	read-only
radwllMilOduAirAntConfAndRatesStatus	1.3.6.1.4.1.4458.1000.1.5.57	Integer	RO	Description: Antenna configuration and Rates status (1 = Single antenna with single data stream 2 = Dual antenna with single data stream 3 = Dual antenna with dual data stream).
radwllMilOduAirDualAntTxMode	1.3.6.1.4.1.4458.1000.1.5.58	Integer	RW	Description: Transmission type when using Dual radios (MIMO or AdvancedDiversity using one stream of data).
radwllMilOduAirTxOperationMode	1.3.6.1.4.1.4458.1000.1.5.59	Integer	RW	This parameter controls the Operation mode of frames sent over the air. The Operation mode is either normal (1) for regular transmission where frame size is determined by the traffic or throughput test (2) when the user requests an actual over the air throughput estimation using full frames. The latter lasts no more than a predetermined interval (default 30 sec).
radwllMilOduAirDesiredNetMasterTxRatio	1.3.6.1.4.1.4458.1000.1.5.60.1	Integer	RW	This parameter is reserved to the element manager provided with the product.
radwllMilOduAirCurrentNetMasterTxRatio	1.3.6.1.4.1.4458.1000.1.5.60.2	Integer	RO	Represents the actual Net Master Tx RAtio.
radwllMilOduAirMinUsableMasterTxRatio	1.3.6.1.4.1.4458.1000.1.5.60.3	Integer	RO	Represents the minimal value the user can configure for Desired net mAster Tx Ratio.
radwllMilOduAirMaxUsableMasterTxRatio	1.3.6.1.4.1.4458.1000.1.5.60.4	Integer	RO	Represents the maximal value the user can configure for Desired net mAster Tx Ratio.
radwllMilOduAirAccumulatedUAS	1.3.6.1.4.1.4458.1000.1.5.61	Integer	RO	Accumulates the Unavailable seconds of the Air Interface.
radwllMilOduPerfMonCurrTable			N/A	This table defines/keeps the counters of the

Name	OID	Type	Access	Description
				current 15 min interval.
radwllMilOduPerfMonCurrEntry			N/A	This is an entry in the Current Interval Table. INDEX {ifIndex }
radwllMilOduPerfMonCurrUAS	1.3.6.1.4.1.4458.1000.1.6.1.1.1	Gauge	RO	The current number of Unavailable Seconds starting from the present 15 minutes period.
radwllMilOduPerfMonCurrES	1.3.6.1.4.1.4458.1000.1.6.1.1.2	Gauge	RO	Current number of Errored Seconds starting from the present 15 minutes period.
radwllMilOduPerfMonCurrSES	1.3.6.1.4.1.4458.1000.1.6.1.1.3	Gauge	RO	Current number of Severely Errored Seconds starting from the present 15 minutes period.
radwllMilOduPerfMonCurrBBE	1.3.6.1.4.1.4458.1000.1.6.1.1.4	Gauge	RO	Current number of Background Block Errors starting from the present 15 minutes period.
radwllMilOduPerfMonCurrIntegrity	1.3.6.1.4.1.4458.1000.1.6.1.1.5	Integer	RO	Indicates the integrity of the entry.
radwllMilOduPerfMonIntervalTable			N/A	This table defines/keeps the counters of the last day (in resolution of 15 min intervals).
radwllMilOduPerfMonIntervalEntry			N/A	This is an entry in the Interval Table. INDEX {ifIndex radwllMilOduPerfMonIntervalIdx }
radwllMilOduPerfMonIntervalIdx			RO	This table is indexed per interval number. Each interval is of 15 minutes and the oldest is 96.
radwllMilOduPerfMonIntervalUAS			RO	The current number of Unavailable Seconds per interval.
radwllMilOduPerfMonIntervalES			RO	Current number of Errored Seconds per interval.
radwllMilOduPerfMonIntervalSES			RO	Current number of Severely Errored Seconds per interval.
radwllMilOduPerfMonIntervalBBE			RO	Current number of Background Block Errors per interval.
radwllMilOduPerfMonIntervalIntegrity			RO	Indicates the integrity of the entry per interval.
radwllMilOduPerfMonDayTable			N/A	This table defines/keeps the counters of the last month (in resolution of days).
radwllMilOduPerfMonDayEntry			N/A	This is an entry in the Days Table. INDEX {ifIndex radwllMilOduPerfMonDayIdx }
radwllMilOduPerfMonDayIdx			RO	This table is indexed per interval number. Each interval is of 24 hours and the oldest is 30.
radwllMilOduPerfMonDayUAS			RO	The current number of Unavailable Seconds per interval of 24 hours.
radwllMilOduPerfMonDayES			RO	Current number of Errored Seconds per interval of 24 hours.
radwllMilOduPerfMonDaySES			RO	Current number of Severely Errored Seconds per interval of 24 hours.

Name	OID	Type	Access	Description
radwllMilOduPerfMonDayBBE			RO	Current number of Background Block Errors per interval of 24 hours.
radwllMilOduPerfMonDayIntegrity			RO	Indicates the integrity of the entry per interval of 24 hours.
radwllMilOduPerfMonAirCurrTable			N/A	This table defines/keeps the air counters of the current 15 min interval.
radwllMilOduPerfMonAirCurrEntry			N/A	This is an entry in the Current Interval Table. INDEX {ifIndex }
radwllMilOduPerfMonAirCurrMinRSL	1.3.6.1.4.1.4458.1000.1.6.4.1.1	Integer	RO	Current Min Received Level Reference starting from the present 15 minutes period.
radwllMilOduPerfMonAirCurrMaxRSL	1.3.6.1.4.1.4458.1000.1.6.4.1.2	Integer	RO	Current Max Received Level Reference starting from the present 15 minutes period.
radwllMilOduPerfMonAirCurrRSLThresh1Exceed	1.3.6.1.4.1.4458.1000.1.6.4.1.3	Gauge	RO	Number of seconds Receive Signal Level exceeded the RSL1 threshold in the last 15 minutes.
radwllMilOduPerfMonAirCurrRSLThresh2Exceed	1.3.6.1.4.1.4458.1000.1.6.4.1.4	Gauge	RO	Number of seconds Receive Signal Level exceeded the RSL2 threshold in the last 15 minutes.
radwllMilOduPerfMonAirCurrMinTSL	1.3.6.1.4.1.4458.1000.1.6.4.1.5	Integer	RO	Current Min Transmit Signal Level starting from the present 15 minutes period.
radwllMilOduPerfMonAirCurrMaxTSL	1.3.6.1.4.1.4458.1000.1.6.4.1.6	Integer	RO	Current Max Transmit Signal Level starting from the present 15 minutes period.
radwllMilOduPerfMonAirCurrTSLThresh1Exceed	1.3.6.1.4.1.4458.1000.1.6.4.1.7	Gauge	RO	Number of seconds Transmit Signal Level exceeded the TSL1 threshold in the last 15 minutes.
radwllMilOduPerfMonAirCurrBBERThresh1Exceed	1.3.6.1.4.1.4458.1000.1.6.4.1.8	Gauge	RO	Number of seconds Background Block Error Ratio exceeded the BBER1 threshold in the last 15 minutes.
radwllMilOduPerfMonAirIntervalTable			N/A	This table defines/keeps the air counters of the last day (in resolution of 15 min intervals).
radwllMilOduPerfMonAirIntervalEntry			N/A	This is an entry in the Interval Table. INDEX {ifIndex radwllMilOduPerfMonAirIntervalIdx }
radwllMilOduPerfMonAirIntervalIdx			RO	This table is indexed per interval number. Each interval is of 15 minutes and the oldest is 96.
radwllMilOduPerfMonAirIntervalMinRSL			RO	Current Min Received Level Reference per interval.
radwllMilOduPerfMonAirIntervalMaxRSL			RO	Current Max Received Level Reference per interval.
radwllMilOduPerfMonAirIntervalRSLThresh1Exceed			RO	Number of seconds Receive Signal Level exceeded the RSL1 threshold per interval.

Name	OID	Type	Access	Description
radwllMilOduPerfMonAirIntervalRSLThresh2Exceed			RO	Number of seconds Receive Signal Level exceeded the RSL2 threshold ACCESS read-only per interval.
radwllMilOduPerfMonAirIntervalMinTSL			RO	Current Min Transmit Signal Level per interval.
radwllMilOduPerfMonAirIntervalMaxTSL			RO	Current Max Transmit Signal Level per interval.
radwllMilOduPerfMonAirIntervalTSLThresh1Exceed			RO	Number of seconds Transmit Signal Level exceeded the TSL1 threshold per interval.
radwllMilOduPerfMonAirIntervalBBERThresh1Exceed			RO	Number of seconds Background Block Error Ratio exceeded the BBER1 threshold per interval.
radwllMilOduPerfMonAirDayTable			N/A	This table defines/keeps the air counters of the last month (in resolution of days).
radwllMilOduPerfMonAirDayEntry			N/A	This is an entry in the Days Table. INDEX {ifIndex radwllMilOduPerfMonAirDayIdx }
radwllMilOduPerfMonAirDayIdx			RO	This table is indexed per Day number. Each Day is of 15 minutes and the oldest is 96.
radwllMilOduPerfMonAirDayMinRSL			RO	Current Min Received Level Reference per Day.
radwllMilOduPerfMonAirDayMaxRSL			RO	Current Max Received Level Reference per Day.
radwllMilOduPerfMonAirDayRSLThresh1Exceed			RO	Number of seconds Receive Signal Level exceeded the RSL1 threshold per Day.
radwllMilOduPerfMonAirDayRSLThresh2Exceed			RO	Number of seconds Receive Signal Level exceeded the RSL2 threshold per Day.
radwllMilOduPerfMonAirDayMinTSL			RO	Current Min Transmit Signal Level per Day.
radwllMilOduPerfMonAirDayMaxTSL			RO	Current Max Transmit Signal Level per Day.
radwllMilOduPerfMonAirDayTSLThresh1Exceed			RO	Number of seconds Transmit Signal Level exceeded the TSL1 threshold per Day.
radwllMilOduPerfMonAirDayBBERThresh1Exceed			RO	Number of seconds Background Block Error Ratio exceeded the BBER1 threshold per Day.
radwllMilOduPerfMonEthCurrTable			N/A	This table defines/keeps the ethernet counters of the current 15 min interval.
radwllMilOduPerfMonEthCurrEntry			N/A	This is an entry in the Current Interval Table. INDEX {ifIndex }
radwllMilOduPerfMonEthCurrRxMBytes	1.3.6.1.4.1.4458.1000.1.6.7.1.1	Gauge	RO	Current RX Mega Bytes starting from the present 15 minutes period.
radwllMilOduPerfMonEthCurrTxMBytes	1.3.6.1.4.1.4458.1000.1.6.7.1.2	Gauge	RO	Current Transmit Mega Bytes starting from the present 15 minutes period.
radwllMilOduPerfMonEthCurrEthCapacityThreshUnder	1.3.6.1.4.1.4458.1000.1.6.7.1.3	Gauge	RO	The number of times throughput was below threshold in the present 15 minutes period.
radwllMilOduPerfMonEthCurrHighTraffi	1.3.6.1.4.1.4458.1000.1.6.7.1.4	Gauge	RO	The number of times actual traffic was above

Name	OID	Type	Access	Description
cThreshExceed				threshold in the present 15 minutes period.
radwllMilOduPerfMonEthCurrActiveSeconds	1.3.6.1.4.1.4458.1000.1.6.7.1.5	Gauge	RO	The number of seconds in which RPL Ethernet swervice was not blocked in the present 15 minutes period.
radwllMilOduPerfMonEthIntervalTable			N/A	This table defines/keeps the ethernet counters of the last day (in resolution of 15 min intervals).
radwllMilOduPerfMonEthIntervalEntry			N/A	This is an entry in the Interval Table. INDEX {ifIndex radwllMilOduPerfMonEthIntervalIdx }
radwllMilOduPerfMonEthIntervalIdx			RO	This table is indexed per interval number. Each interval is of 15 minutes and the oldest is 96.
radwllMilOduPerfMonEthIntervalRxMBytes			RO	Current RX Mega Bytes per interval.
radwllMilOduPerfMonEthIntervalTxMBytes			RO	Current Transmit Mega Bytes per interval.
radwllMilOduPerfMonEthIntervalEthCapacityThreshUnder			RO	The number of times throughput was below threshold in the each interval.
radwllMilOduPerfMonEthIntervalHighTrafficThreshExceed			RO	The number of times actual traffic was above threshold in the each interval.
radwllMilOduPerfMonEthIntervalActiveSeconds			RO	The number of seconds in which RPL Ethernet service was not blocked in the each interval.
radwllMilOduPerfMonEthDayTable			N/A	This table defines/keeps the ethernet counters of the last month (in resolution of days).
radwllMilOduPerfMonEthDayEntry			N/A	This is an entry in the Days Table. INDEX {ifIndex radwllMilOduPerfMonEthDayIdx }
radwllMilOduPerfMonEthDayIdx			RO	This table is indexed per Day number. Each interval is of 15 minutes and the oldest is 96.
radwllMilOduPerfMonEthDayRxMBytes			RO	Current RX Mega Bytes per day.
radwllMilOduPerfMonEthDayTxMBytes			RO	Current Transmit Mega Bytes per day.
radwllMilOduPerfMonEthDayEthCapacityThreshUnder			RO	The number of times throughput was below threshold each day.
radwllMilOduPerfMonEthDayHighTrafficThreshExceed			RO	The number of times actual traffic was above threshold each day.
radwllMilOduPerfMonEthDayActiveSeconds			RO	The number of seconds in which RPL Ethernet service was not blocked each day.
radwllMilOduPerfMonTdmCurrTable			N/A	This table defines/keeps the TDM counters of the current 15 min interval.
radwllMilOduPerfMonTdmCurrEntry			N/A	This is an entry in the Current Interval Table. INDEX {ifIndex }

Name	OID	Type	Access	Description
radwllMilOduPerfMonTdmCurrActiveSeconds	1.3.6.1.4.1.4458.1000.1.6.10.1.1	Gauge	RO	Parameter indicating whether the TDM service was active. Under TDM backup link the parameter indicates whether the backup link was active.
radwllMilOduPerfMonTdmIntervalTable			N/A	This table defines/keeps the TDM counters of the last day (in resolution of 15 min intervals).
radwllMilOduPerfMonTdmIntervalEntry			N/A	This is an entry in the Interval Table. INDEX {ifIndex radwllMilOduPerfMonTdmIntervalIdx }
radwllMilOduPerfMonTdmIntervalIdx			RO	This table is indexed per interval number. Each interval is of 15 minutes and the oldest is 96.
radwllMilOduPerfMonTdmIntervalActiveSeconds			RO	Parameter indicating whether the TDM service was active. Under TDM backup link the parameter indicates whether the backup link was active.
radwllMilOduPerfMonTdmDayTable			N/A	This table defines/keeps the TDM counters of the last month (in resolution of days).
radwllMilOduPerfMonTdmDayEntry			N/A	This is an entry in the Days Table. INDEX {ifIndex radwllMilOduPerfMonTdmDayIdx }
radwllMilOduPerfMonTdmDayIdx			RO	This table is indexed per Day number. Each interval is of 15 minutes and the oldest is 96.
radwllMilOduPerfMonTdmDayActiveSeconds			RO	Parameter indicating whether the TDM service was active. Under TDM backup link the parameter indicates whether the backup link was active.
radwllMilOduPerfMonTxThresh1	1.3.6.1.4.1.4458.1000.1.6.20	Integer	RW	When the Transmit power exceeds this threshold a performance monitoring TSL1 counter is incremented.
radwllMilOduPerfMonRxThresh1	1.3.6.1.4.1.4458.1000.1.6.21	Integer	RW	When the RX power exceeds this threshold a performance monitoring RSL1 counter is incremented.
radwllMilOduPerfMonRxThresh2	1.3.6.1.4.1.4458.1000.1.6.22	Integer	RW	When the RX power exceeds this threshold a performance monitoring RSL2 counter is incremented.
radwllMilOduPerfMonBBERThresh1	1.3.6.1.4.1.4458.1000.1.6.23	Integer	RW	When the BBER exceeds this threshold a performance monitoring BBER counter is incremented. The units are 1/10 of a percent.
radwllMilOduPerfMonEthCapacityThreshKbps	1.3.6.1.4.1.4458.1000.1.6.24	Integer	RW	When the current throughput is below this threshold the corresponding counter is incremented
radwllMilOduPerfMonHighTrafficThreshKbps	1.3.6.1.4.1.4458.1000.1.6.25	Integer	RW	When the current traffic is above this threshold then corresponding counter is incremented.
radwllMilOduAgnGenAddTrapExt	1.3.6.1.4.1.4458.1000.1.7.1.1	Integer	RW	If 'yes' is chosen the ifIndex Unit Severity

Name	OID	Type	Access	Description
				Time_T and Alarm Id from the radwllMilOduAgnCurrAlarmTable will be bind to the end of each private trap.
radwllMilOduAgnGenSetMode	1.3.6.1.4.1.4458.1000.1.7.1.2	Integer	RW	This parameter is reserved to the element manager provided with the product.
radwllMilOduAgnNTPCfgTimeServerIP	1.3.6.1.4.1.4458.1000.1.7.2.1	IpAddress	RW	IP address of the server from which the current time is loaded.
radwllMilOduAgnNTPCfgTimeOffsetFromUTC	1.3.6.1.4.1.4458.1000.1.7.2.2	Integer	RW	Offset from Coordinated Universal Time (minutes). Possible values: -1440..1440.
radwllMilOduAgnRealTimeAndDate	1.3.6.1.4.1.4458.1000.1.7.2.3	OctetString	RW	This parameter specifies the real time and date Format 'YYYY-MM-DD HH:MM:SS' (Hexadecimal). A date-time specification: field octets contents range 1 1-2 year 0..65536 2 3 month 1..12 3 4 day 1..31 4 5 hour 0..23 5 6 minutes 0..59 6 7 seconds 0..60 (use 60 for leap-second) 7 8 deci-seconds 0..9 For example Tuesday May 26 1992 at 1:30:15 PM EDT would be displayed as: 07 c8 05 1a 0d 1e 0f 00 (1992 -5 -26 13:30:15)
radwllMilOduAgnCurrAlarmLastChange	1.3.6.1.4.1.4458.1000.1.7.3.1	Integer	RO	This counter is initialized to 0 after a device reset and is incremented upon each change in the radwllMilOduAgnCurrAlarmTable (either an addition or removal of an entry).
radwllMilOduAgnCurrAlarmTable			N/A	This table includes the currently active alarms. When a RAISED trap is sent an alarm entry is added to the table. When a CLEAR trap is sent the entry is removed.
radwllMilOduAgnCurrAlarmEntry			N/A	Entry containing the details of a currently RAISED trap. INDEX { radwllMilOduAgnCurrAlarmCounter }
radwllMilOduAgnCurrAlarmCounter	1.3.6.1.4.1.4458.1000.1.7.3.2.1.1	Integer	RO	A running counter of active alarms. The counter is incremented for every new RAISED trap. It is cleared after a device reset.
radwllMilOduAgnCurrAlarmSeverity	1.3.6.1.4.1.4458.1000.1.7.3.2.1.2	Integer	RO	Current Alarm severity.
radwllMilOduAgnCurrAlarmId	1.3.6.1.4.1.4458.1000.1.7.3.2.1.3	Integer	RO	Unique Alarm Identifier (combines alarm type and interface). The same AlarmId is used for RAISED and CLEARED alarms.
radwllMilOduAgnCurrAlarmIfIndex	1.3.6.1.4.1.4458.1000.1.7.3.2.1.4	Integer	RO	Interface Index where the alarm occurred. Alarms that are not associated with a

Name	OID	Type	Access	Description
				specific interface will have the following value: 65535.
radwllMilOduAgnCurrAlarmUnit	1.3.6.1.4.1.4458.1000.1.7.3.2.1.5	Integer	RO	Unit associated with the alarm.
radwllMilOduAgnCurrAlarmTrapID	1.3.6.1.4.1.4458.1000.1.7.3.2.1.6	Integer	RO	ID of the raised trap that was sent when this alarm was raised.
radwllMilOduAgnCurrAlarmTimeT	1.3.6.1.4.1.4458.1000.1.7.3.2.1.7	Integer	RO	Timestamp of this alarm. This number is in seconds from Midnight January 1st 1970.
radwllMilOduAgnCurrAlarmText	1.3.6.1.4.1.4458.1000.1.7.3.2.1.8	DisplayString	RO	Alarm display text (same as the text in the sent trap).
radwllMilOduAgnLastEventsNumber	1.3.6.1.4.1.4458.1000.1.7.4.1	Integer	RO	This counter indicates the size of the radwllMilOduAgnLastEventsTable
radwllMilOduAgnLastEventsTable			N/A	This table includes the last events. When a trap is sent an event entry is added to the table.
radwllMilOduAgnLastEventsEntry			N/A	Entry containing the details of last traps. INDEX { radwllMilOduAgnLastEventsIndex }
radwllMilOduAgnLastEventsIndex	1.3.6.1.4.1.4458.1000.1.7.4.2.1.1	Integer	RO	The index of the table
radwllMilOduAgnLastEventsSeverity	1.3.6.1.4.1.4458.1000.1.7.4.2.1.2	Integer	RO	Current Trap severity.
radwllMilOduAgnLastEventsIfIndex	1.3.6.1.4.1.4458.1000.1.7.4.2.1.3	Integer	RO	Interface Index where the event occurred. Traps that are not associated with a specific interface will have the following value: 65535.
radwllMilOduAgnLastEventsTimeT	1.3.6.1.4.1.4458.1000.1.7.4.2.1.4	Integer	RO	Timestamp of this trap. This number is in seconds from Midnight January 1st 1970.
radwllMilOduAgnLastEventsText	1.3.6.1.4.1.4458.1000.1.7.4.2.1.5	DisplayString	RO	Trap display text (same as the text in the sent trap).
radwllMilIduAdmProductType	1.3.6.1.4.1.4458.1000.2.1.1	DisplayString	RO	IDU configuration description.
radwllMilIduAdmHwRev	1.3.6.1.4.1.4458.1000.2.1.2	DisplayString	RO	IDU Hardware Revision.
radwllMilIduAdmSwRev	1.3.6.1.4.1.4458.1000.2.1.3	DisplayString	RO	IDU Software Revision.
radwllMilOduAdmNumOfExternalAlarmIn	1.3.6.1.4.1.4458.1000.2.1.4	Integer	RO	Indicates the number of currently available External Alarm Inputs.
radwllMilOduAdmExternAlarmInTable			N/A	This is the External Alarm Inputs table.
radwllMilOduAdmExternAlarmInEntry			N/A	Entry containing the elements of a single External Alarm Input. INDEX { radwllMilOduAdmExternAlarmInIndex}
radwllMilOduAdmExternAlarmInIndex	1.3.6.1.4.1.4458.1000.2.1.5.1.1	Integer	RO	This value indicates the index of the External Alarm Input entry.
radwllMilOduAdmExternAlarmInText	1.3.6.1.4.1.4458.1000.2.1.5.1.2	DisplayString	RW	This field describes the External Alarm Input. It is an optional string of no more than 64 characters which will be used in the event being sent as a result of a change in the status

Name	OID	Type	Access	Description
				of the External Alarm Input. DEFVAL {Alarm Description}
radwllMilOduAdmExternAlarmInAdminState	1.3.6.1.4.1.4458.1000.2.1.5.1.3	Integer	RW	This value indicates if this External Alarm Input is enabled or disabled.
radwllMilOduAdmExternAlarmInStatus	1.3.6.1.4.1.4458.1000.2.1.5.1.4	Integer	RO	This value indicates the current status of the External Alarm Input.
radwllMilIduAdmSN	1.3.6.1.4.1.4458.1000.2.1.6	DisplayString	RO	IDU Serial Number
radwllMilIduAdmIduDetectionMode	1.3.6.1.4.1.4458.1000.2.1.7	Integer	RW	The parameter defines whether to send Ethernet frames to detect an IDU. The valid writable values are: userDisabled (3) userEnabled (4). A change requires a reset and is effective after reset.
radwllMilIduAdmMountedTrunks	1.3.6.1.4.1.4458.1000.2.1.8	Integer	RO	Number of mounted trunks in the IDU
radwllMilIduAdmLicensedTrunks	1.3.6.1.4.1.4458.1000.2.1.9	Integer	RO	Number of Licensed Trunks in the IDU
radwllMilIduAdmVlanSupported	1.3.6.1.4.1.4458.1000.2.1.10	Integer	RO	Identifies if the local IDU supports VLAN tag/untag
radwllMilIduAdmVlanEgressMode	1.3.6.1.4.1.4458.1000.2.1.11	DisplayString	RW	VLAN tag/untag egress values
radwllMilIduAdmVlanIngressMode	1.3.6.1.4.1.4458.1000.2.1.12	DisplayString	RW	VLAN tag/untag ingress values
radwllMilIduAdmVlanDefaultPortVIDs	1.3.6.1.4.1.4458.1000.2.1.13	DisplayString	RW	VLAN tag/untag default VLAN ids for each port - Right most digit is Vlan priority (0-6) other digits compose Vlan Id (1-4094)
radwllMilIduAdmVlanLan1UntaggedVIDs	1.3.6.1.4.1.4458.1000.2.1.14	DisplayString	RW	VLAN untagged VIDs for LAN1 port
radwllMilIduAdmVlanLan2UntaggedVIDs	1.3.6.1.4.1.4458.1000.2.1.15	DisplayString	RW	VLAN untagged VIDs for LAN2 port
radwllMilIduAdmVlanSfpUntaggedVIDs	1.3.6.1.4.1.4458.1000.2.1.16	DisplayString	RW	VLAN untagged VIDs for Sfp port
radwllMilIduAdmVlanLan1FilteredVIDs	1.3.6.1.4.1.4458.1000.2.1.17	DisplayString	RW	VLAN filtered VIDs for LAN1 port
radwllMilIduAdmVlanLan2FilteredVIDs	1.3.6.1.4.1.4458.1000.2.1.18	DisplayString	RW	VLAN filtered VIDs for LAN2 port
radwllMilIduAdmVlanSfpFilteredVIDs	1.3.6.1.4.1.4458.1000.2.1.19	DisplayString	RW	VLAN filtered VIDs for Sfp port
radwllMilIduSrvDesiredTrunks	1.3.6.1.4.1.4458.1000.2.2.2	Integer	RW	Required trunks bitmap. Note that the number of possible trunks that can be configured may vary based on the IDU hardware configuration the selected air interface rate and the range of the installation. The provided Manager application enables the user to select only available configurations. A change is effective immediately if applied to a master unit and the link is in service mode.
radwllMilIduSrvServices	1.3.6.1.4.1.4458.1000.2.2.4	ObjectID	RO	This parameter is reserved to the Manager application provided with the product.

Name	OID	Type	Access	Description
radwllMilIduSrvActiveTrunks	1.3.6.1.4.1.4458.1000.2.2.6	Integer	RO	A bitmap describing the currently open TDM trunks.
radwllMilIduSrvAvailableTrunks	1.3.6.1.4.1.4458.1000.2.2.8	Integer	RO	A bitmap describing the number of TDM trunks that can be opened in the current configuration. The values take into account the IDU hardware configuration the air rate and the installation range.
radwllMilIduSrvPossibleServicesTable			N/A	IDU Possible Services table.
radwllMilIduSrvPossibleServicesEntry			N/A	IDU Services table entry. INDEX { radwllMilIduSrvPossibleServicesIndex }
radwllMilIduSrvPossibleServicesIndex	1.3.6.1.4.1.4458.1000.2.2.10.1.1	Integer	RO	Table index Rate index of the air interface.
radwllMilIduSrvPossibleTdmServices	1.3.6.1.4.1.4458.1000.2.2.10.1.2	Integer	RO	Deprecated parameter. A bitmap describing the TDM trunks that can be opened in the corresponding Air Rate.
radwllMilIduSrvPossibleEthServices	1.3.6.1.4.1.4458.1000.2.2.10.1.3	Integer	RO	Deprecated parameter. This parameter describes if the Ethernet Service can be opened in the corresponding Air Rate. The valid values are: disabled (0) enabled (1).
radwllMilIduSrvRemainingRate	1.3.6.1.4.1.4458.1000.2.2.10.1.4	Integer	RO	Current Ethernet bandwidth in bps per air rate.
radwllMilIduSrvTrunkCost	1.3.6.1.4.1.4458.1000.2.2.10.1.5	Integer	RO	Cost of the TDM Service in bps.
radwllMilIduSrvAvailServicesTable			N/A	ODU Possible TDM Services table.
radwllMilIduSrvAvailServicesEntry			N/A	ODU TDM Services table entry. INDEX { radwllMilIduSrvAvailServicesIndex }
radwllMilIduSrvAvailServicesIndex	1.3.6.1.4.1.4458.1000.2.2.11.1.1	Integer	RO	Table index. The index is the bit mask of the TDM service.
radwllMilIduSrvAvailServicesState	1.3.6.1.4.1.4458.1000.2.2.11.1.2	Integer	RO	Represents the TDM service availability.
radwllMilIduSrvAvailServicesMinRateIdx	1.3.6.1.4.1.4458.1000.2.2.11.1.3	Integer	RO	Minimum rate index of the air interface which make the service possible.
radwllMilIduSrvAvailServicesMaxRateIdx	1.3.6.1.4.1.4458.1000.2.2.11.1.4	Integer	RO	Maximum rate index of the air interface which make the service possible.
radwllMilIduSrvAvailServicesReason	1.3.6.1.4.1.4458.1000.2.2.11.1.5	Integer	RO	Information about the TDM Service availability. - Not Applicable if the service is available. The reasons for TDM Service unavailability: - The available throughput isn't sufficient for Service demands; - The IDU HW doesn't support the service; - A Link Password mismatch was detected; - The external pulse type detected is improper for TDM services; - A Software versions mismatch was detected. - A-Symetric TDD Mode Is Obligated.
radwllMilIduSrvEthActive	1.3.6.1.4.1.4458.1000.2.2.12	Integer	RO	Represents the Ethernet service activation

Name	OID	Type	Access	Description
				state.
radwllMilIduSrvEthAvailable	1.3.6.1.4.1.4458.1000.2.2.13	Integer	RO	Represents the Ethernet service availability state.
radwllMilIduSrvEthThroughput	1.3.6.1.4.1.4458.1000.2.2.14	Gauge	RO	Current available Ethernet service throughput in bps.
radwllMilIduSrvEthMaxInfoRate	1.3.6.1.4.1.4458.1000.2.2.15	Integer	RW	Holds the maximum bandwidth (kbps) to be allocated for Ethernet service. Value of zero means that Ethernet service works as best effort. The maximum value is product specific. Refer to the user manual.
radwllMilIduSrvAvailableTrunksT1	1.3.6.1.4.1.4458.1000.2.2.16	Integer	RO	A bitmap describing the TDM trunks that can be opened under T1 configuration. The values take into account the IDU hardware configuration the air rate and the installation range.
radwllMilIduEthernetIfTable			N/A	IDU Ethernet Interface table.
radwllMilIduEthernetIfEntry			N/A	IDU Ethernet Interface table entry. INDEX { radwllMilIduEthernetIfIndex }
radwllMilIduEthernetIfIndex			RO	If Index corresponding to this Interface.
radwllMilIduEthernetIfAddress	1.3.6.1.4.1.4458.1000.2.3.1.1.5	DisplayString	RO	IDU MAC address.
radwllMilIduEthernetNumOfLanPorts	1.3.6.1.4.1.4458.1000.2.3.3	Integer	RO	Number of LAN interfaces in the IDU.
radwllMilIduEthernetNumOfSfpPorts	1.3.6.1.4.1.4458.1000.2.3.4	Integer	RO	The number of SFP interfaces in the IDU.
radwllMilIduEthernetSfpProperties	1.3.6.1.4.1.4458.1000.2.3.5	DisplayString	RO	SFP venfor properties : Vendor Name PN and Revision.
radwllMilIduBridgeTpAging	1.3.6.1.4.1.4458.1000.2.4.4.2	Integer	RW	Timeout in seconds for aging. Note that for this parameter to be effective the ODU must be configured to HUB mode. A change is effective immediately.
radwllMilIduTdmTxClockAvailStates	1.3.6.1.4.1.4458.1000.2.6.1.1	Integer	RO	Available states of the TDM Transmit Clock Control each input status is represented by a bit. When the state is available the bit value is 1. When the state is unavailable the bit value is 0. The available states are: bit 2 = Transparent bit 3 = Local Loop Timed bit 4 = Remote Loop Timed bit 5 = Local Internal bit 6 = Remote Internal
radwllMilIduTdmTxClockDesiredState	1.3.6.1.4.1.4458.1000.2.6.1.2	Integer	RW	Required state of the TDM Transmit Clock Control. A change is effective after re-activation of the TDM service.
radwllMilIduTdmTxClockActualState	1.3.6.1.4.1.4458.1000.2.6.1.3	Integer	RO	Actual state of the TDM Transmit Clock Control.
radwllMilIduTdmMasterClockAvailOptio	1.3.6.1.4.1.4458.1000.2.6.2.1	Integer	RO	Available options of the TDM Master Clock Control each input status is represented by a

Name	OID	Type	Access	Description
ns				bit. When the option is available the bit value is 1. When the option is unavailable the bit value is 0. The available options are: bit 2 = Automatic bit 3 = Trunk #1 bit 4 = Trunk #2 bit 5 = Trunk #3 bit 6 = Trunk #4 When no options are available the returned value is: 1
radwllMilIduTdmMasterClockDesired	1.3.6.1.4.1.4458.1000.2.6.2.2	Integer	RW	Required TDM Master Clock. A change is effective after re-activation of the TDM service.
radwllMilIduTdmMasterClockActual	1.3.6.1.4.1.4458.1000.2.6.2.3	Integer	RO	Actual Trunk used for TDM Master Clock.
radwllMilIduTdmConfigTable			N/A	IDU TDM Links Configuration table.
radwllMilIduTdmConfigEntry			N/A	IDU TDM Links Configuration table entry. INDEX { radwllMilIduTdmConfigIndex }
radwllMilIduTdmConfigIndex			RO	Table index.
radwllMilIduTdmIfIndex			RO	Link index in the interface table.
radwllMilIduTdmLineCoding	1.3.6.1.4.1.4458.1000.2.6.6.1.6	Integer	RW	This parameter applies to T1 trunks only. The parameter controls the line coding. Setting the value to each of the indices applies to all. A change is effective after the next open of the TDM service.
radwllMilIduTdmLoopbackConfig	1.3.6.1.4.1.4458.1000.2.6.6.1.9	Integer	RW	Loop back configuration table. Each of the trunks can be set Normal Line loop back or Reverse line loop back. A change is effective immediately.
radwllMilIduTdmLineStatus	1.3.6.1.4.1.4458.1000.2.6.6.1.10	Integer	RO	Line status.
radwllMilIduTdmCurrentTable			N/A	IDU TDM Links Statistics table.
radwllMilIduTdmCurrentEntry			N/A	IDU TDM Links Statistics table entry. INDEX { radwllMilIduTdmCurrentIndex }
radwllMilIduTdmCurrentIndex			RO	Table index (Same as radwllMilIduTdmLineIndex).
radwllMilIduTdmCurrentBlocks	1.3.6.1.4.1.4458.1000.2.6.7.1.101	Counter	RO	Number of correct blocks transmitted to the line.
radwllMilIduTdmCurrentDrops	1.3.6.1.4.1.4458.1000.2.6.7.1.102	Counter	RO	Number of error blocks transmitted to the line.
radwllMilIduTdmCurrentTxClock	1.3.6.1.4.1.4458.1000.2.6.7.1.103	Integer	RW	TDM Transmit Clock. A change is effective after re-activation of the TDM service.
radwllMilIduTdmCurrentBlocksHigh	1.3.6.1.4.1.4458.1000.2.6.7.1.104	Counter	RO	High part of the 64 bits counter Current Blocks
radwllMilIduTdmRemoteQual	1.3.6.1.4.1.4458.1000.2.6.8	Integer	RO	Estimated average interval between error second events. The valid values are 1-2^31 where a value of -1 is used to indicate an undefined state.
radwllMilIduTdmRemoteQualEval	1.3.6.1.4.1.4458.1000.2.6.9	Integer	RO	Estimated average interval between error second events during evaluation process. The

Name	OID	Type	Access	Description
				valid values are 1-2^31 where a value of -1 is used to indicate an undefined state.
radwllMillduTdmSrvEval	1.3.6.1.4.1.4458.1000.2.6.10	Integer	RW	Evaluated TDM service bit mask. Setting this parameter to value that is bigger than the activated TDM service bit mask will execute the evaluation process for 30 seconds. Setting this parameter to 0 will stop the evaluation process immediately.
radwllMillduTdmBackupAvailableLinks	1.3.6.1.4.1.4458.1000.2.6.11	Integer	RO	Number of TDM backup trunks.
radwllMillduTdmBackupTable			N/A	IDU TDM Links Statistics table.
radwllMillduTdmBackupEntry			N/A	IDU TDM Links Statistics table entry. INDEX { radwllMillduTdmBackupIndex }
radwllMillduTdmBackupIndex	1.3.6.1.4.1.4458.1000.2.6.12.1.1	Integer	RO	Table index.
radwllMillduTdmBackupMode	1.3.6.1.4.1.4458.1000.2.6.12.1.2	Integer	RW	TDM backup mode: Enable or Disable where the main link is the air link or the external link. Changes will be effective immediatly.
radwllMillduTdmBackupCurrentActiveLink	1.3.6.1.4.1.4458.1000.2.6.12.1.3	Integer	RO	TDM backup current active link: N/A air link is active or external link is active.
radwllMillduTdmJitterBufferSize	1.3.6.1.4.1.4458.1000.2.6.13	Integer	RW	TDM Jitter Buffer Size. The value must be between the minimum and the maximum TDM Jitter Buffer Size. The units are 0.1 x millisecond.
radwllMillduTdmJitterBufferDefaultSize	1.3.6.1.4.1.4458.1000.2.6.14	Integer	RO	TDM Jitter Buffer Default Size. The units are 0.1 x millisecond.
radwllMillduTdmJitterBufferMinSize	1.3.6.1.4.1.4458.1000.2.6.15	Integer	RO	TDM Jitter Buffer Minimum Size. The units are 0.1 x millisecond.
radwllMillduTdmJitterBufferMaxSize	1.3.6.1.4.1.4458.1000.2.6.16	Integer	RO	TDM Jitter Buffer Maximum Size. The units are 0.1 x millisecond.
radwllMillduTdmJitterBufferSizeEval	1.3.6.1.4.1.4458.1000.2.6.17	Integer	RW	TDM Jitter Buffer Size for evaluation. The value must be between the minimum and the maximum TDM Jitter Buffer Size. The units are 0.1 x millisecond.
radwllMillduTdmType	1.3.6.1.4.1.4458.1000.2.6.18	Integer	RW	TDM Type (The value undefined is read-only).
radwllMillduTdmTypeEval	1.3.6.1.4.1.4458.1000.2.6.19	Integer	RW	TDM Type for evaluation.
radwllMillduTdmLineStatusStr	1.3.6.1.4.1.4458.1000.2.6.20	DisplayString	RO	Line status.
radwllMillduTdmHotStandbySupport	1.3.6.1.4.1.4458.1000.2.6.21	Integer	RO	Indicates if Hot Standby is supported.
radwllMillduTdmDesiredHotStandbyMode	1.3.6.1.4.1.4458.1000.2.6.22	Integer	RW	Desired Hot Standby Mode.
radwllMillduTdmHotStandbyOperationStatus	1.3.6.1.4.1.4458.1000.2.6.23	Integer	RO	The Link Actual Status.

Name	OID	Type	Access	Description
radwllMilIduTdmBackupLinkConfiguration	1.3.6.1.4.1.4458.1000.2.6.24	Integer	RW	The current configuration of the backup link.
radwllMilGeneralTrapDescription	1.3.6.1.4.1.4458.1000.100.1	DisplayString	RO	Trap's Description. Used for Trap parameters.
radwllMilGeneralTrapSeverity	1.3.6.1.4.1.4458.1000.100.2	Integer	RO	Trap's Severity. Used for Trap parameters.
radwllMilGeneralCookie	1.3.6.1.4.1.4458.1000.100.3	DisplayString	RW	Reserved for the Manager application provided with the product used for saving user preferences affecting ODU operation.
radwllMilGeneralEcChangesCounter	1.3.6.1.4.1.4458.1000.100.4	Integer	RO	This counter is initialized to 0 after a device reset and is incremented upon each element constant write operation via SNMP or Telnet.
radwllMilGeneralTelnetSupport	1.3.6.1.4.1.4458.1000.100.5	Integer	RW	Enable/disable Telnet protocol.

E.4 MIB Traps

Each ODU can be configured with up to 10 different trap destinations. When the link is operational, each ODU sends traps originating from both Site A and Site B.

The source IP address of the trap is the sending ODU. The trap originator can be identified by the trap Community string or by the trap description text.

Each trap contains a trap description and additional relevant information such as alarm severity, interface index, time stamp and additional parameters. See *Table E-3* for additional information.

Table E-3. MIB Traps

Name	ID	Severity	Description
trunkStateChanged	1	normal	Indicates a change in the state of one of the TDM trunks. Raised by both sides of the link. Contains 3 parameters: 1 - Description: TDM Interface %n - %x 2 - %n: Is the trunk number 3 - %x: Is the alarm type and can be one of the following: Normal AIS LOS Loopback
linkUp	2	normal	Indicates that the radio link is up. Contains a single parameter which is its description: 1 - Description: Radio Link - Sync on channel %n GHz. %n Is the channel frequency in GHz.
linkDown	3	critical	Indicates that the radio link is down. Contains a single parameter which is its description: 1 - Description: Radio Link - Out of Sync. The reason is: %s. %s Is the reason.

Name	ID	Severity	Description
detectIDU	4	normal	Indicates that the IDU was detected. Raised by both sides of the link. Contains a single parameter which is its description: 1 - Description: IDU of Type %s was Detected. %s Is the type of the IDU.
disconnectIDU	5	major	Indicates that the IDU was disconnected. Raised by both sides of the link. Contains a single parameter which is its description: 1 - Description: IDU Disconnected.
mismatchIDU	6	major	Indicates a mismatch between the IDUs. Raised by the master only. Contains a single parameter which is its description: 1 - Description: IDUs Mismatch: One Side is %s and the Other is %s. %s Is the type of the IDU.
openedServices	7	normal	Indicates that services were opened. Raised by the master only. Contains 3 parameters: 1 - Description: %n2 out of %n1 Requested TDM Trunks have been Opened 2 - %n1: Is the requested number of TDM trunks 3 - %n2: Is the actual number of TDM trunks that were opened
closedServices	8	normal	Indicates that services were closed. Raised by the master only. Contains a single parameter which is its description: 1 - Description: TDM Service has been closed. The reason is: %s. %s Is the reason.
incompatibleODUs	9	critical	Indicates that the ODUs are incompatible. Contains a single parameter which is its description: 1 - Description: Incompatible ODUs.
incompatibleIDUs	10	major	Indicates that the IDUs are incompatible. Contains a single parameter which is its description: 1 - Description: Incompatible IDUs.
incompatibleOduIdu	11	major	Indicates that the ODU and IDU are incompatible. Contains a single parameter which is its description: 1 - Description: The IDU could not be loaded. The reason is: %s. %s Is the incompatibility type.
probingChannel	12	normal	Indicates that the ODU is monitoring radar activity. Contains a single parameter which is its description: 1 - Description: Monitoring for radar activity on channel %n GHz. %n is the channel frequency in GHz.
radarDetected	13	normal	Indicates that radar activity was detected. Contains a single parameter which is its description: 1 - Description: Radar activity was detected in %s on channel %n GHz. %s Is the site name. %n Is the channel frequency in GHz.

Name	ID	Severity	Description
transmittingOnChannel	14	normal	Indicates that the ODU is transmitting on channel. Contains a single parameter which is its description: 1 - Description: Transmitting on channel %n GHz. %n Is the channel frequency in GHz.
scanningChannels	15	normal	Indicates that the ODU is scanning channels. Contains a single parameter which is its description: 1 - Description: Channel scanning in progress.
incompatiblePartner	16	critical	Indicates that configuration problem was detected and that link installation is required in order to fix it. Contains a single parameter which is its description: 1 - Description: Configuration problem detected. Link installation required.
timeClockSet	17	normal	Indicates that the ODU time clock was set. Contains a single parameter which is its description: 1 - Description: The time was set to: %p. %p Is the date and time.
configurationChanged	18	normal	Indicates that the ODU recovered from an error but there are configuration changes. Contains two parameters: 1 - Description: Configuration changed. Error code is: %n. 2 - %n number.
hssOpStateChangedToINU	19	normal	Indicates that the HSS operating state was changed to INU type. Contains a single parameter which is its description: 1 - Description: HSS operating state was changed to: INU.
hssOpStateChangedToHSM	20	normal	Indicates that the HSS operating state was changed to HSM type. Contains a single parameter which is its description: 1 - Description: HSS operating state was changed to: HSM.
hssOpStateChangedToHSC	21	normal	Indicates that the HSS operating state was changed to HSC type. Contains a single parameter which is its description: 1 - Description: HSS operating state was changed to: HSC_DT/HSC_CT.
vlanModeActive	22	normal	Indicates to non-VLAN PC that after 2 minutes the system will support only VLAN tag on management interface. Contains a single parameter which is its description: 1 - Description: VLAN Mode is active. Non-VLAN traffic will be blocked in 2 minutes.
spectrumAnalysis	23	normal	Indicates that the ODU is in Spectrum Analysis mode. Contains a single parameter which is its description: 1 - Description: Spectrum analysis in progress.

Name	ID	Severity	Description
tdmServiceAlarm	100	major	Indicates that TDM Service is in alarm state. Contains a single parameter which is its description: 1 - Description: TDM Service - Alarm.
ethServiceClosed	101	major	Indicates that Ethernet Service is closed. Contains a single parameter which is its description: 1 - Description: Ethernet Service is closed.
ethServiceNotPermitted	102	major	Indicates that Ethernet Service is not permitted. Contains a single parameter which is its description: 1 - Description: A valid IDU could not be detected at %s. Please check your configuration. %s - Is the Local Site name or Remote Site name or both sides of the Link.
encryptionAlarm	103	major	Indicates an encryption key mismatch. Contains a single parameter which is its description: 1 - Description: Encryption Status - Failed. No Services are available.
changeLinkPasswordAlarm	104	major	Indicates that a failure has occurred while attempting to change the Link Password. Contains a single parameter which is its description: 1 - Description: Failed to change the Link Password at/on: %s. %s - Is the Local Site name or Remote Site name or both sides of the Link.
externalAlarmInPort1Alarm	105	major	The trap is sent every time an alarm occurs in the External Alarm Input of port #1. Contains a single parameter which is its description: 1 - Description: External Alarm 1 - <User Text> - Alarm.
externalAlarmInPort2Alarm	106	major	The trap is sent every time an alarm occurs in the External Alarm Input of port #2. Contains a single parameter which is its description: 1 - Description: External Alarm 2 - <User Text> - Alarm.
bitFailedAlarm	107	critical	The trap is sent if there is no way to recover from the situation.Contains two parameters: 1 - Description: ODU power up built in test failed. Error code is: %n 2 - %n number
wrongConfigurationLoadedAlarm	108	major	The trap is sent if there is a way to recover from the situation.Contains two parameters: 1 - Description: Wrong configuration loaded. Error code is: %n 2 - %n number
lanPort1DisconnectedAlarm	109	major	Indicates the LAN port 1 status changed to disconnected.Contains a single parameter which is its description: 1 - Description: LAN port 1 status changed to disconnected.

Name	ID	Severity	Description
lanPort2DisconnectedAlarm	110	major	Indicates the LAN port 2 status changed to disconnected.Contains a single parameter which is its description: 1 - Description: LAN port 2 status changed to disconnected.
mngPortDisconnectedAlarm	111	major	Indicates the management port status changed to disconnected.Contains a single parameter which is its description: 1 - Description: Management port status changed to disconnected.
externalAlarmInPort3Alarm	112	major	The trap is sent every time an alarm occurs in the External Alarm Input of port #3. Contains a single parameter which is its description: 1 - Description: External Alarm 3 - <User Text> - Alarm.
externalAlarmInPort4Alarm	113	major	The trap is sent every time an alarm occurs in the External Alarm Input of port #4. Contains a single parameter which is its description: 1 - Description: External Alarm 4 - <User Text> - Alarm.
swVersionsMismatchFullCompatibilityAlarm	114	warning	The trap is sent if SW versions mismatch with full link functionality. Contains a single parameter which is its description: 1 - Description: Software versions mismatch - full link functionality
swVersionsMismatchRestrictedCompatibilityAlarm	115	minor	The trap is sent if SW versions mismatch with restricted link functionality. Contains a single parameter which is its description: 1 - Description: Software versions mismatch - restricted link functionality
swVersionsMismatchSoftwareUpgradeRequired	116	major	The trap is sent if SW versions mismatch and SW upgrade is required. Contains a single parameter which is its description: 1 - Description: Software versions mismatch - Software upgrade required
swVersionsIncompatible	117	critical	The trap is sent if SW versions are incompatible. Contains a single parameter which is its description: 1 - Description: SW Versions incompatible
hssMultipleSourcesDetectedAlarm	118	major	Indicates that multiple sync pulse sources were detected. Contains a single parameter which is its description: 1 - Description: HSS multiple sync sources were detected.
hssSyncToProperSourceStoppedAlarm	119	major	Indicates that synchronization to a proper sync pulse source was stopped. Contains a single parameter which is its description: 1 - Description: HSS sync pulse - Down. The reason is: %s. %s - Is the reason for the sync down.

Name	ID	Severity	Description
hssSyncPulseDetectedAlarm	120	major	Indicates that HSS additional sync pulse was detected. Contains a single parameter which is its description: 1 - Description: HSS additional sync pulse was detected.
tdmBackupAlarm	121	major	Indicates that the TDM backup link was activated. Contains a single parameter which is its description: 1 - Description: TDM backup alarm - backup link was activated.
linkLockUnauthorizedRemoteODU	122	major	Indicates that the remote ODU is unauthorized.Contains a single parameter which is its description: 1 - Description: Unauthorized remote ODU connection rejected.
linkLockUnauthorizedODU	123	major	Indicates that the ODU is unauthorized.Contains a single parameter which is its description: 1 - Description: Unauthorized ODU connection rejected.
hotStandbyAlarm	124	major	Indicates that the hot standby secondary link was activated. Contains a single parameter which is its description: 1 - Description: Secondary Link Is Active.
sfpInsertion	126	major	Indicates that a device was inserted to SFP Port
sfpPort1DisconnectedAlarm	127	major	Indicates the SFP port 1 status changed to disconnected.Contains a single parameter which is its description: 1 - Description: SFP port 1 status changed to disconnected.
desiredRatioCanNotBeAppliedAlarm	129	normal	Indicates Desired UL/DL RAtio Can Not Be Applied.
cbwMismatch	130	major	Indicates that a Channel Bandwidth mismatch was detected.Contains two parameters: 1 - Description: Channel Bandwidth Mismatch: one side is %n0 MHz and the other is %n1 MHz. %n0 is the local Channel Bandwidth value in MHz. %n1 is the remoet Channel Bandwidth value in MHz.
gpsNotSynchronized	131	major	Indicates that the GPS is not synchronized with satellites. Pulses are self generated.
tdmServiceClear	200	normal	Indicates that TDM Service fault is cleared. Contains a single parameter which is its description: 1 - Description: TDM Service - Normal.
ethServiceOpened	201	normal	Indicates that Ethernet Service has been opened. Contains a single parameter which is its description: 1 - Description: Ethernet Service has been opened.

Name	ID	Severity	Description
encryptionClear	203	normal	Indicates that encryption is OK. Contains a single parameter which is its description: 1 - Description: Encryption Status - Normal.
changeLinkPasswordClear	204	normal	Indicates that the Link Password was changed successfully. Contains a single parameter which is its description: 1 - Description: Link Password has been changed at/on: %s. %s - Is the Local Site name or Remote Site name or both sides of the Link.
externalAlarmInPort1Clear	205	normal	This Trap is sent every time an External Alarm Input fault of port # 1 is cleared. Contains a single parameter which is its description: 1 - Description: External Alarm 1 - <User Text> - Alarm Cleared.
externalAlarmInPort2Clear	206	normal	This Trap is sent every time an External Alarm Input fault of port # 2 is cleared. Contains a single parameter which is its description: 1 - Description: External Alarm 2 - <User Text> - Alarm Cleared.
lanPort1Clear	209	normal	Indicates the LAN port 1 status changed to connected. Contains two parameters: 1 - Description: LAN port 1 status changed to connected - %s 2 - %s Is the Eth. mode (speed & duplex)
lanPort2Clear	210	normal	Indicates the LAN port 2 status changed to connected. Contains two parameters: 1 - Description: LAN port 2 status changed to connected - %s. 2 - %s Is the Eth. mode (speed & duplex).
mngPortClear	211	normal	Indicates the management port status changed to connected. Contains two parameters: 1 - Description: Management port status changed to connected - %s 2 - %s Is the Eth. mode (speed & duplex)
externalAlarmInPort3Clear	212	normal	This Trap is sent every time an External Alarm Input fault of port # 3 is cleared. Contains a single parameter which is its description: 1 - Description: External Alarm 3 - <User Text> - Alarm Cleared.
externalAlarmInPort4Clear	213	normal	This Trap is sent every time an External Alarm Input fault of port # 4 is cleared. Contains a single parameter which is its description: 1 - Description: External Alarm 4 - <User Text> - Alarm Cleared.
swVersionsMatchFullCompatibilityClear	214	normal	The trap is sent if SW versions match. Contains a single parameter which is its description: 1 - Description: Software Versions compatible
swVersionsMatchRestrictedCompatibilityClear	215	normal	The trap is sent if SW versions match and link functionality is not restricted. Contains a single parameter which is its description: 1 - Description: Software Versions compatible

Name	ID	Severity	Description
swVersionsMatchSoftwareUpgradeRequiredClear	216	normal	The trap is sent if SW versions match and SW upgrade is successful. Contains a single parameter which is its description: 1 - Description: Software Versions compatible
swVersionsCompatibleClear	217	normal	The trap is sent if SW versions compatible Contains a single parameter which is its description: 1 - Description: Software Versions compatible
hssMultipleSourcesDisappearedClear	218	normal	Indicates that multiple sync pulse sources disappeared. Contains a single parameter which is its description: 1 - Description: HSS multiple sync pulse sources disappeared.
hssSyncToProperSourceAchievedClear	219	normal	Indicates that synchronization to a proper Sync source was achieved. Contains a single parameter which is its description: 1 - Description: HSS sync pulse - Up.
hssSyncPulseDisappearedClear	220	normal	Indicates that HSS additional sync pulse disappeared. Contains a single parameter which is its description: 1 - Description: HSS additional sync pulse was disappeared.
tdmBackupClear	221	normal	Indicates that the TDM main link was activated. Contains a single parameter which is its description: 1 - Description: TDM main link was activated.
linkLockAuthorizedRemoteODU	222	normal	Indicates that the remote ODU is authorized. Contains a single parameter which is its description: 1 - Description: Authorized remote ODU connection accepted.
linkLockAuthorizedODU	223	normal	Indicates that the ODU is authorized. Contains a single parameter which is its description: 1 - Description: Authorized ODU connection permitted.
linkAuthenticationDisabled	224	normal	Indicates that the Link Lock is disabled. Contains a single parameter which is its description: 1 - Description: Link Authentication has been disabled.
hotStandbyClear	225	normal	Indicates that the Primary Link Was Activated. Contains a single parameter which is its description: 1 - Description: Primary Link Is Active.
sfpExtraction	226	normal	Indicates that a device was extracted from SFP Port
sfpPort1Clear	227	normal	Indicates the SFP port 1 status changed to connected. Contains two parameters: 1 - Description: SFP port 1 status changed to connected - %s 2 - %s Is the Eth. mode (speed & duplex)

Name	ID	Severity	Description
compatibleIdus	228	normal	Indicates that the ODU has identified compatible Idus on both sides of the link.
desiredRatioCanNotBeAppliedClear	229	normal	Indicates Current UL/DL Ratio Is Equal To Desired Ratio.
cbwMatch	230	normal	Indicates that a Channel Bandwidth match was detected. Contains a single parameter which is its description: 1 - Channel Bandwidth value in MHz.
switchCbwAndChannel	231	normal	Indicates that the system is switching Channel Bandwidth and channel frequency. Contains two parameters: 1 - Switching to Channel Bandwith %n0 MHz and to channel %n1 GHz.
ringRplStateIdle	232	normal	RPL state changed to Idle.
ringEthServiceStatus	233	normal	Indicates Ethernet service's state - blocked \ unblocked. Contains a single parameter: 1 - Description: Ethernet's state (blocked \ unblocked)
ringFirstRpmReceived	234	normal	Ring application: in non-RPL link indicates first from a specific RPL was received. Contains a single parameter: 1 - Description: RPM's VLAN ID

Name	ID	Severity	Description
ringEthernetSrviceUnblockedTO	235	normal	Ring application: in non-RPL link Ethernet service is unblocked due to RPM timeout.
gpsSynchronized	236	normal	Indicates that the GPS is synchronized with satellites.

The Link Manager application issues traps to indicate various events. These traps are shown in the Link Manager Events Log.

Appendix F

Preloading IP Address and Changing Default Band

This appendix explains how to preload a static IP address to an ODU and change its factory-default band in the field.

F.1 Preloading an ODU with an IP Address

All ODUs supplied by GE come pre-configured with an IP address of 10.0.0.120. For use in a network, the ODUs must be configured with suitable static IP addresses. The method for doing this under office conditions is explained in *Chapter 4*.

There are two situations under which ODUs may need to be preloaded with an IP address prior to installation to a link:

- Changing an individual ODU in the field
- Preparing a large number of ODUs in a warehouse prior to deployment in the field, according to a network installation plan.

The minimal equipment required to pre-load an ODU with an IP address is:

- Laptop computer (managing computer)
- An installed copy of the Airmux Manager
- A PoE device
- A crossed Ethernet LAN cable
- An IDU-ODU cable
- If you have connectorized ODUs, two N-type RF terminators.

✱ **To preload an ODU with an IP address:**

1. Using the IDU-ODU cable, connect the PoE device to the ODU, ensuring that the cable is plugged into the PoE port marked P-LAN-OUT.
2. For connectorized ODUs, screw the RF terminators into the two antenna ports.


Warning

A powered up ODU emits RF radiation from the antenna port (or connected antenna). When working with a powered up connectorized ODU, always use RF terminators.

For an ODU with an integrated antenna, ensure that the antenna is always directed away from people.

3. Connect the Poe device to AC power.

4. Using a crossed LAN cable, connect the LAN-IN port of the PoE device to the Ethernet port of the managing computer. The ODU will commence beeping at about once per second, indicating correct operation.
5. Launch the Airmux Manager.
6. At the log on window, choose Local Connection.

Figure F-1. Log on Window for Local Connection

7. Enter the default password, **admin**. After a few moments, the Airmux Manager main window appears:

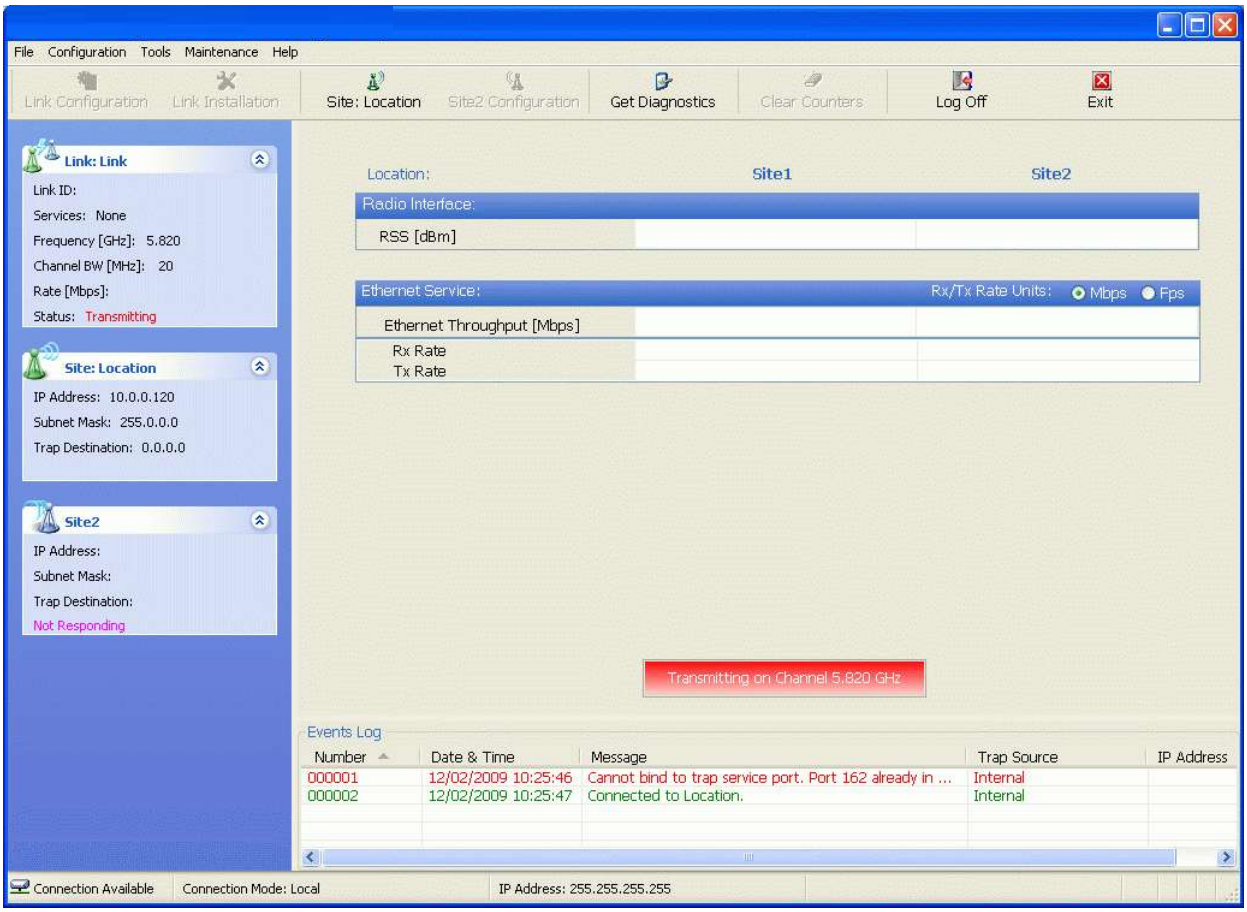


Figure F-2. Opening Link Manager Window prior to Installation

8. Click the available **Site:Location** button and select Management. The following dialog box appears:

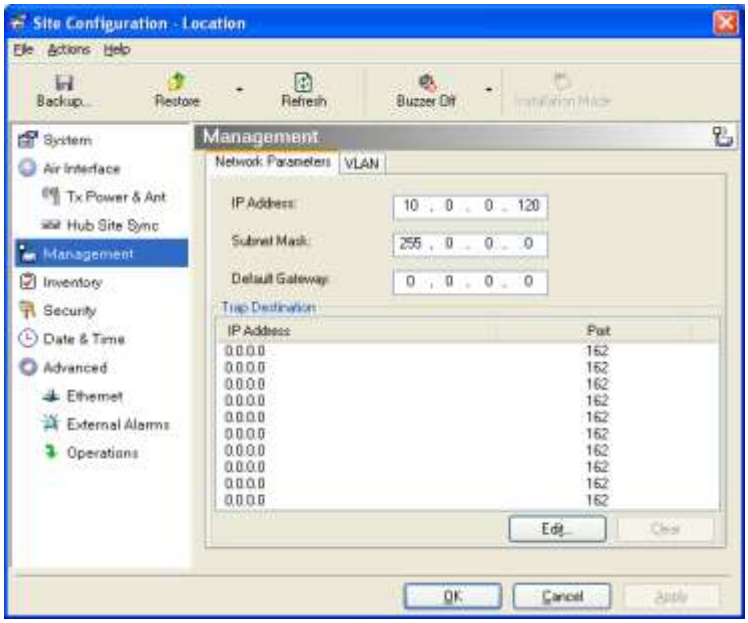


Figure F-3. Management Configuration Dialog Box

9. Enter the IP address, subnet mask and default gateway as required. For example, the ODU used here is to be configured as follows:

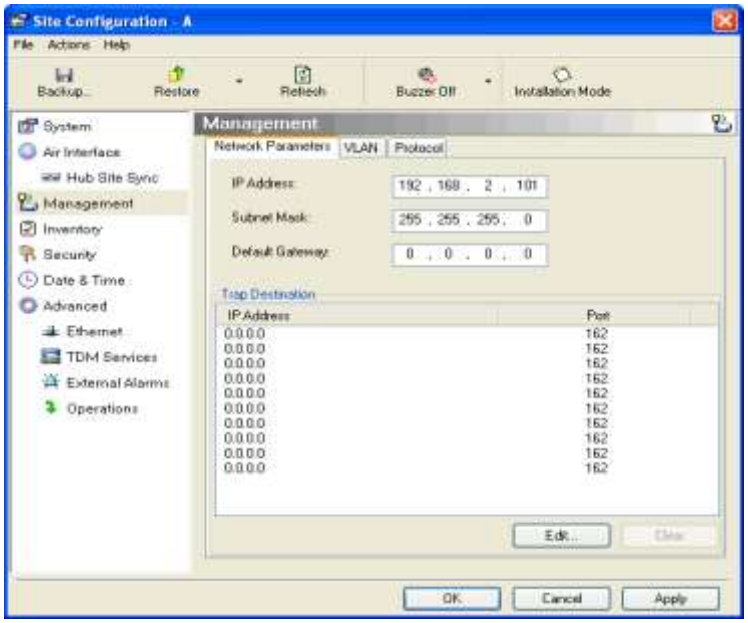


Figure F-4. ODU with IP Parameters Configured

10. Click **OK.**

    You are asked to confirm the change.

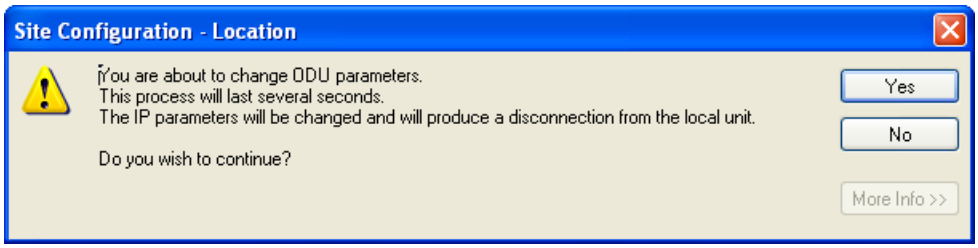


Figure F-5. Confirmation of IP Address Change

11. Click **Yes** to accept the change.

    After about half a minute the changes are registered in the ODU. The left hand panel of the main window displays the new IP configuration for the ODU.

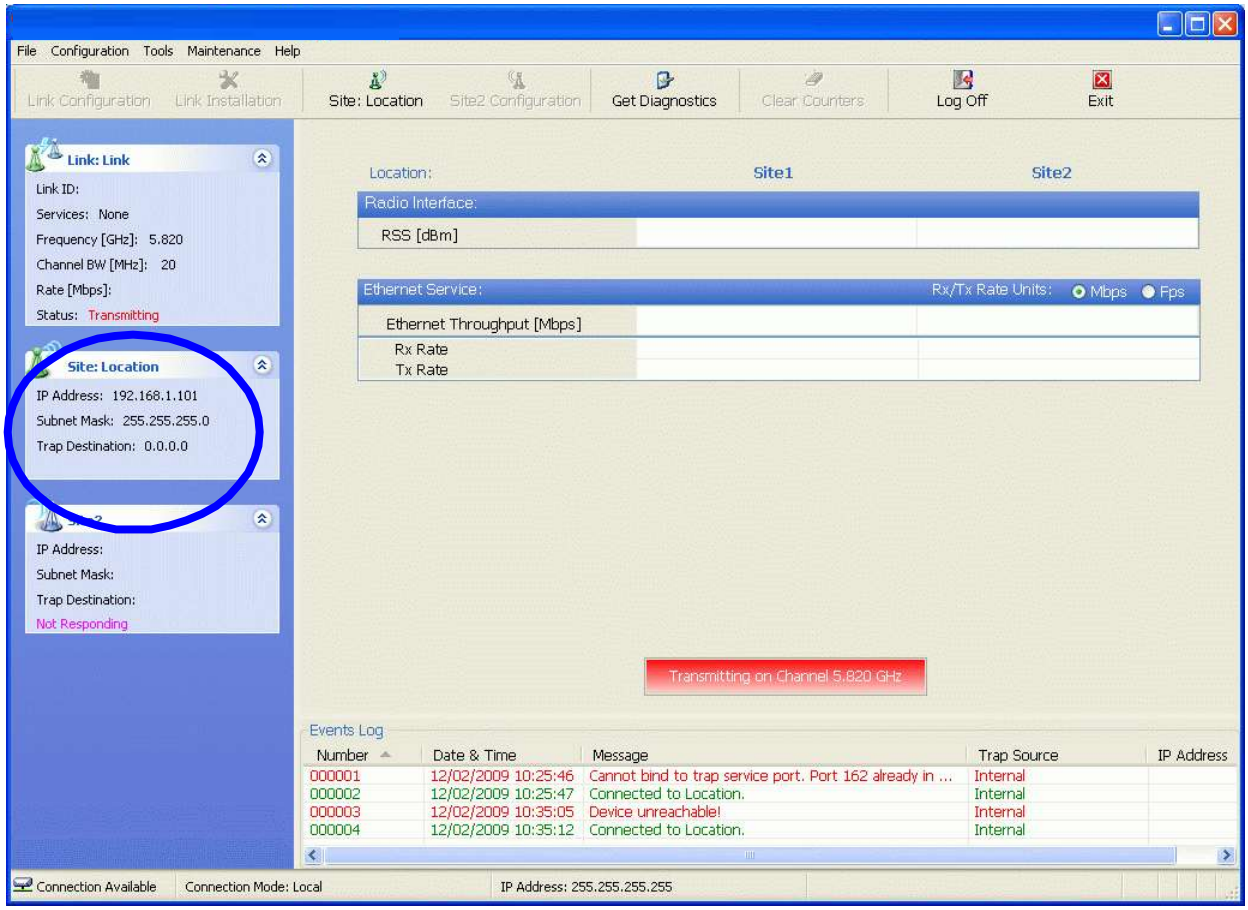


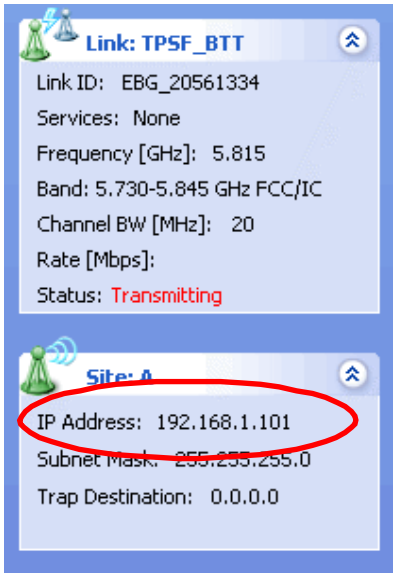
Figure F-6. Main Window after IP Address Change

12. Click **Cancel** to leave the open Management dialog.
13. Remove the RF terminators from a connectorized ODU after powering it down.
14. You may now exit the Airmux Manager, or connect to another ODU. If you choose to connect to another ODU, after about a minute, the main window of the Airmux Manager will revert to that shown in *Figure F-2* above. In any event, power down the changed ODU; the IP address change will take effect when you power it up again.

✱ **To recover a lost or forgotten ODU IP address:**

- Use the above procedure to log on to it using Local Connection.

The IP address will appear in the left hand status area:



F.2 Changing the Factory-Default Band

All ODUs supplied by GE MDS come pre-configured with a factory set up product (part number) dependent band. It may be changed using the procedure explained in this appendix.

Caution

- If for some reason the default band needs to be changed, it must be done before link Installation.
- Use of an incorrect band may be in violation of local regulations.

The minimal equipment required to change an ODU default band is:

- Laptop computer (managing computer).
- An installed copy of the Airmux Manager
- A PoE device
- A crossed Ethernet LAN cable
- An IDU-ODU cable.

✱ **To change the factory default band:**

1. Using the IDU-ODU cable, connect the PoE device to the ODU, ensuring that the cable is plugged into the PoE port marked P-LAN-OUT.
2. Connect the Poe device to AC power.
3. Using a crossed LAN cable, connect the LAN-IN port of the PoE device to the Ethernet port of the managing computer.

   The ODU starts beeping at about once per second, indicating correct operation.
4. Launch the Airmux Manager.
5. Log in as Installer.

Figure F-7. Logging in as an Installer

6. Enter the default password, **wireless**.

   After a few moments, the Link Manager main window appears:

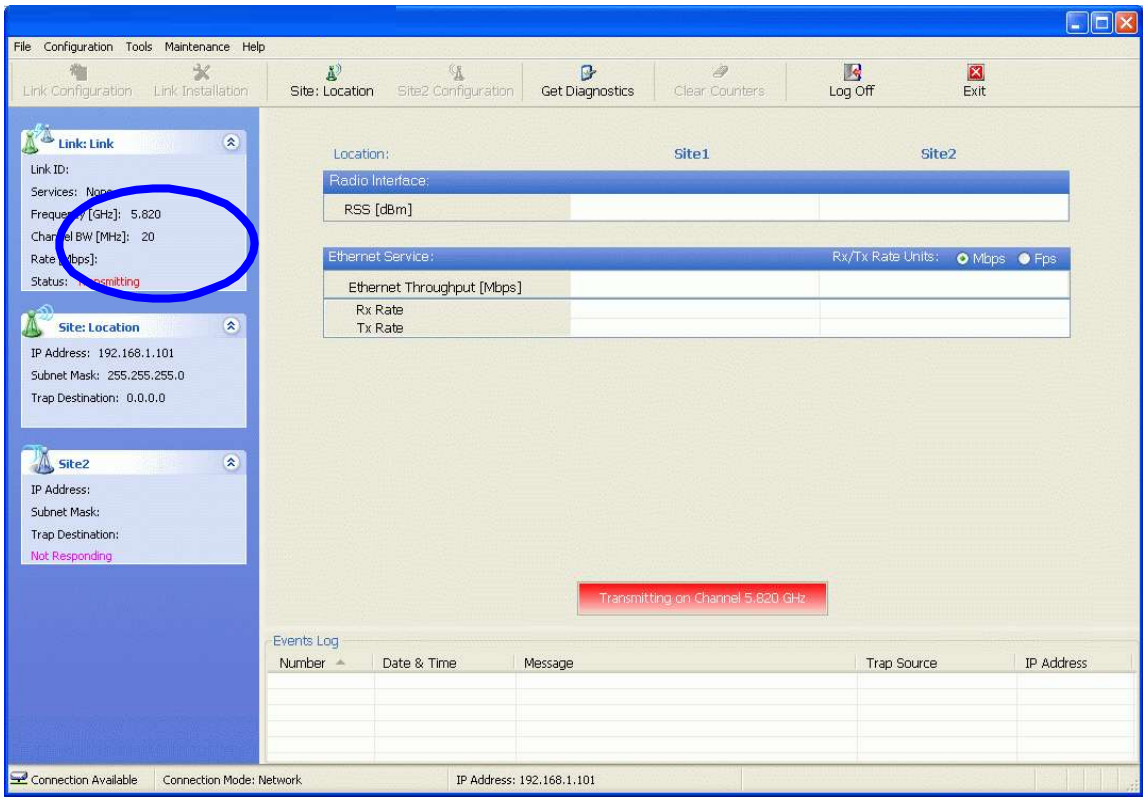


Figure F-8. Opening Link Manager Window prior to Band Change

Caution If you are changing the band on an installed link, change the "over the air" site (site B) first. Otherwise you will lock yourself out of the link.

7. If you are required to enter a license key, click Site: Location and select Operations.
8. Enter a license key obtained from GE MDS into the License Key field.
9. Click **Activate** to activate the key.

Figure F-9. Using the Operations Window to Enter a License Key

10. Click **Cancel** to return to the Airmux Manager main win
11. Select **Tools** > **Change Band**.

    The Change Band dialog box is displayed.

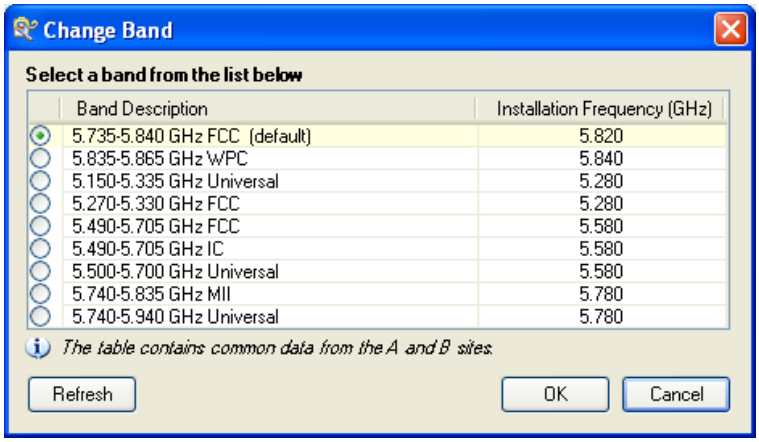


Figure F-10. Change Band Dialog Box

Note *The bands appearing in Figure F-10 are product-dependent.*

12. Select the required band.

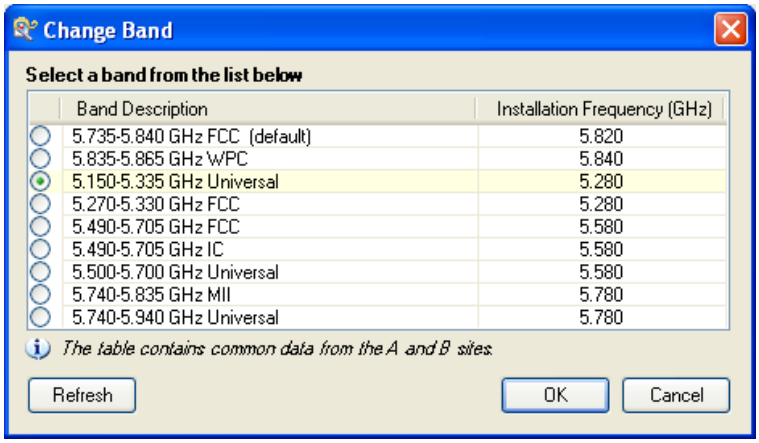


Figure F-11. Selecting a Different Band

13. Click **OK**.

    The Change Band warning is displayed.

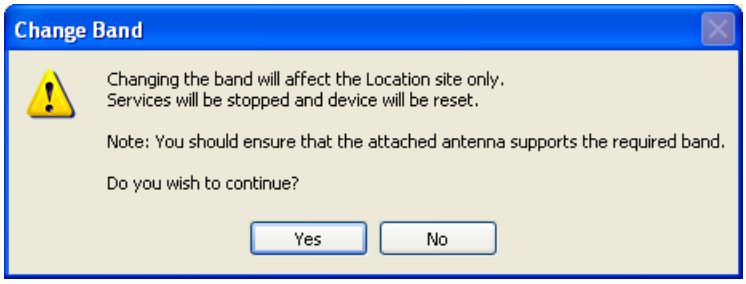


Figure F-12. Change Band Confirmation

14. Click **Yes** to confirm.

    The band change starts. The left hand panel of the main window displays the new band.

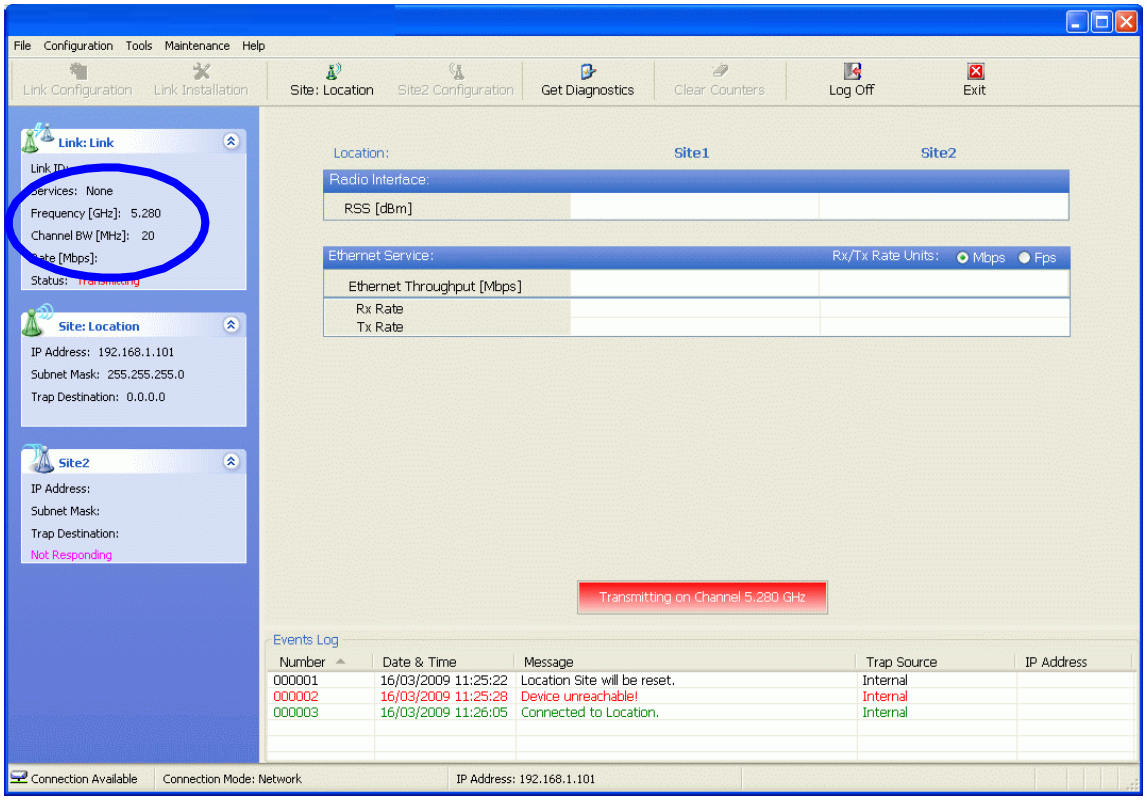


Figure F-13. Main Window after Band Change

Note *If you carry out this operation on a link, the band change is effective on both sites and installation mode is initiated. For a DFS band all configurations are made via the main window and the installation mode is disabled.*

Entering a License Key

License keys are required for activating certain product features or enabling operational frequencies. License keys are distributed by GE MDS

✱ **To enter a license key:**

1. Log on as Installer.
2. In the Operations dialog box (Site Configuration > Advanced > Operations button from the main tool bar, enter your license key into the License Key field and click **Activate**.

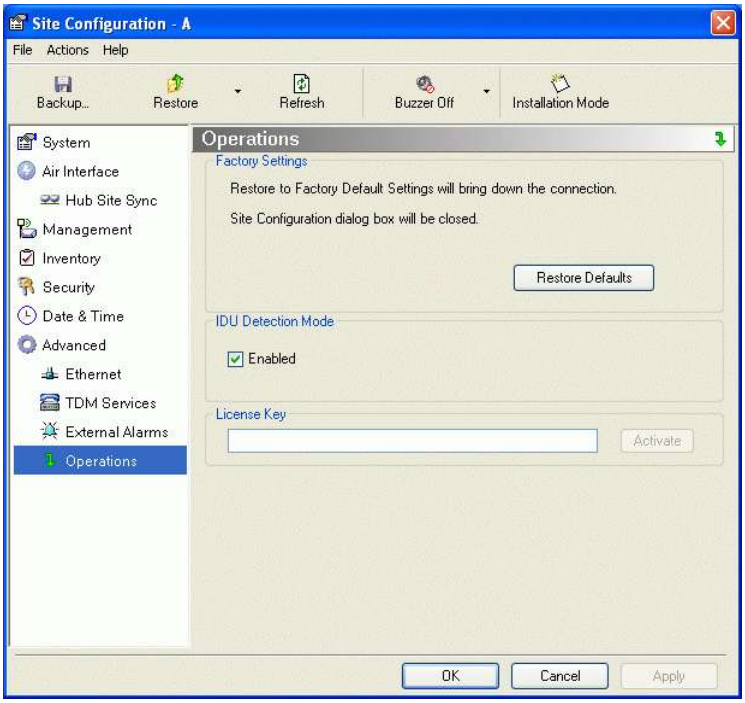


Figure F-14. Entering a License Key

3. When it is accepted, click **Cancel**.

Appendix G

Hub Site Synchronization

When several units are collocated at a common hub site, interference may occur from one unit to another. ODU units support the collocation of more than two units at a central site. Like any other RF deployment, the wireless operation is highly dependent on factors such as available frequencies, the physical spacing between radios, other interfering radios or GE MDS Intrepid units are installed.

Note

- *HSS does not eliminate the need for careful RF planning to ensure the design will work as planned. See Chapter 2 for information on installation site survey.*

The Hub Site Synchronization (HSS) method uses a cable connected from the master ODU to all collocated ODUs; this cable carries pulses sent to each ODU, which synchronize their transmission with each other. The pulse synchronization ensures that transmission occurs at the same time for all collocated units. This also results in all of the hub site units receiving data at the same time, eliminating the possibility of interference that could result if some units transmit while other units at the same location receive.

Figure G-1 shows interference caused by non-synchronized collocated units.

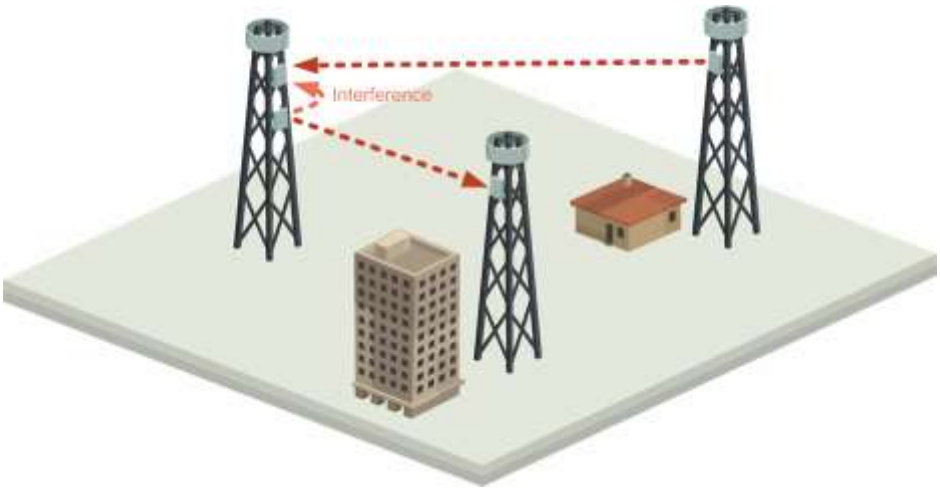


Figure G-1. Interference Caused by Collocated Units

Adding HSS removes interference as shown in the next two figures:

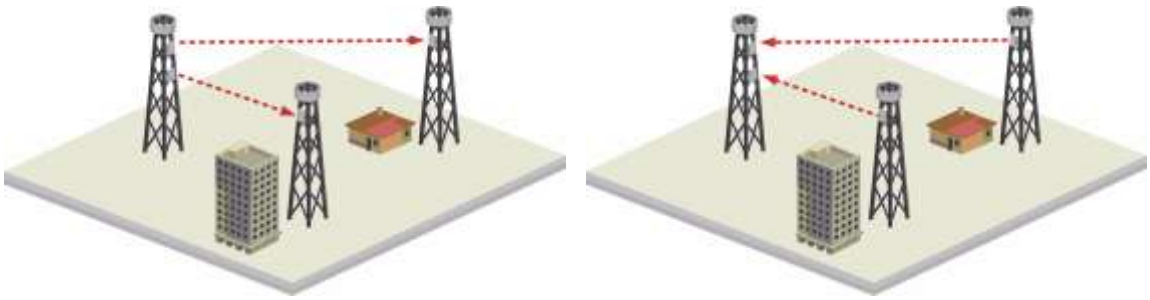


Figure G-2. Collocated units using Hub Site Synchronization (A)

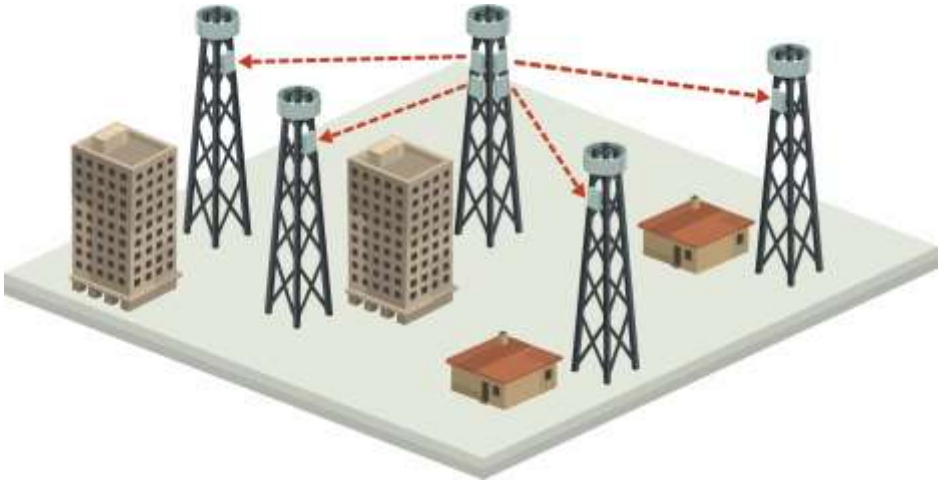


Figure G-3. Collocated units using Hub Site Synchronization (B)

The units are connected to each other with HSS cables and HSS distribution units.

One of the radios in the site is defined as HSS Master and generates synchronization pulses.

The other collocated radios in the site, the HSS clients, are connected to the HSS master and synchronize their transmission to the pulses. An HSS client can be configured to work in one of two modes:

- **HSS Client-Continue Transmission** (HSC-CT): If the unit loses synchronization with the HSS master, the link remains active. However, without synchronization pulses, it is possible that this unit will cause interference.
- **HSS Client-Disable Transmission** (HSC-DT): If the unit loses synchronization with the HSS master, the link is dropped until the synchronization pulses resume. This setting prevents the unit from causing interference.

The remote ODUs that are not located at the hub site, are called independent units and do not require HSS hardware.

G.1 Hardware Installation

A single HSS unit supports up to ten collocated ODUs. In addition to each unit being connected to its IDU or PoE device, the collocated unit has an additional cable that is connected to the HSS unit. The HSS unit is a compact, weatherproof (IP67) connector box that is installed on the same mast as the ODUs. All collocated units connect to this box using CAT-5e cable. Cables in prepared lengths are available for purchase.

The HSS unit is supplied with ten protective covers; any port not in use must be closed with a protective cover.

Figure G-4. HSS Interconnection Unit

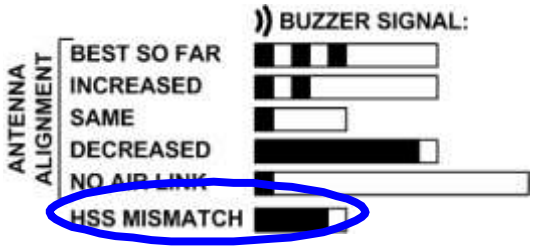
Note

- *If you collocate more than eight radios, cascade two HSS Units with an HSS cable.*
- *Ensure that the collocated units are connected in sequence from SYNC 1. If an ODU is removed from the hub site, then all remaining ODUs must be reconnected to maintain the connectivity.*

To connect an ODU to the HSS

1. Prepare a Cat. 5e cable with RJ-45 connectors in accordance to the cable ODU-to-HSS unit cable wiring in *Appendix A*.
2. Unscrew the protective cover from the port marked SYNC 1.
3. Connect the RJ-45 connector from one end of the CAT 5e cable to SYNC 1.
4. Connect the other end of the CAT 5e cable to the ODU connector labeled SYNC.
5. Tighten the protective seal that is on the prepared cable over the RJ-45 connector.
6. Repeat for all ODUs that are to be collocated at the hub site. The next ODU to be connected is inserted to SYNC 2, followed by SYNC 3 and so on.

Note *In the event of an HSS installation fault, the ODU will sound a beep pattern according to the following chart, which may also be seen on the ODU product label:*



Using a Single HSS Unit

The wiring, as shown in *Figure G-5* is self explanatory. The synchronization signal path is less self evident. If you set ODU 1 (on SYNC 1) to HSS Master, then the synchronization signal path. The signal travels from ODU 1 to SYNC 1, from SYNC 1 to SYNC 2, from SYNC 2 to ODU 2 and back again. The back and forth paths repeat for the second to fourth ODU, from left to right. The signal exits the HSS unit at SYNC 5 and terminates in ODU 5.

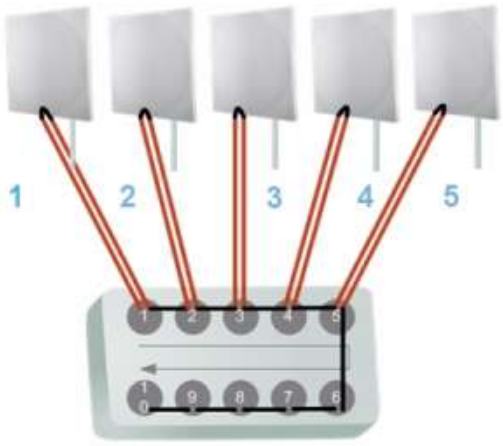


Figure G-5. HSS Wiring Schematics

The choice of the ODU on SYNC 1 as HSS master is not mandatory, but is good practice. If for example you were to use ODU 3 as HSS master, the synchronization signal path would be ODU 3 to SYNC 3, then left and right to SYNC 2 and SYNC 4. It would then propagate to ODUs 2 and 4, terminating at both ODUs 1 and 5.

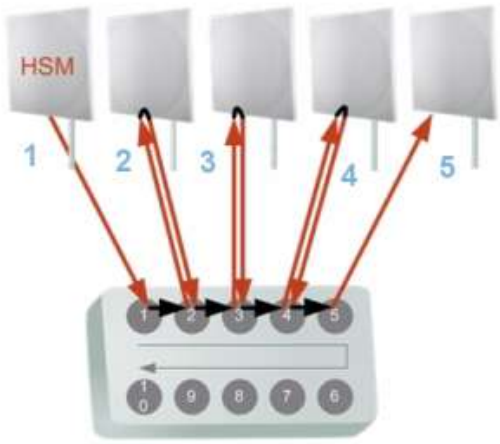


Figure G-6. HSS Synchronization Signal Path with ODU 1 as HSS Master

Using More than One HSS Unit

Several ODUs may be connected in a large collocation site subject to the following two conditions:

Condition 1: Cabling Sequence

1. Up to nine ODUs can be connected to the first HSS unit using HSS ports SYNC 1, SYNC 2, SYNC 3,... up to SYNC 9 in order without leaving empty ports.
2. The next available SYNC port of the first HSS unit should be connected to SYNC 10 of the second HSS unit as shown in *Figure G-7*. In the illustration, the next available port on the first HSS unit is SYNC 6.
3. The second HSS unit may be filled out with up to nine more ODUs in **reverse** order. That is, connect SYNC 9, SYNC 8, SYNC 7... as shown in *Figure G-7*.

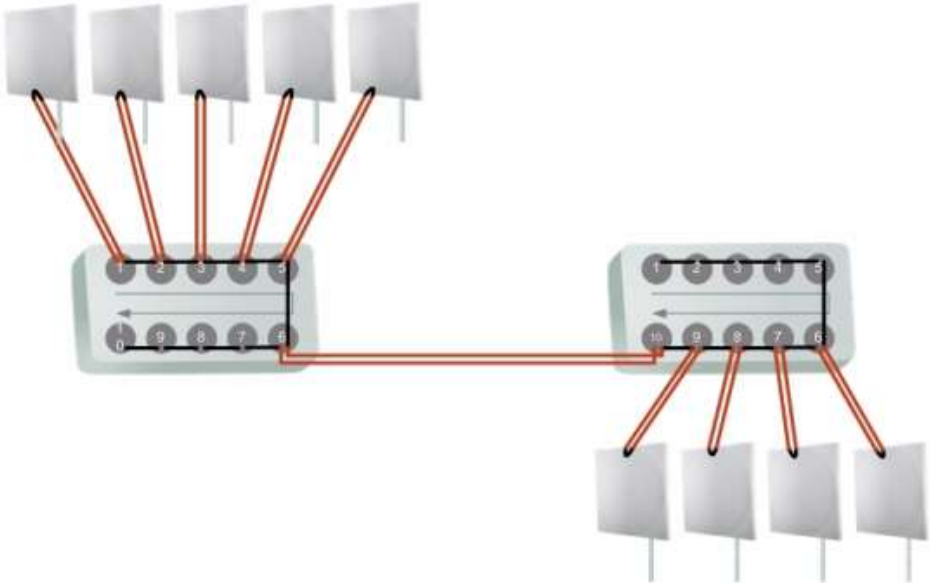


Figure G-7. Cascading Two HSS Units

4. To add a further HSS unit: Connect the next available SYNC port from the second HSS unit in **descending order** (SYNC 5 in *Figure G-7*) to SYNC 1 of the third HSS unit.
5. ODUs are connected to the third HSS unit from SYNC 2 as shown in *Figure G-8*, in **ascending order**:

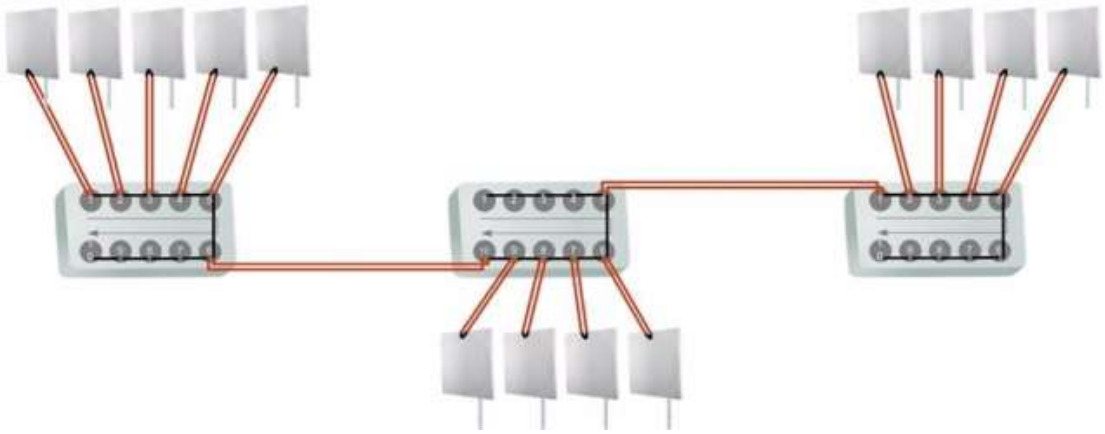


Figure G-8. Cascading Three HSS Units

6. If further ODUs are required, observe the convention that additional even numbered units are populated in **descending order** from SYNC 9 and odd numbered HSS units are populated in **ascending order** from SYNC 2.

Note *If an ODU is disconnected from an HSS unit, then all remaining ODUs must be moved up or down to maintain the connectivity.*

Condition 2: Total HSS Cable Length

The total path of the HSS sync pulse must not exceed 300m (984 ft). This applies no matter how many HSS units are used. To illustrate the method for calculating the sync pulse path length we show three examples. For our purpose, let:

- L_{mn} denote the length of the ODU-HSS unit cable at SYNC n on HSS unit m
- H_m be the length of the cable joining HSS unit m to HSS unit m+1.

One HSS unit with five collocated ODUs

$$PathLength = L_{11} + 2 \times L_{12} + 2 \times L_{13} + 2 \times L_{14} + L_{15}$$

Two cascaded HSS units as shown in *Figure G-7*:

$$PathLength = L_{11} + 2 \times L_{12} + 2 \times L_{13} + 2 \times L_{14} + 2 \times L_{15} + H_1 + 2 \times L_{29} + 2 \times L_{28} + 2 \times L_{27} + L_{26}$$

Three cascaded HSS units as shown in *Figure G-8*:

$$PathLength = L_{11} + 2 \times L_{12} + 2 \times L_{13} + 2 \times L_{14} + 2 \times L_{15} + H_1 + 2 \times L_{29} + 2 \times L_{28} + 2 \times L_{27} + 2 \times L_{26} + H_2 + 2 \times L_{32} + 2 \times L_{33} + 2 \times L_{34} + L_{35}$$

G.2 Radio Frame Pattern Table

A Radio Frame Pattern (RFP) is the cycle duration of transmit and receive of the air-frame.

Without HSS

When selecting TDM or Ethernet services, the system automatically and transparently chooses the optimal RFP. When TDM and Ethernet services are configured, the RFP is optimized for TDM.

RFP and HSS

When HSS is used, the RFP for the collocated radios must be selected manually.

Both Airmux-200 and GE MDS Intrepid use the Time Division Duplex (TDD) mechanism.

Under HSS, TDD enables synchronization of transmission for the collocated units as shown in *Figure G-9*.

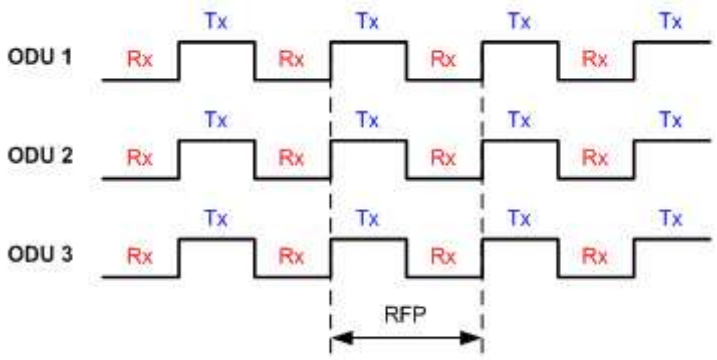


Figure G-9. Radio Frame Pattern

Five RFP types (A to E) are available. Under HSS the RFP must be configured by the user depending on the type of the radio products, services and channel bandwidth in accordance with the *Table H-1* and *Table H-2*.

The tables describe the efficiency of the air interface according to the RFP type, radio products mix, services and channel bandwidth. The tables may also be viewed in the Link Manager and in the Link Budget Calculator fo GE MDS Intrepid. The efficiency of the air interface will vary according to the product used.

Table H-1. Radio Frame Pattern Table (older Intrepid Radios)

RFP	20 MHz		10 MHz		5 MHz	
	TDM	Ethernet	TDM	Ethernet	TDM	Ethernet
A	Best	Best	Fit	Fit	N/A	N/A
B	N/A	N/A	Best	Fit	Best	Fit
C	N/A	N/A	N/A	Best	N/A	Fit
D	N/A	N/A	N/A	N/A	N/A	Best
E	Fit	Fit	Fit	Fit	N/A	N/A

Table H-2. Radio Frame Pattern Table (GE MDS Intrepid)

RFP	40 MHz		20 MHz		10 MHz	
	TDM	Ethernet	TDM	Ethernet	TDM	Ethernet
B	Fit	Fit	Fit	Fit	Fit	Fit
E	Best	Best	Best	Best	Best	Best

Legend:

Fit – available RFP for TDM and Ethernet services.

Best – optimal RFP for TDM and Ethernet services.

N/A – service unavailable

Select the RFP that gives you the **Best** or **Fit** for required system services and select the channel bandwidth accordingly.

Note *The RFP must be the same for each link within the collocated system.*

Five RFP types (A to E) are available. The RFP is selected depending on the type of the radio products, services and channel bandwidth used by the complete system.

Note

- *RFP type E should be used if and only if GE MDS Intrepid links are part of the HSS installation.*
- *The RFP must be the same for each link within the collocated system.*

Select the RFP that gives you the Best Fit for the system services and select the Channel Bandwidth accordingly.

The table below describes the efficiency of the Older Radio air interface according to the RFP type, radio products mix, services and channel bandwidth. The table may be viewed in the Link Manager and in the Link Budget Calculator and varies according to the product used.

RFP Considerations

When setting the RPF, the following considerations should be borne in mind:

- When synchronizing GE MDS Intrepid units you must use RFP B or E
- If you mix GE MDS Intrepid in a collocated site, you must use RFP B or E
- Selection of the RFP influences the capacity, latency and TDM quality
- RFP influences capacity and latency. Jitter buffer configuration can be used to set the TDM quality
- Using the Link Budget Calculator, you can see the effect of the RFP on the Ethernet throughput.

GE MDS Intrepid Considerations

- RFP B and channel bandwidths 14 MHz, 7 MHz and 5 MHz will only be available for release 1.9.30 and later
- The performance of GE MDS Intrepid radios that operate with RFPs B or E can be seen in the Link Budget Calculator.
- For GE MDS Intrepid 100M series: If the HSS Master works in asymmetric Tx/Rx ratio, then all other collocated GE MDS Intrepid units must operate in the same Tx/Rx ratio. In this case the ratio will be fixed and not automatic adaptive.
- Installation/Configuration considerations: If you are using GE MDS Intrepid 100M master and GE MDS Intrepid clients, the Services and Rates dialog will look like this:

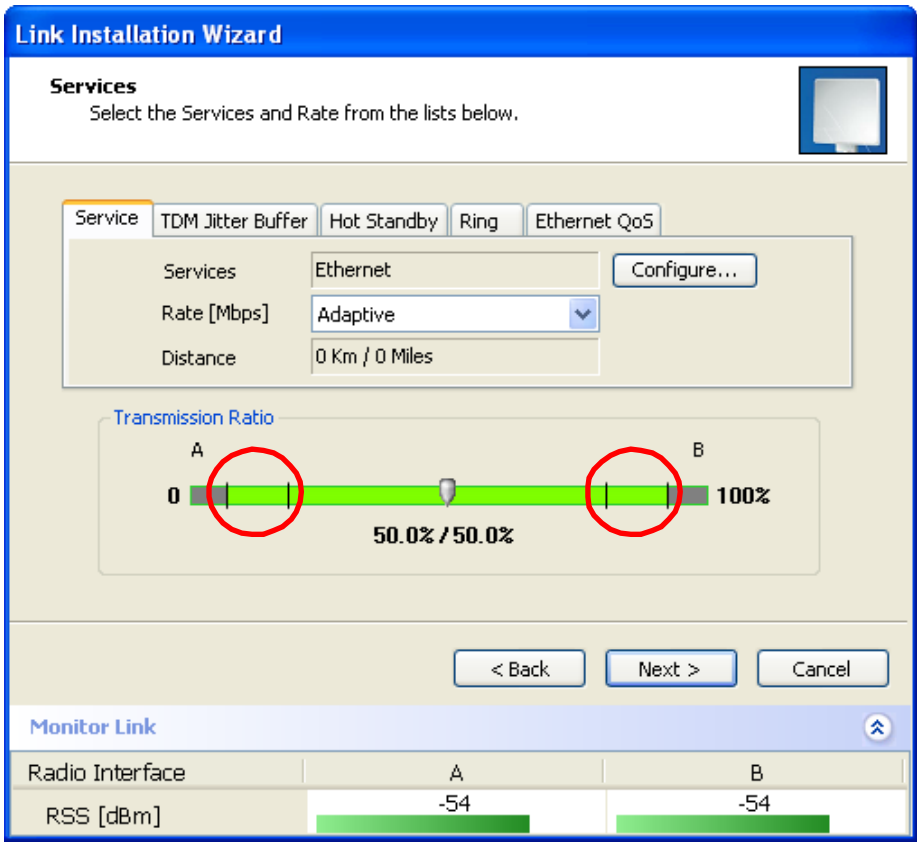


Figure H-10. Services and Rates, GE MDS Intrepid Ultra Master, GE MDS Intrepid Clients

- The circled areas should not be used. Using those areas, you may lose the collocated link with the longest distance between sites. If you do move the slider into a circled area, you will receive a popup warning:

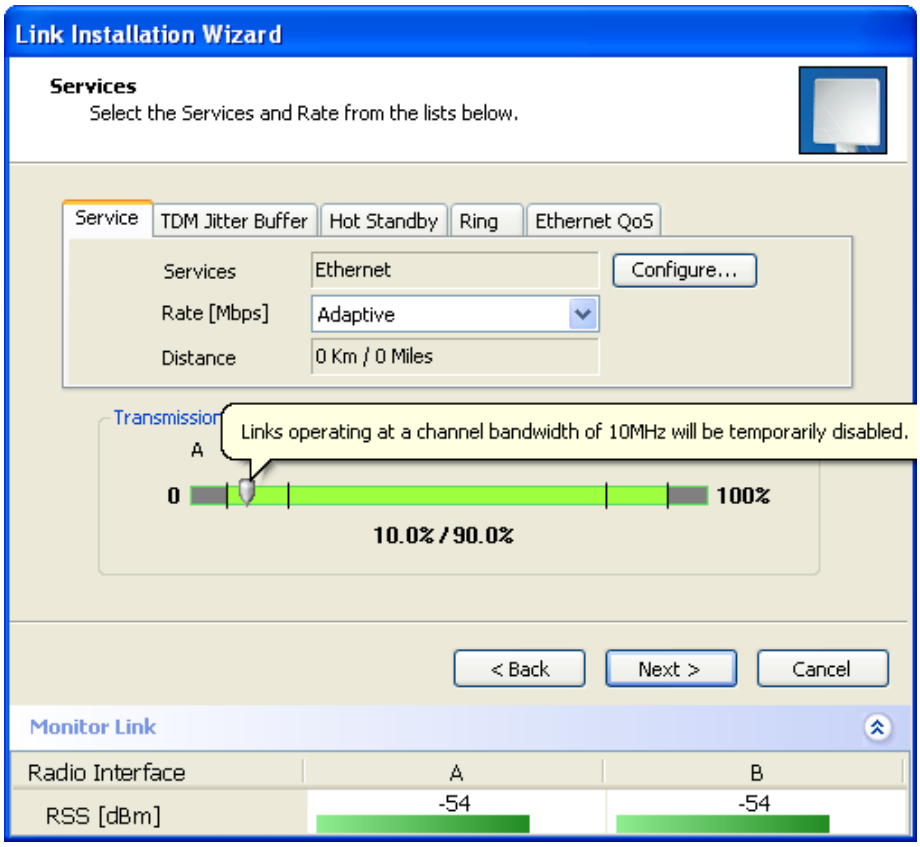


Figure H-11. Services and Rates, GE MDS Intrepid Ultra Master, GE MDS Intrepid Clients, Extreme Asymmetric Allocation

By restricting one direction into the restricted area, the more distant sites may not even be able to sustain the links much less sends or receive data.

- Asymmetric Allocation and Collocation: If the link is collocated, the use of Asymmetric Allocation is limited.

  The effective available range for Asymmetric Allocation (between the two circled tick in *Figure H-10*) is primarily determined by three factors:

  - The RFP in use (B or E)
  - Channel bandwidth
  - Link distance

  The first two parameters are entered during link installation/configuration.

  Possible scenarios are shown in ***Error! Reference source not found.***. Whenever asymmetric allocation is available, it is static for all traffic conditions.

H.1 Configuring an HSS Link

For HSS-enabled units, the Hub Site Synchronization Settings dialog box appears in the Link Installation and Configuration Wizard.

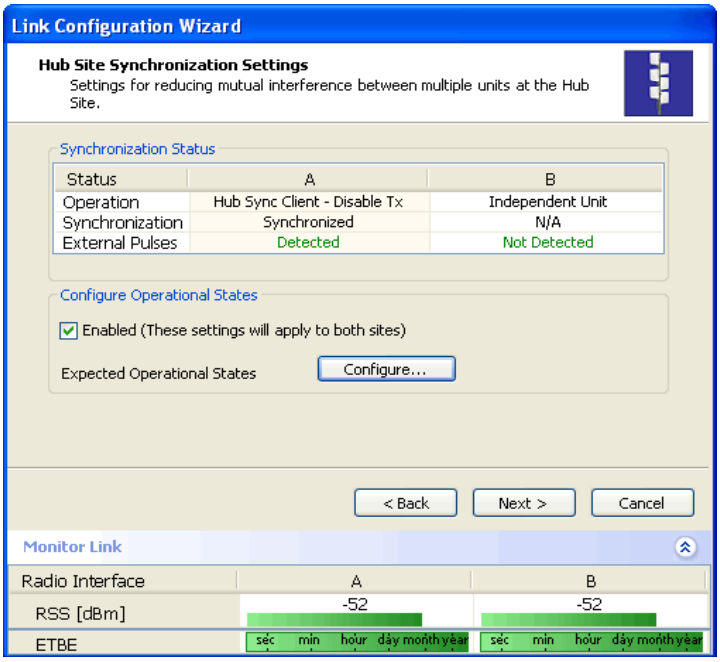


Figure H-12. Hub Site Synchronization Settings Dialog Box

The Synchronization Status dialog box displays the current status of each side of the link.

- Operation: Type of unit
  - Hub Sync Master (HSM)
  - Hub Sync Client – Disable Transmission (HSC-DT)
  - Hub Sync Client – Continue Transmission (HSC-CT)
  - Independent Unit

.

- Synchronization:
  - N/A- for Master or Independent Units
  - Synchronized – for Hub Site Clients
  - Not Synchronized – for Hub Site Clients
- External Pulses: The status of the pulses running through the HSS cable. The Master generates such pulses. The severity of each of these states is indicated by green, yellow or red text color.

Table H-3. External Pulse Status

HSS Sync Status	Meaning	Color Code
Generating	ODU is HSM and generates the sync pulse	Green
Detected	ODU is HSC and detects the sync pulse	
Not detected	ODU is independent	
Generating and detected	HSM, but other HSM present	Orange
Generating and Improperly Detected	GE MDS Intrepid ODU is HSM, but detects an older Indrepid radio HSM signal that is not RFP E	
Not detected	HSC but no HSM present	
Improperly detected	HSC but HSM pulse doesn't fit the HSC as configured. Occurs only for GE MDS Intrepid, which stops transmitting.	Red

✱ **To configure the operational states of the hub site unit:**

1. Click the **Enabled** check box.
2. Click the **Configure** button

   The Hub Site Configuration dialog box with the current status of the ODUs is displayed.
3. Select the type of unit configuration from the drop-down list.
4. Select the appropriate RFP radio button. Some RFP options may be disabled depending on the BW previously selected.

Note *Take care to avoid incorrect configuration of bandwidth, RFP or to set multiple Hub Sync Masters, as system interference can occur. Link Manager gives error messages and tool tips if the system is configured with mismatches.*

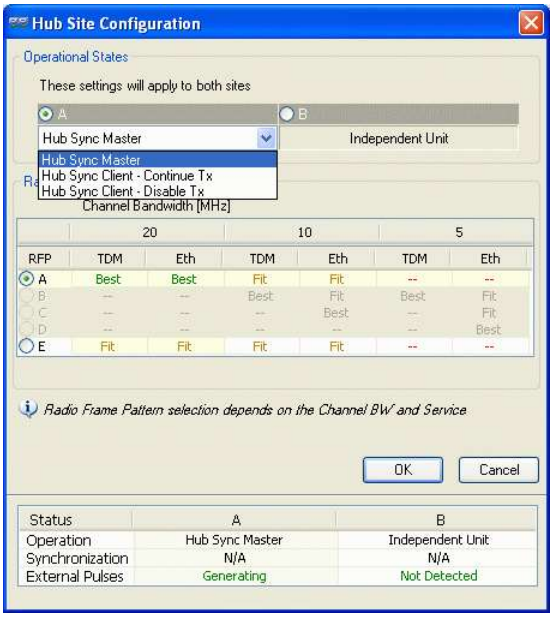


Figure H-13. Hub Site Configuration Dialog Box

H.2 Configuring a Site

For units that support HSS, the Hub Site Sync option appears in the Air Interface section and displays the current HSS of the unit. Configure the unit from the Link Configuration Wizard according to the procedure described above.

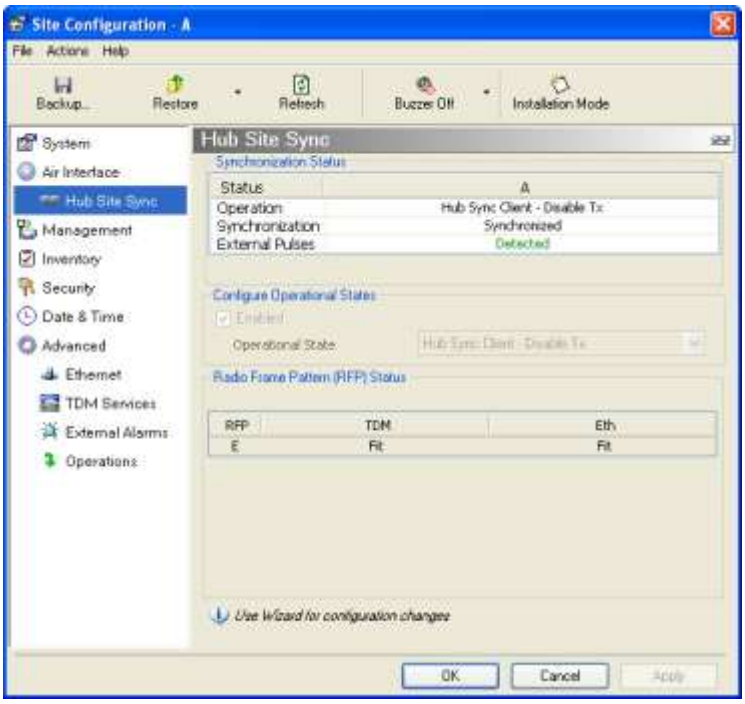


Figure H-14. Site Configuration – Hub Site Sync Dialog Box

The following figure is displayed when the hardware does not support HSS. These units may be used as independent remote units.

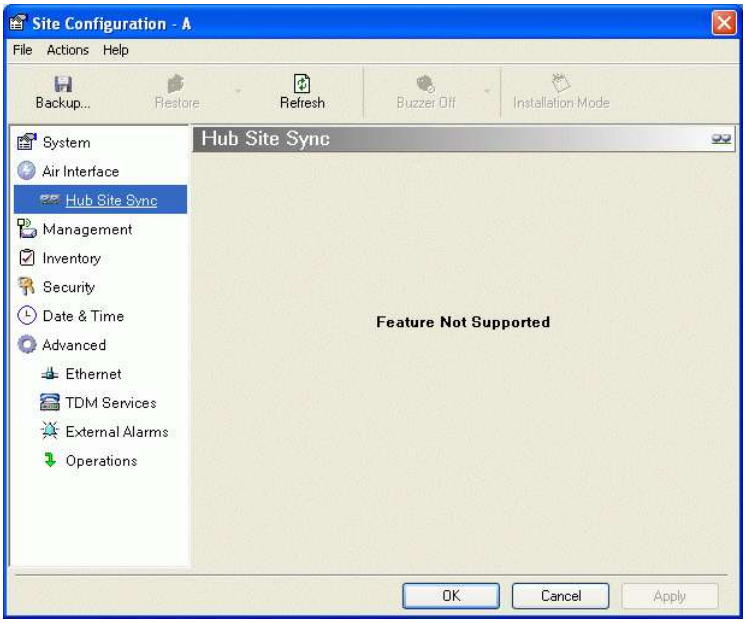


Figure H-15. HSS Not Supported Message

Appendix H

Installing a Hot Standby Link

Intrepid's hot standby link is a duplicated link set up as a primary link and a secondary link in hot standby mode as shown in figure below.

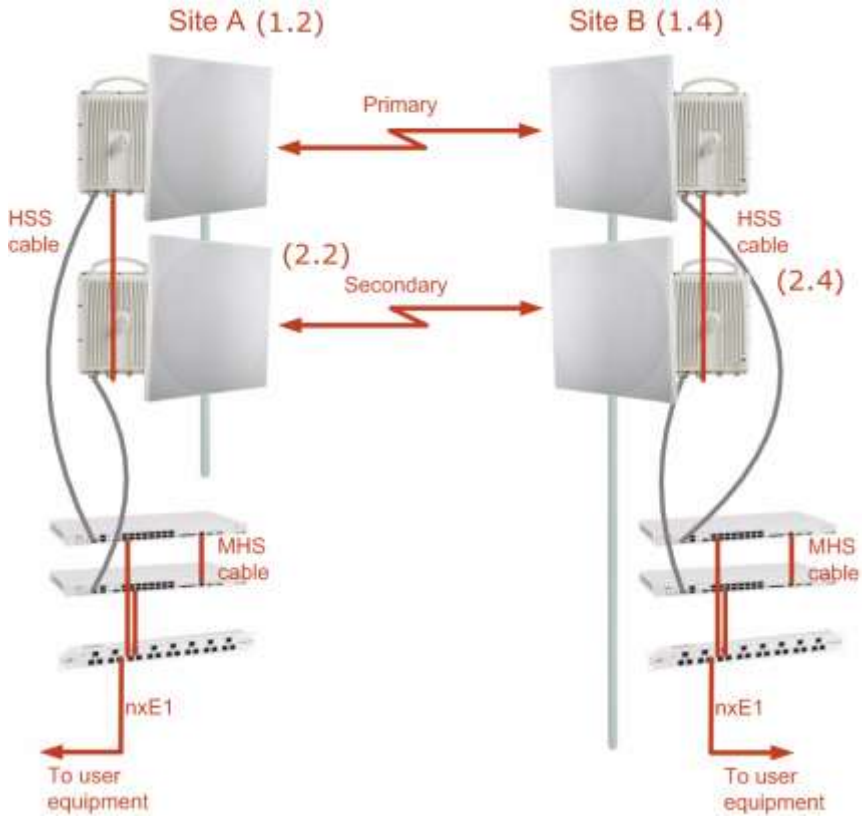


Figure H-1. Hot Standby Link

MHS provides redundancy and backup to TDM services. It is designed to provide high reliability high-capacity Point-to-Point links. The MHS is:

- Designed to provide redundancy and high reliability for carrier class operators
- Optimized for high capacity links operating in license-free bands
- A comprehensive solution providing protection against equipment failure and loss of air interface, by simple connectivity between a primary link and a secondary link

The main service redundancy features of the MHS are:

- TDM service cut-over from the primary to the secondary link is completely automatic
- TDM service cut-over time no more than 50 ms
- Automatic restore to primary link as soon as it becomes available
- Support for up to sixteen TDM channels For Intrepid Ultra and eight TDM channels for Intrepid .

Equipment Protection

Equipment protection is provided for the electrically-active network elements, ODU and IDU.

The primary IDU and the secondary IDU are connected by a cable to monitor failure and to control protection switching. Switching time is less than 50 ms.

When connecting two Intrepid links as 1+1, one dual-polarization antenna can be shared by the primary link and the secondary link.

Air-Interface Protection

Air-Interface protection is unique to GE and is optimized for wireless links operating in license-free bands.

The primary link and the secondary link use different frequency channels. If the air-interface of the primary link is disturbed and cannot carry the required TDM service, then the system automatically switches to the secondary link.

In addition, improved robustness and frequency planning flexibility is achieved, as the primary and secondary air interfaces can operate in the same frequency band or in different frequency bands.

Automatic Channel Selection (ACS) can be configured for each link to add additional robustness.

The primary and secondary links are synchronized using Hub Site Synchronization (HSS).

It is recommended that both sites be installed with HSS cables. If HSS fails at one site, it can be operated from the other site by remote configuration.

H.1 Hot Standby Package Contents

In addition to the regular GE MDS Intrepid Series units and accessories, the following items are required for implementation of a hot standby link:

- One MHS cable
- Hot standby patch panels

Figure H-2. Hot Standby Patch Panel

H.2 Installing a Hot Standby Link

The following procedure is substantially generic to all intrepid radio products. What you see on your running Link Manager may differ in some details from the screen captures used to illustrate this appendix.

Figure H-1 illustrate an MHS setup. *Figure H-3* shows how to connect the IDUs to the patch panel.

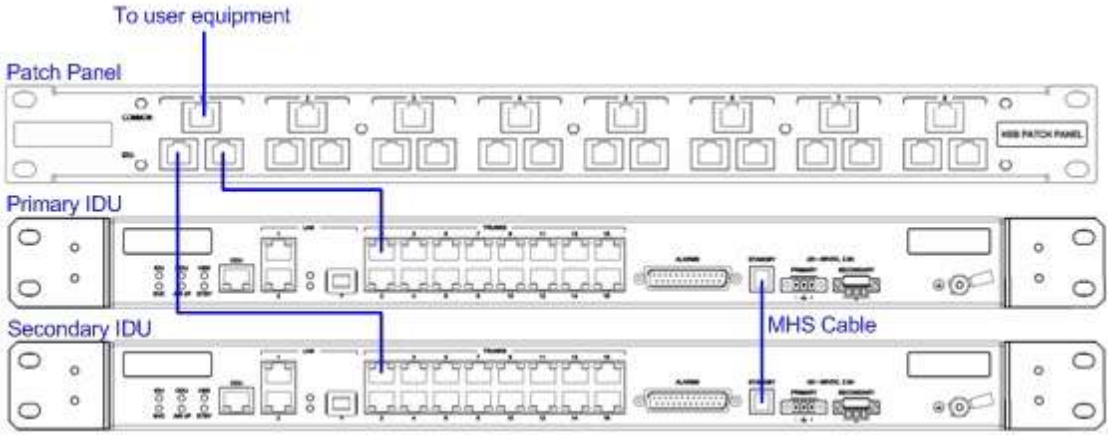


Figure H-3. Connecting IDUs to Patch Panels

Note

- *With GE MDS Intrepid Series links you can protect up to 16 TDM ports. To protect more than eight TDM ports use two patch panels at each site.*
- *Ethernet services are carried independently by primary and secondary links. Each link carries different Ethernet traffic. MHS does not protect Ethernet traffic.*

In what follows, it is assumed that:

- We depart from our usual Site A / Site B conventions. Sites A and B on the primary link will be Sites 1.2 and 1.4 respectively. The corresponding sites on the secondary link will be Sites 2.2 and 2.4. The site names reflect their IP addresses. This is a useful convention and is reflected in the screen captures below.
- The link will be managed from Site 1.2; Site 1.4 may be a remote site.
- The links intended as the primary and secondary are referred to their respective names, Primary Link and Secondary Link as shown in *Figure H-1* above, despite their having yet to be installed.

❋ **To install a hot standby link:**

1. Set up Primary Link in the usual way. Ensure that it is fully operational in accordance with the relevant instructions in the previous chapters of the manual.

Note *Do not proceed unless this condition is fully met!*

2. Connect user equipment to Site 1.4.
3. At Site 1.2, disconnect the TDM cables from the external equipment or disconnect external equipment from the Hot Standby patch panel.
4. The HSS cable (connecting the ODUs) should be connected at Site 1.2. The ODU belonging to the primary link should be configured as HSM, whereas the ODU belonging to the secondary link should be configured as HSC-CT.
5. Establish Secondary Link in the usual way, with HSS enabled. **The two link frequencies should be at least 5 MHz apart.**
6. Connect the MHS cables at Sites A and B as shown in *Figure H-1* and *Figure H-3* above.
7. Run the Configuration Wizard for Primary Link. Activate TDM services in the usual way. Notice that there is a new tab, "Hot Standby", in the Services Configuration panel:

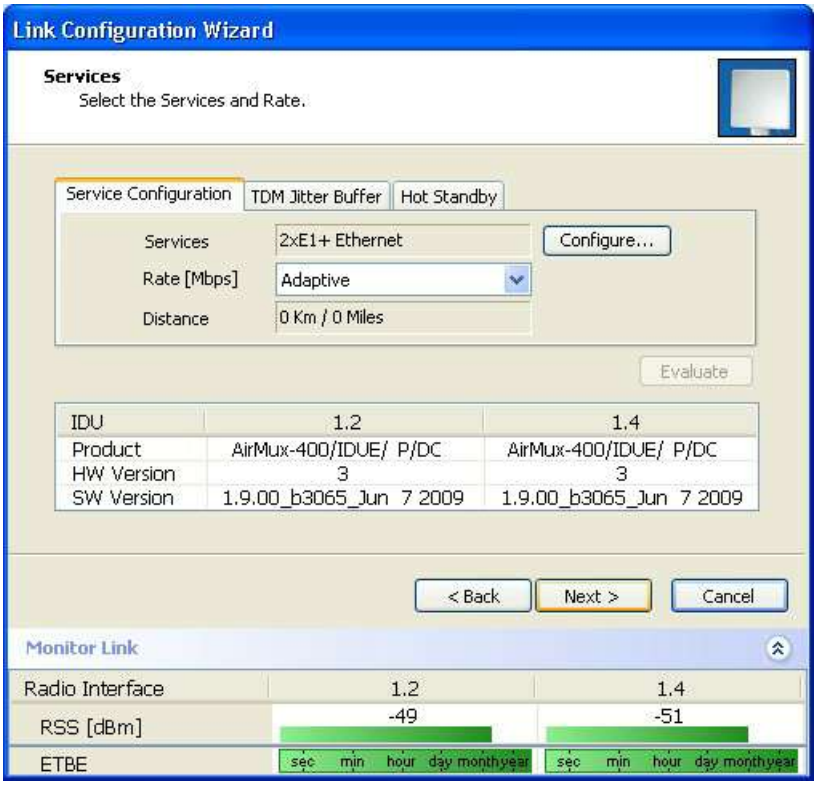


Figure H-4. Services Configuration Panel Showing Hot Standby Tab

8. After you have configured TDM services, click the Hot Standby tab.

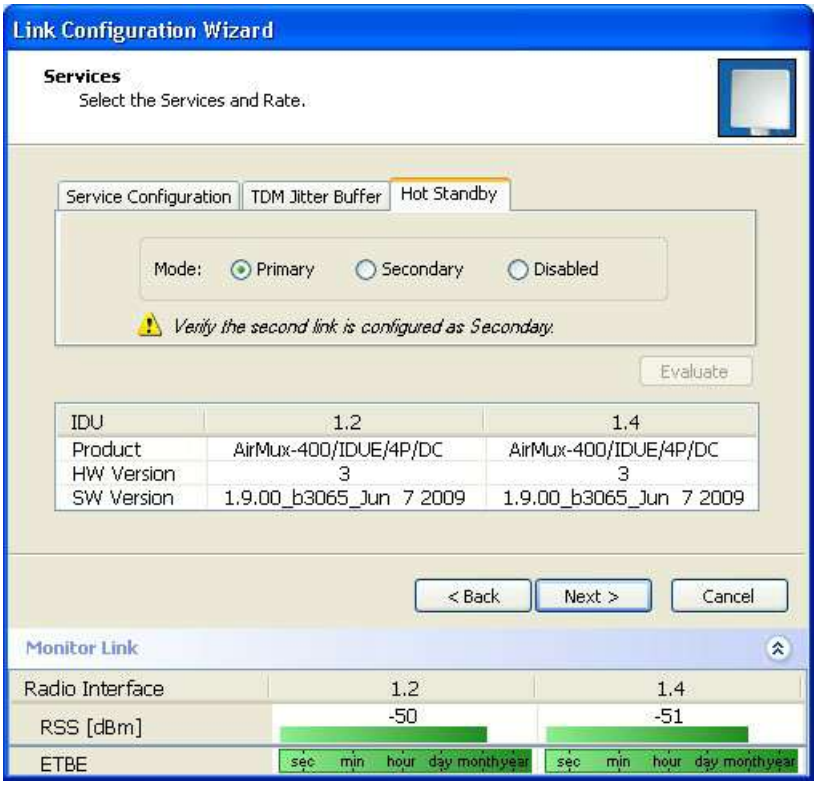


Figure H-5. Services Configuration Panel, Hot Standby Tab Selected

9. Check the Primary button to configure primary link as the primary link.

10. Complete the configuration wizard, and then move to secondary link.
11. Repeat step 10 for secondary link. For the Services Hot Standby tab, this time, check the Secondary button.
12. Complete the configuration wizard.
13. At Site 1.2, reconnect the Hot Standby Patch panel to the external equipment.

    From this point on, we will simply refer to primary and secondary link (no capitalized names).

    At the end of the process, the Link Manager main windows should look like this:

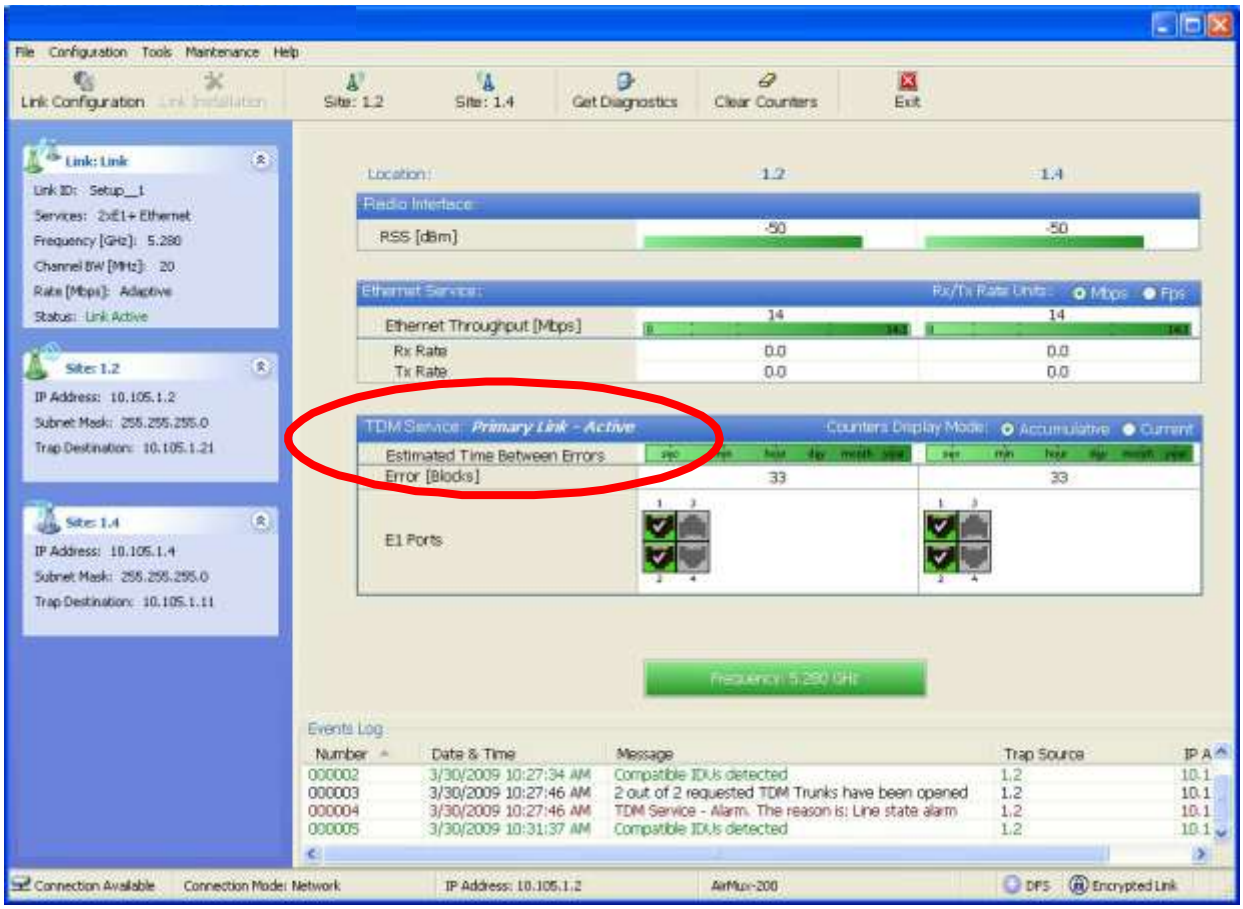


Figure H-6. The Primary Link under Normal Operation

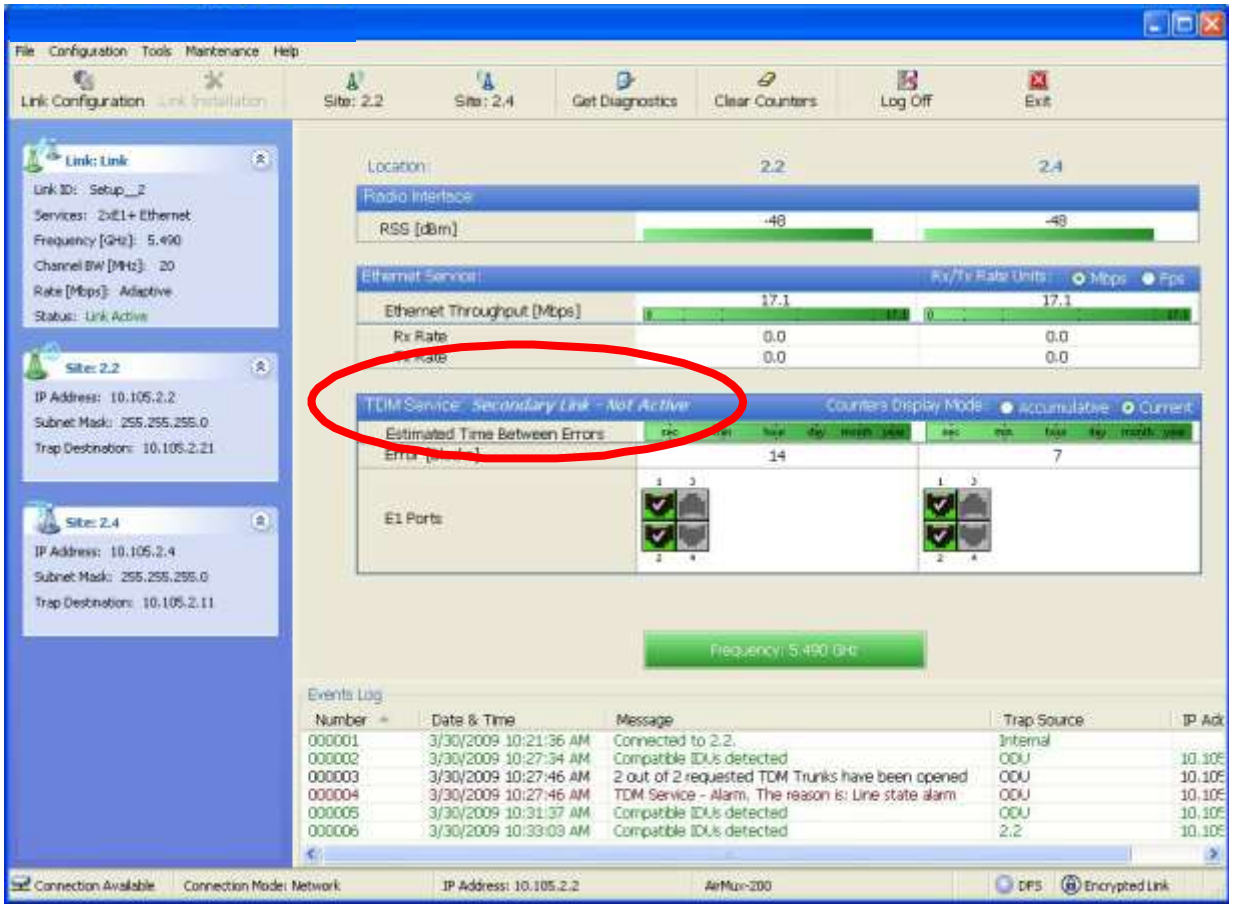


Figure H-7. The Secondary Link under Normal Operation

To see what happens following a switchover from the primary link to the secondary link, you need to have running two copies of the Link Manager – one logged into the primary link, and one logged into the secondary link.

When the switchover to the secondary link occurs, the following indications appear:

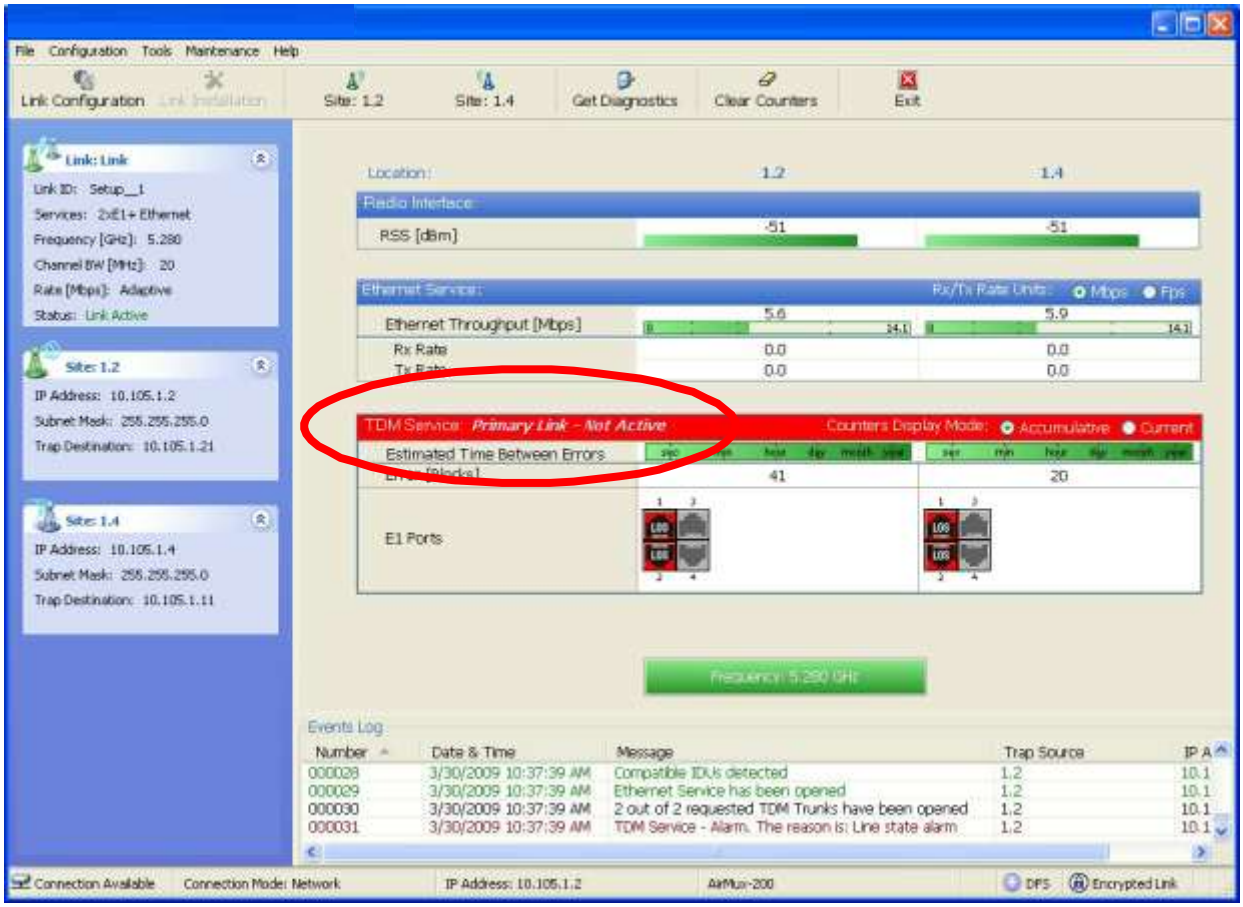


Figure H-8. Primary Link a few Seconds before Regular No-Link Display

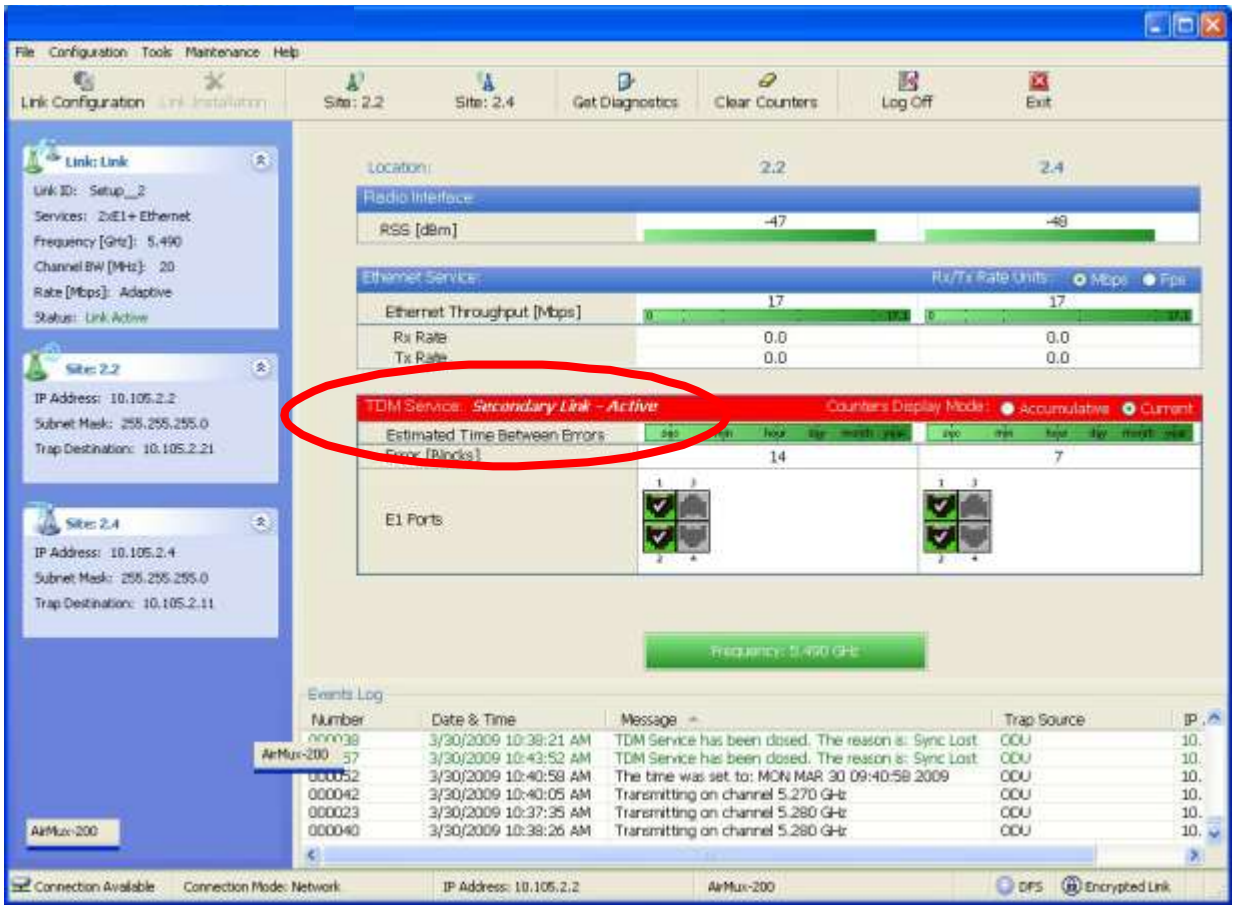


Figure H-9. Active Secondary Link after Switchover

Note *The active secondary link appears in red, although is operational.*

H.3 Maintaining a Hot Standby Link

IDU Replacement

There are two situations, which must be treated differently.

Situation 1

To replace either of the IDUs at Site 1.4 or the secondary IDU at Site 1.2, nothing special is required. Simply disconnect the IDU to be replaced – and replace it with a new one. Replacing a secondary link IDU obviously has no effect on the TDM service. Disconnecting the Site 1.4 primary IDU activates Hot Standby. After the Site 1.4 primary IDU is replaced, the Link will detect the change and switch back to the primary link.

If you replaced the Site 1.2 secondary IDU, remember to reconnect the MHS cable.

Situation 2

Replacing the Site 1.2 primary IDU is different, and requires several steps.

✱ **To replace the Site 1.2 primary link IDU:**

1. 1. Power off the Site 1.2 primary IDU. This activates the secondary link using Hot Standby.
2. Run the Configuration manager on the secondary link, and in the Hot Standby panel of *Figure H-5* above, check the Disabled button.
3. Replace the Site 1.2 primary IDU without connecting it to the ODU (to prevent transmission by the primary link with the undefined IDU).
4. Reconnect the MHS cable between the IDUs at Site 1.2.
5. Again, run the configuration wizard on the secondary link, and in the panel of *Figure H-5* above, check the Secondary button to re-enable the link as secondary.
6. Connect the new Site 1.2 primary IDU to its ODU.

   The hot standby automatically reverts to the primary link within 50 ms.

ODU Replacement

Both the primary and secondary replacement ODUs require pre-configuration prior to insertion into the link. The items to be pre-configured are

- HSS mode
- Link ID
- Frequency
- Hot Standby mode – using the new Services panel in *Figure H-5* above
- IP address (optional).

Note *Pre-configuration **must** be carried out before the new ODU is connected to its IDU. If you try to do it "live" against its IDU, it will cause spurious transmissions and a service break.*

✱ **To pre-configure an ODU:**

1. Attach the new ODU to a PoE device or IDU.
2. Run the Link Manager and use Hot Standby tab of *Figure H-5* above to configure the new ODU to Primary or Secondary mode as required.
3. Ensure that it is set to the proper HSS mode in accordance with *Figure H-5* above. Enter the required Link ID and frequency.

✱ **To replace an ODU for primary or secondary link, at either site:**

- Install the pre-configured ODU. (Since the other link is working normally, nothing need be done with it. If the secondary ODU was replaced, service remains as is on the primary link. If the primary ODU was replaced, then the service switches back to the primary link.)

H.4 Switching Logic

This section describes logic behind link switchover and restoration process.

Switching from Primary Link to Secondary Link

Switching from primary link to secondary link will occur following:

- Loss of the primary air interface due to sync loss
- Loss of the primary air interface due to failure of the receiver to acquire expected E1/T1 data during a period of 24 ms
- The primary equipment (either ODU or IDU, local or remote) is powered off.

Following the switch from the primary to the secondary link, the primary and secondary link Manager main windows should look like this:

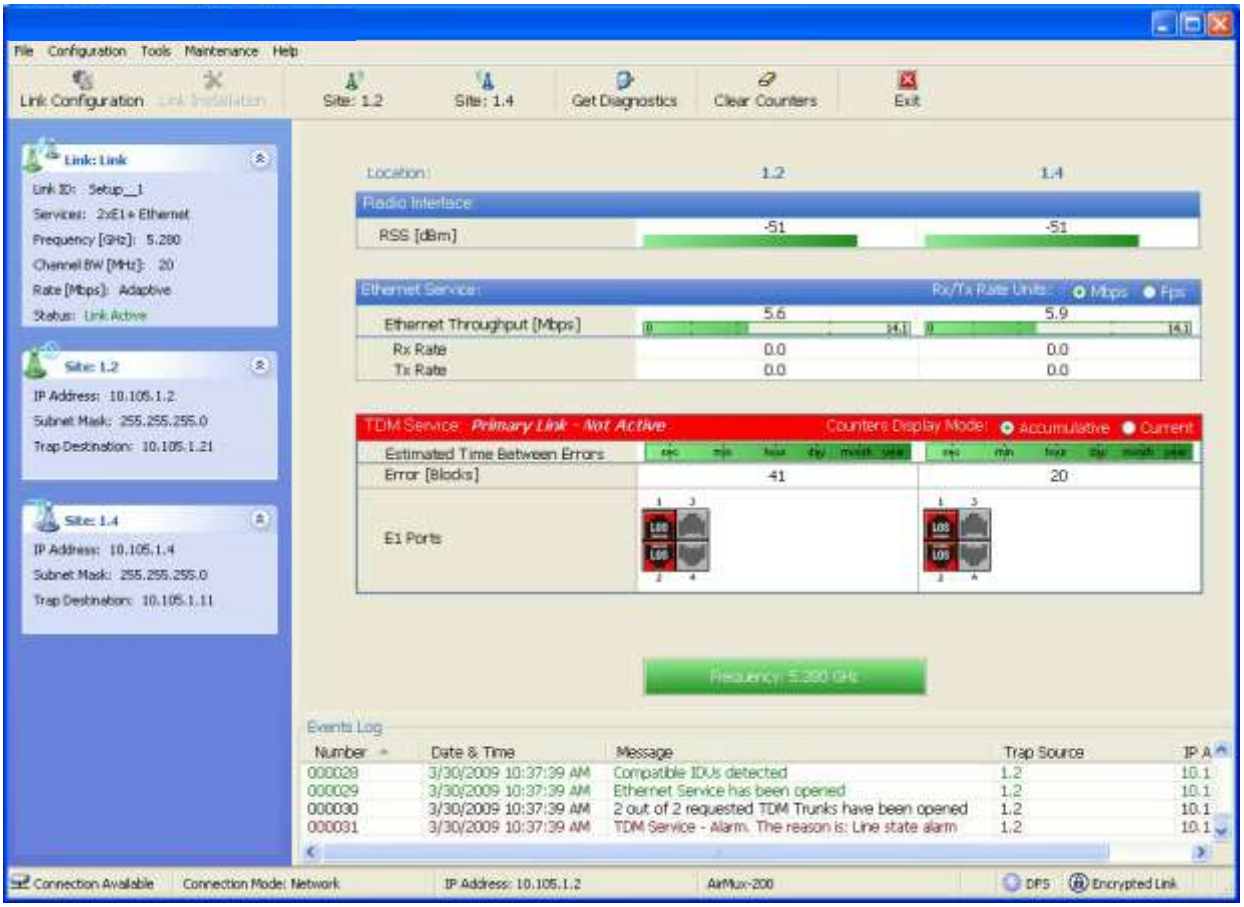


Figure H-10. Primary Link after the Switchover to Secondary Link

Note *After a few seconds the display in Figure H-10 moves to No-Link display, with TDM ports grayed out.*

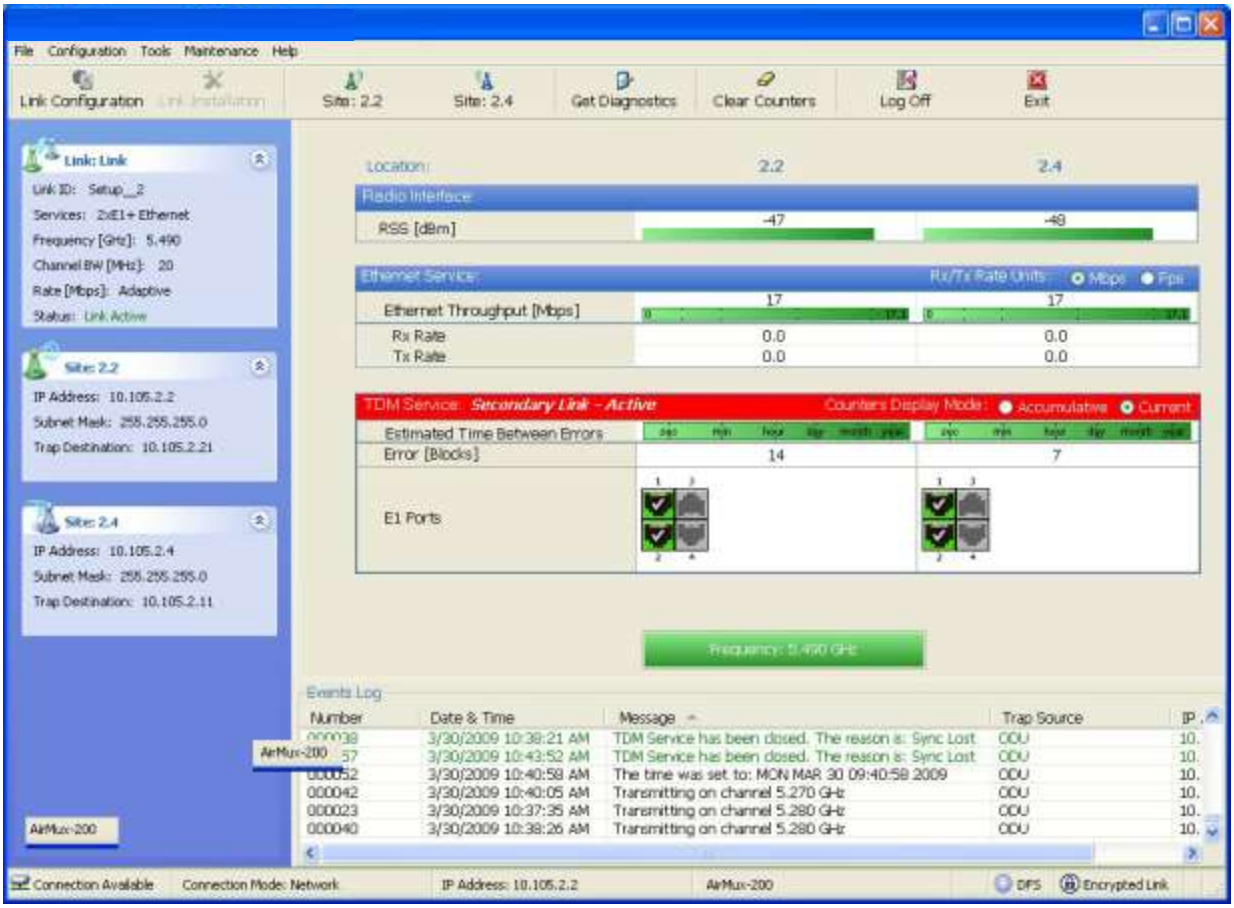


Figure H-11. Secondary Link Operating after the Switchover to Secondary

Note *After a few moments the TDM icons in Figure H-11 become green.*

Switching back from the Secondary to the Primary Link

Switching back from the secondary link to the primary link will occur after the primary link has become and remains fully functional for a continuous period of at least one second. Following reversion from the secondary link to the primary link, the Manager main windows should look like this:

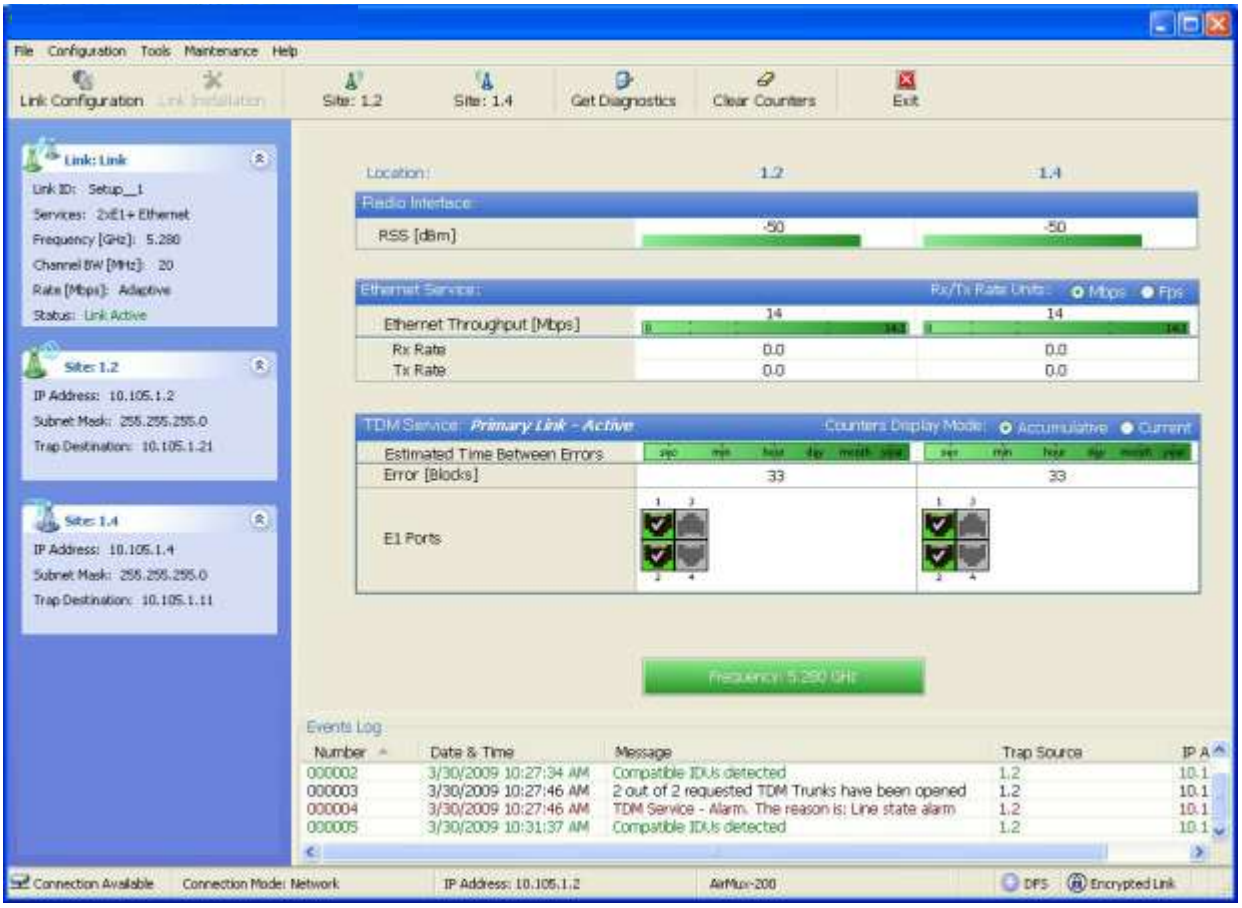


Figure H-12. Primary Link Operating after the Switchover from Secondary

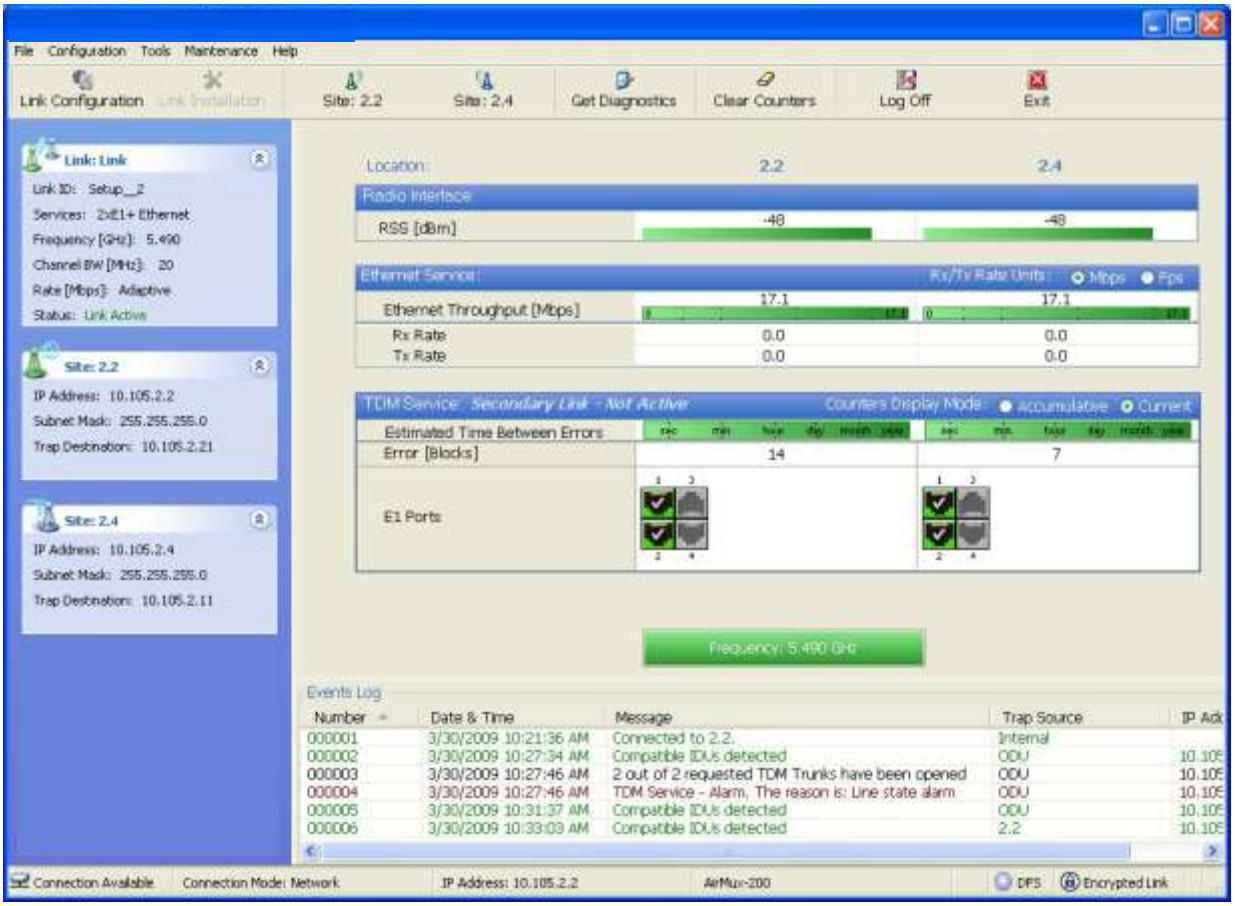


Figure H-13. Secondary Link operating after the switch back to Primary

System Operation Description

Normal operation:

- E1 services are carried by the primary link
- The secondary link (equipment and air interface) is operating but not carrying user traffic
- E1 ports on the secondary IDUs are tri-state.

Switching to backup link:

- Loss of the primary air interface due to sync loss
- Loss of the primary air interface due to failure of the receiver to acquire expected E1/T1 data during a period of 24 ms
- Primary equipment power off (either ODU or IDU, local or remote)
- E1 ports on the primary IDUs turn to tri-state
- E1 ports on the secondary IDUs become active.

Backup operation: E1 services are carried by the secondary link

Restoration of primary link: Switching back to primary occurs as soon as the primary link is fully functional for 1 second.

Appendix I

FCC/IC DFS Installation Procedure

The FCC/IC regulation for 5.4/5.3 GHz allows unlicensed wireless data equipment, provided that it does not interrupt radar services. If radar activity is detected, the equipment must automatically change frequency channel. This feature is termed Dynamic Frequency Selection (DFS). According to the standard, a channel with active radar is prohibited from use for 30 minutes. Before using a channel for transmission, the radio equipment must probe it for radar signals for a period of 60 seconds.

GE MDS Intrepid Series products have the DFS feature available as well as ACS.

An immediate consequence of the FCC/IC regulation for 5.4/5.3 GHz is that the standard method of link installation using a single default fixed installation channel, cannot be used.

Instead of the installation procedure of *Chapter 2*, a link activation method is used.

The ODUs are either supplied from the factory ready for use at 5.4 GHz or 5.3 GHz FCC/IC or alternatively, they can be set up for these bands using the Link Manager.

I.1 Activating FCC/IC 5.4/5.3 GHz Link

✱ **To activate a FCC/IC 5.4/5.3 GHz link:**

1. Install Link Manager software as usual.
2. Connect the PC to the IDU-ODU pair to be used as the local site.
3. Run the Link Manager and log in as Installer.

   You will see the following window with the Link Status label red and showing Inactive.

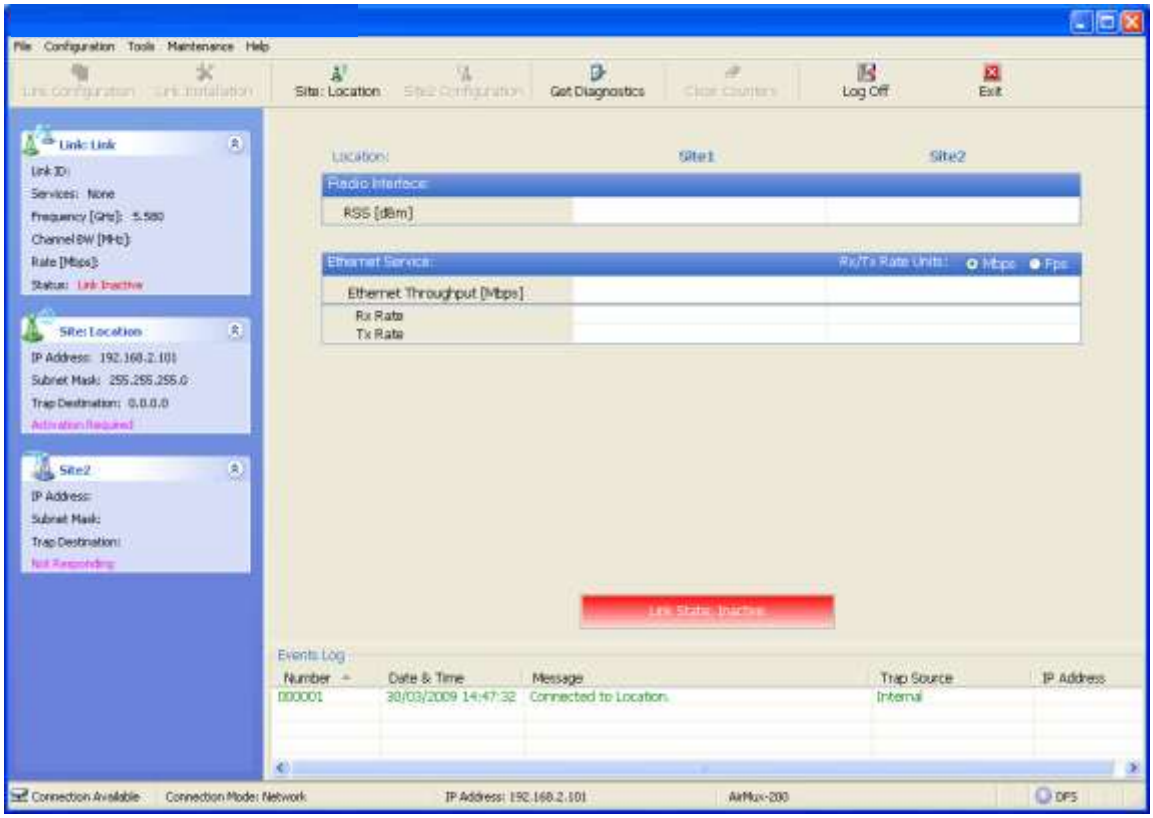


Figure I-1. Activating an ODU, Inactive Manager Window

4. Select **Site:Location** > **Air Interface** for the logged in site.

   The Air Interface dialog box opens:

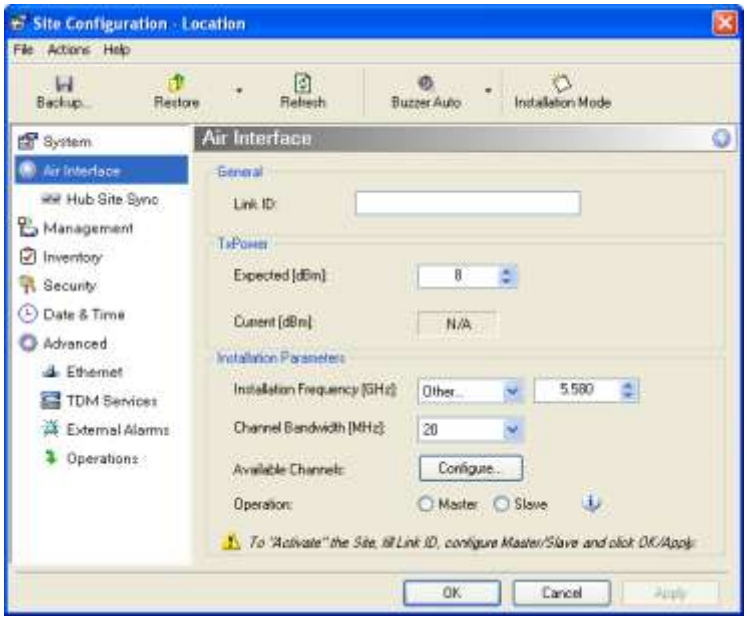


Figure I-2. Air Interface Dialog Box

5. Enter the Link ID and note it for use with the second site of the link.
6. Check the Master radio button.

7. Click OK.

   The following window appears:

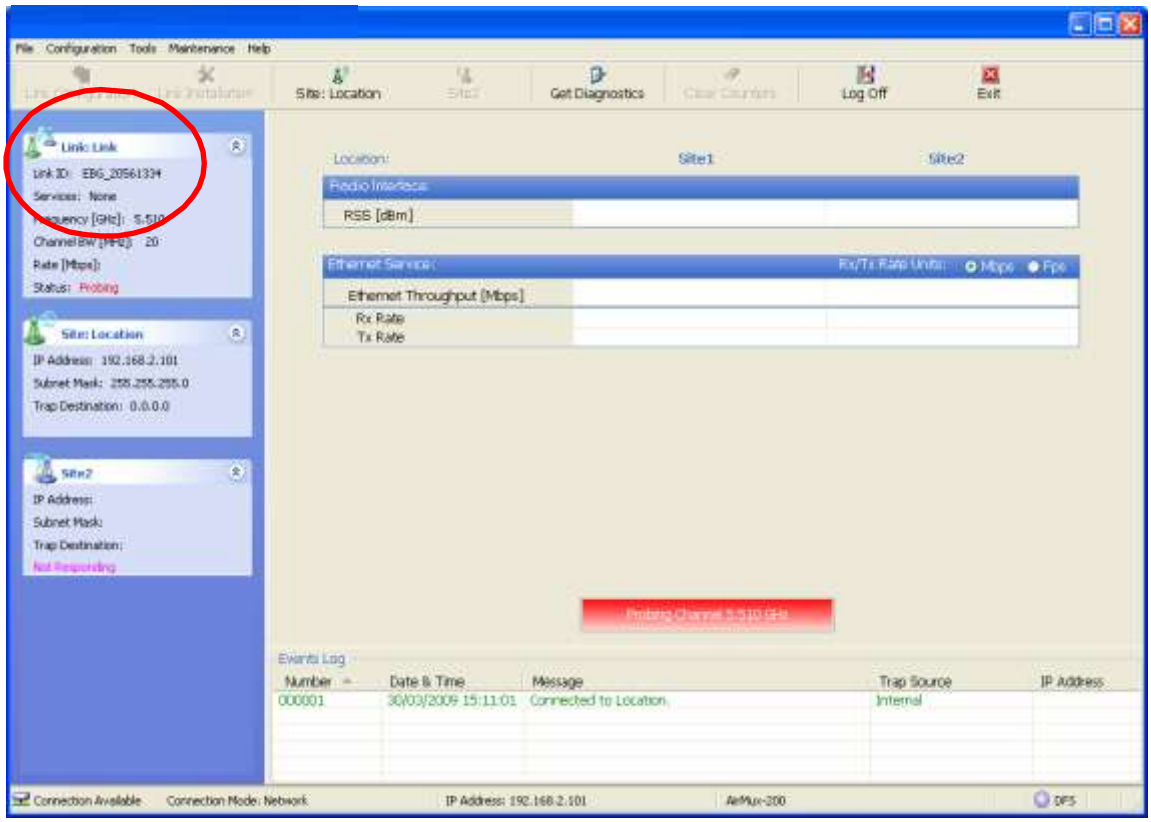


Figure I-3. Active Manager Window, Local ODU after Activation – Probing

Note *The Link ID is shown in the Link name pane.*

8. Repeat the above procedure for the remote ODU, ensuring that in the Air Interface window, that you enter exactly the same Link ID, but this time that you check the **Slave** radio button

   If both ODUs are powered up, after a minute or so a link will be established. If you are still connected to the remote site (from the previous steps), the window of *Figure I-3* will look like this:

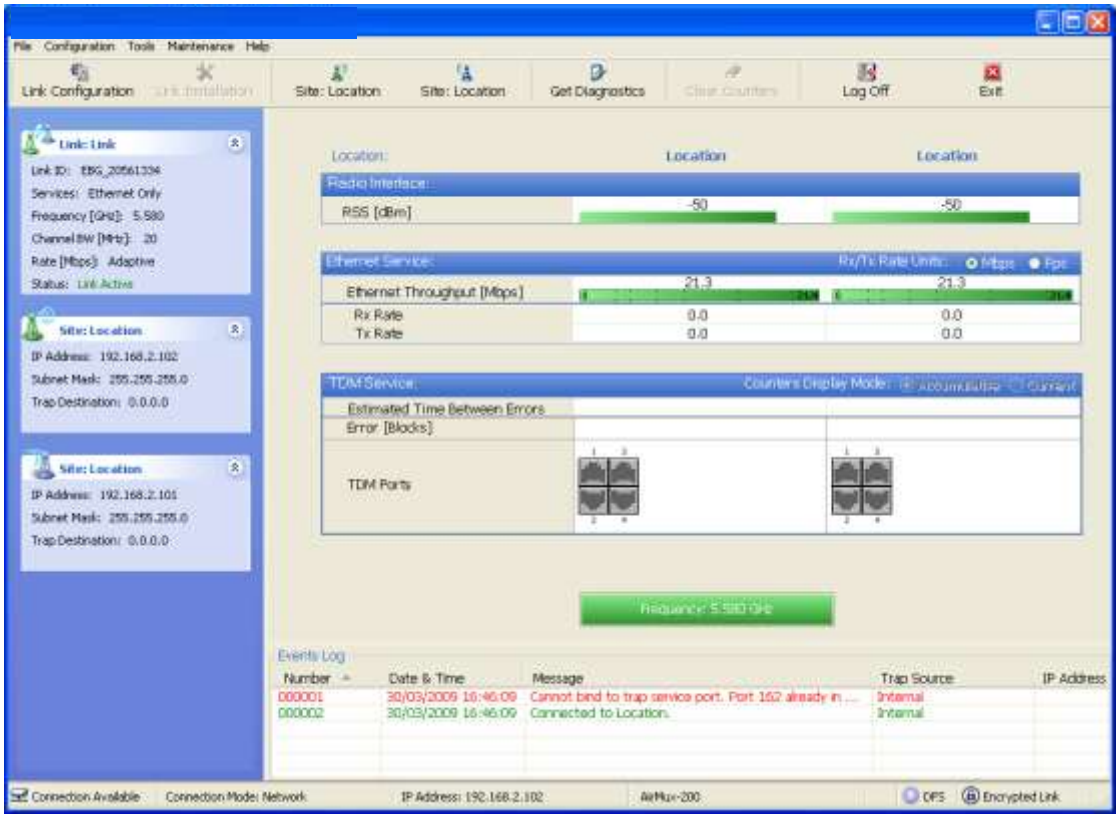


Figure I-4. Both Sites Activated and Awaiting Configuration

I.2 Configuring FCC/IC 5.4/5.3 GHz Link

The configuration procedure can be carried out from either site using the configuration wizard as described in *Chapter 4*.

Note *Both sites in a FCC/IC 5.4/5.3 GHz Link must be configured identically.*

The only difference is in the Channel Settings window, which does not allow disabling the ACS.

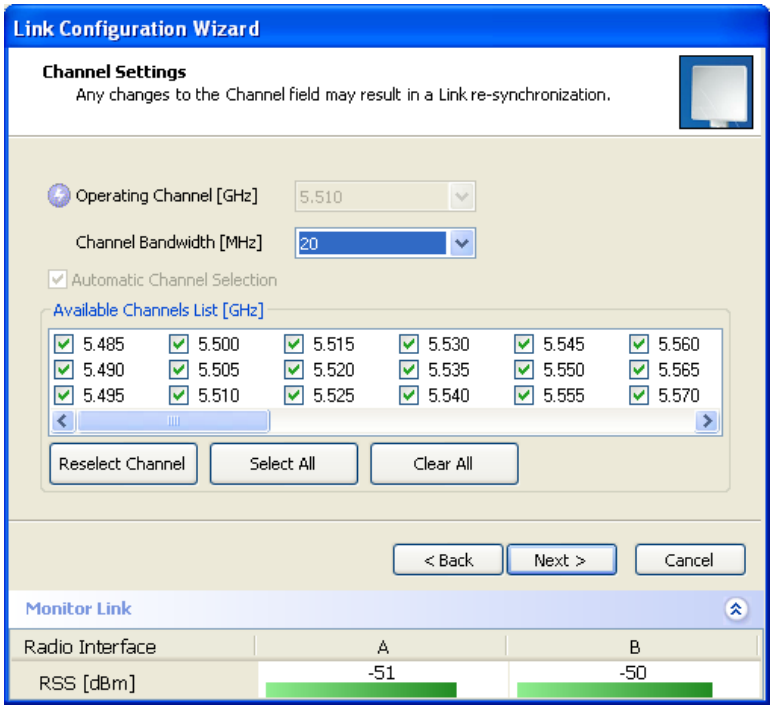


Figure I-5. Channel Settings Dialog Box, ACS is Permanently Enabled

Upon completion of the wizard, the Site configuration dialogs can be used in the usual way. Once operational, the Link Manager window is the same as for other Link Models.

Here is the Link Manager main window upon completion of the wizard:

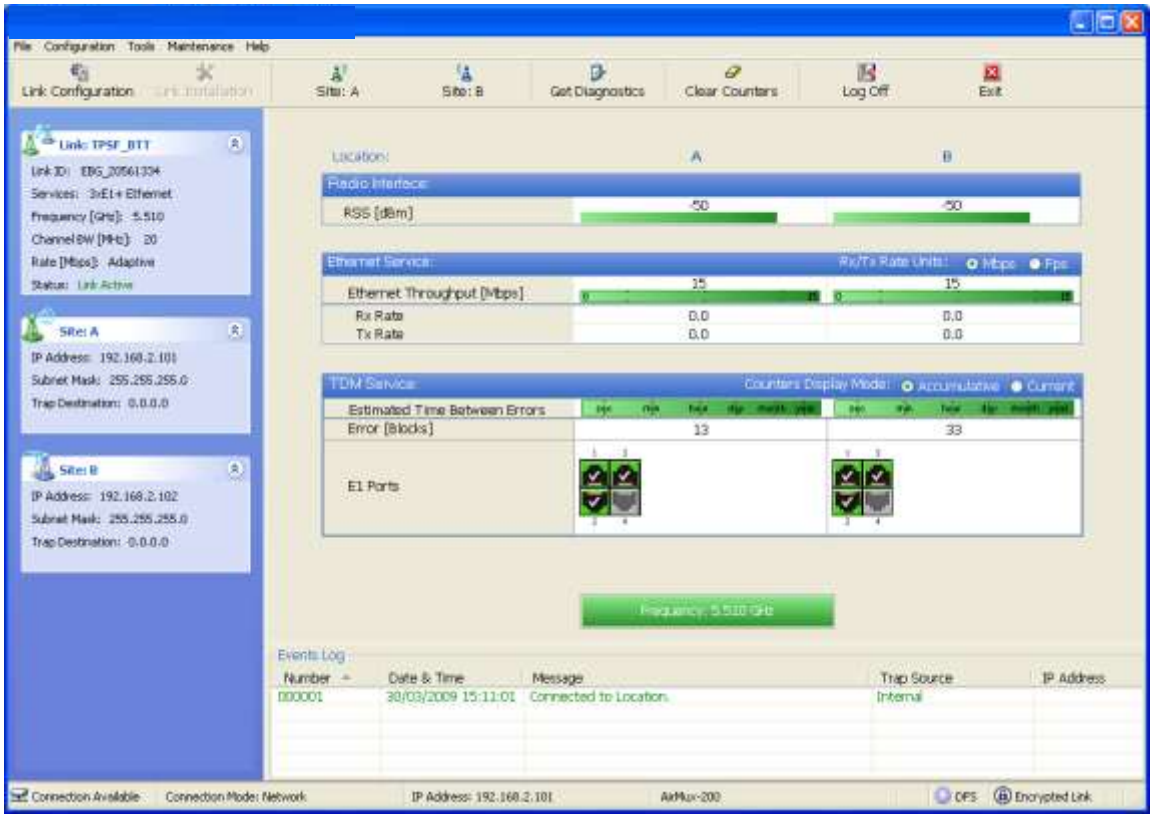


Figure I-6. FCC/IC 5.4/5.3 GHz Link is Operational

Appendix J
GPS Synchronization

The GPS-based synchronization unit (GSU) is designed to handle inter-site interferences under large-scale deployment scenarios.

The GSU is an outdoor unit consisting of a standard wireless link enclosure, a GPS antenna and a PoE device.

The GSU is connected to the HSS Unit using a standard HSS cable. It synchronizes the transmission timing of multiple hub sites to the same clock source thus eliminating mutual interference.

The GSU receives a synchronization signal from the GPS once per second. It distributes a proprietary synchronization signal to all other ODU units using the RS-422 protocol and the standard HSS mechanism, where the GSU acts as an HSM unit.

When the GSU doesn't receive a synchronization signal from the GPS for 30 seconds, it moves automatically to Self-Generation mode and acts as a regular HSM unit, until the GPS recovers.

J.1 Typical Applications

This section describes possible deployment scenarios with GPS-based synchronization.

Independent Distributed Sites

In the scenario of *Figure J-1*, we have multiple independent collocated sites, which may interfere with each other. To meet this situation, we coordinate all of them using the GSU as shown.

The GSU functions like "wide area HSS unit", ensuring that all participating radios at the locations marked GSU each transmit and receive at the same time.

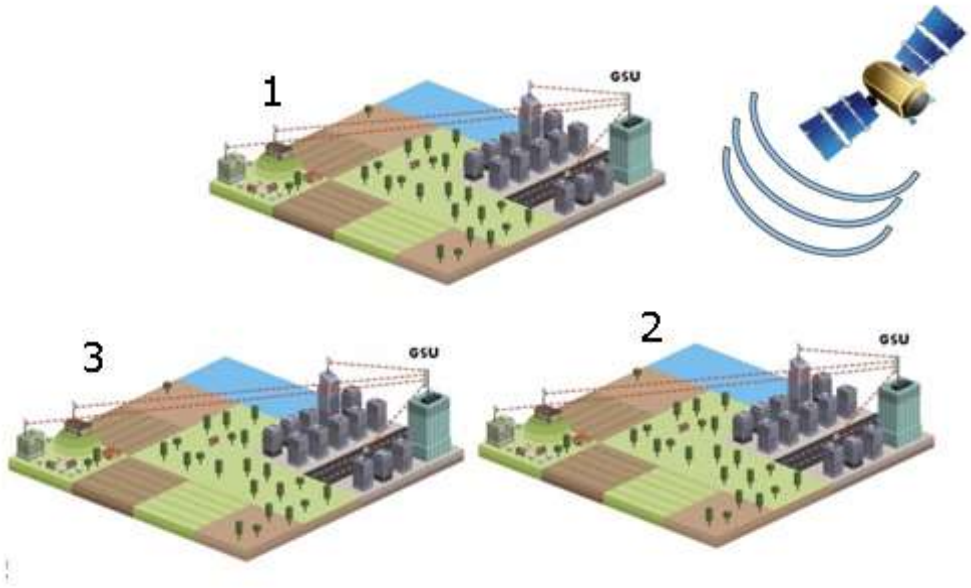


Figure J-1. Independent Distributed Sites

Multiple Distributed Sites with Communication

What happens if, in *Figure J-1*, the GSU towers themselves have radios communicating as shown in *Figure J-2*?

Consider GSU 1 and GSU 2: Both collocated towers transmit and receive simultaneously. However, the radios communicating at GSU 1 and GSU 2 must transmit and receive in turn according to the scheme in marked "Normal Phase" in *Figure J-3*. This is an impossible situation, if all the links must send and receive together. It is further complicated by adding a third and further sites as shown.

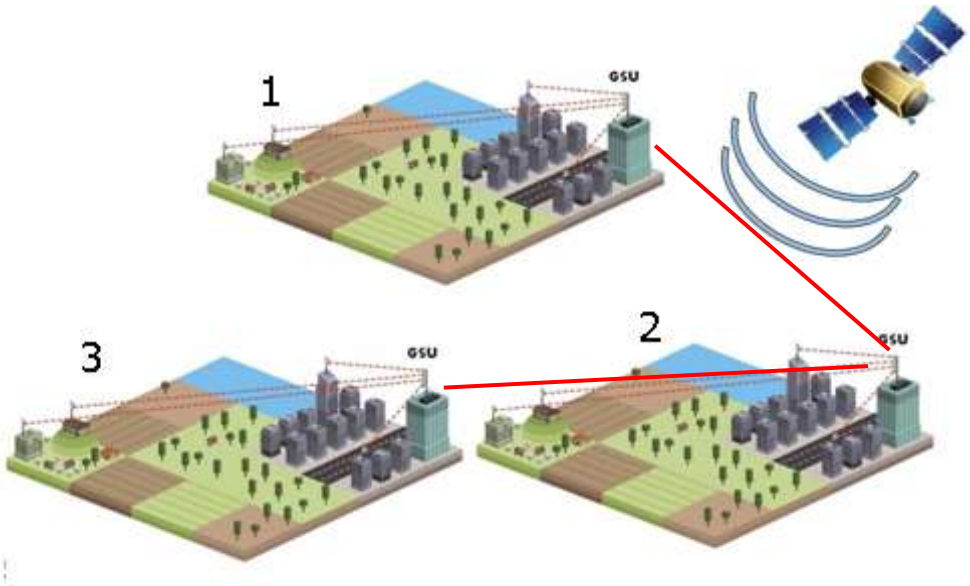


Figure J-2. Communicating Distributed Sites

Cascaded Sites using Shifted Phase Transmission

The solution offered here is not a "universal cure". The following conditions are necessary, but in any specific case may not be sufficient:

- The GSU sites (marked 1, and 3 above) are sufficiently far apart as to ensure that there is no mutual interference between communicating sites (1–2 and 2–3 above)
- There should be no interference between non-communicating sites (1 and 3 above).

To see how it works, we use *Figure J-2*. The GSU towers are numbered and marked for cascading, 1–2 and 2–3. There should not be a link between 1 and 3.

The GSU can synchronize the TDD timing of several sites enabling the cascading of consecutive links without mutual interference.

To use cascading, the TDD timing of the even-ordered links (GSU 2 above) must be "shifted" (Shifted Phase) and odd-ordered links (GSU 1 and GSU 3 above) must be "unshifted" (Normal Phase). The phase shift is half of the Radio Frame Duration (RFD) from the chosen RFP. The scheme is shown in *Figure J-3*.

Since the GSU is always HSS master (HSM), at each GSU location, the GSU can "force" the synchronization of its collocated radios. By half RFD shifting, alternate collocated sites can talk to each other.

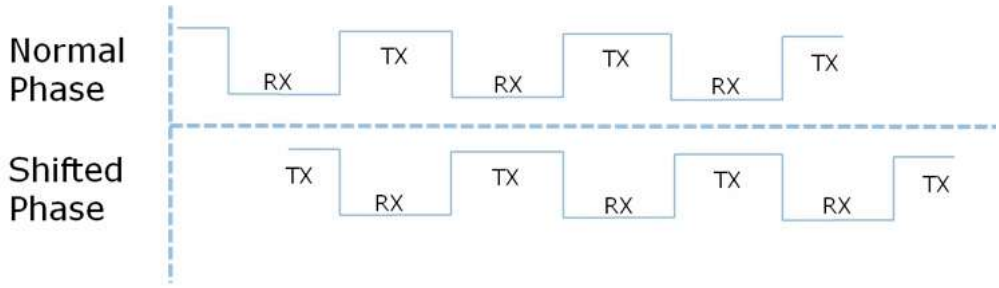


Figure J-3. Phase-Shifted Transmission, Phase Shift is 1/2 the RFD

Choice of normal or shifted phase is configurable per GSU using the Manager.

J.2 GSU Redundancy

The GSU is designed to support redundancy, improving the robustness of a GSU based topology.

In redundancy mode, two GSUs are installed at the same HSS site. One of them self-configures to generate HSS sync signals. We will call it the Primary unit. The other one, the Secondary unit remains dormant merely polling the first GSU. If the Primary GSU fails, then the Secondary GSU becomes active immediately. If the Primary unit becomes active again, it remains dormant, reversing the original roles. The choice of the Primary GSU is random and of no significance.

If the Primary GSU fails, and then the Secondary GSU also fails to receive sync signals from its GPS, then it moves to self-generation HSM mode like an ordinary HSM ODU until its GPS recovers.

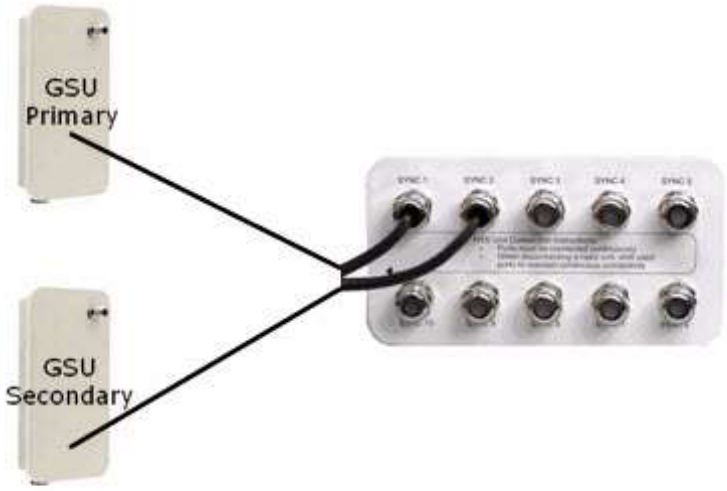


Figure J-4. Connecting Two GSUs to HSSU

J.3 Installing the GSU

Kit Contents

The GSU package includes:

- GSU
- Mounting kit
- GPS antenna
- GPS antenna mounting kit
- RF cable, 1.5m (4.9 ft).

Installing the Unit

Figure J-5 illustrates a typical installation of a GSU.

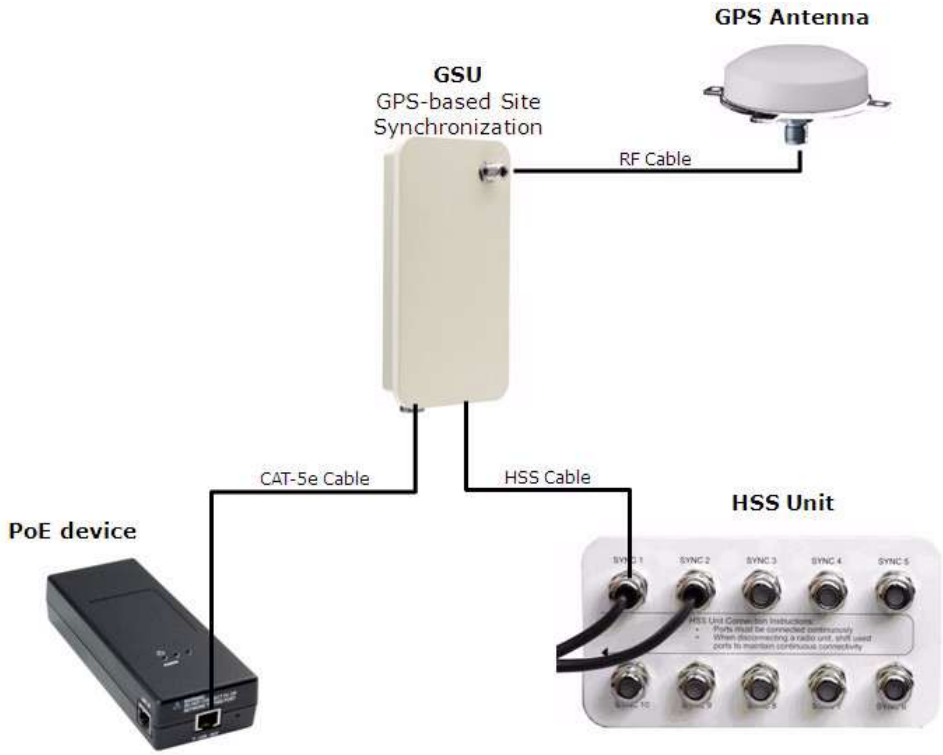


Figure J-5. Typical Installation Diagram

Connecting the GSU

✱ **To connect the GSU:**

1. Mount the GSU and the GPS antenna.
2. Connect the GSU ODU port to PoE device
3. Connect the GSU to the HSS unit.
4. Connect the external LAN port of the PoE device to the managing computer.

Note *If you are accessing the GSU through a network it is essential that you use the IP preloading method. The default IP address may be inaccessible and you may not use the Local Connection method over a network.*

J.4 Configuring the GSU

Use the method described in *Appendix F* to change the IP address from the default (10.0.0.120). In the example screen captures below, we use 192.168.222.20 with subnet mask 255.255.252.0.

✱ **To configure the GSU:**

1. Log in as described in *Chapter 2*.

   The Main window is displayed.

   The main menu is a subset of the main menu applicable to Intrepid. Notice that there are no Installation or Configuration wizards. Such configuration as is necessary is carried out using a modified version of Site Configuration for Intrepid.

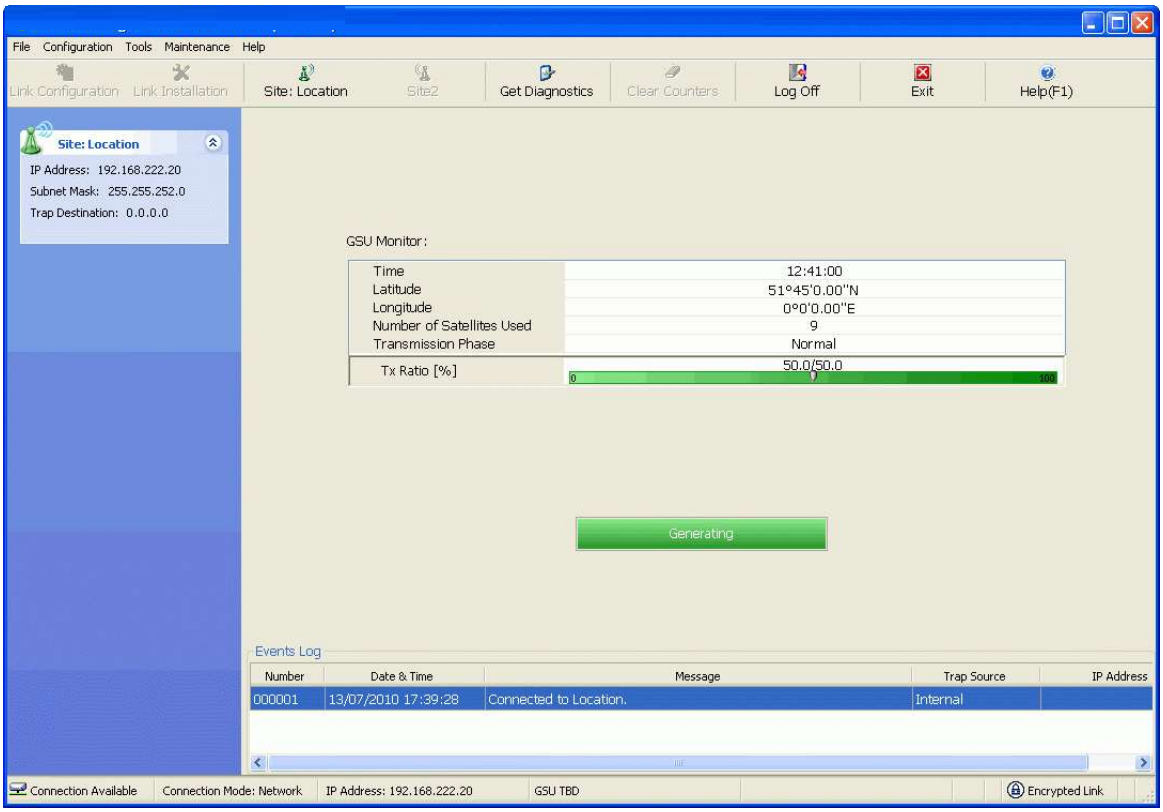


Figure J-6. GSU Main Configuration Window

The top five items in the GSU Monitor panel are taken from a satellite. The transmission Phase may be Normal as shown or Shifted. It purpose, together with the Tx Ratio bar, will be explained below.

Under normal operating conditions, the status box will be green as shown, indicating that it is synchronized with a satellite.

If satellite synchronization is lost, then the GSU will function as an independent HSM and the status box will change color:

2. Display the Site Configuration System dialog box and fill out the necessary fields.

Figure J-7. Site Configuration: System

3. Display the GPS Sync Unit dialog box.

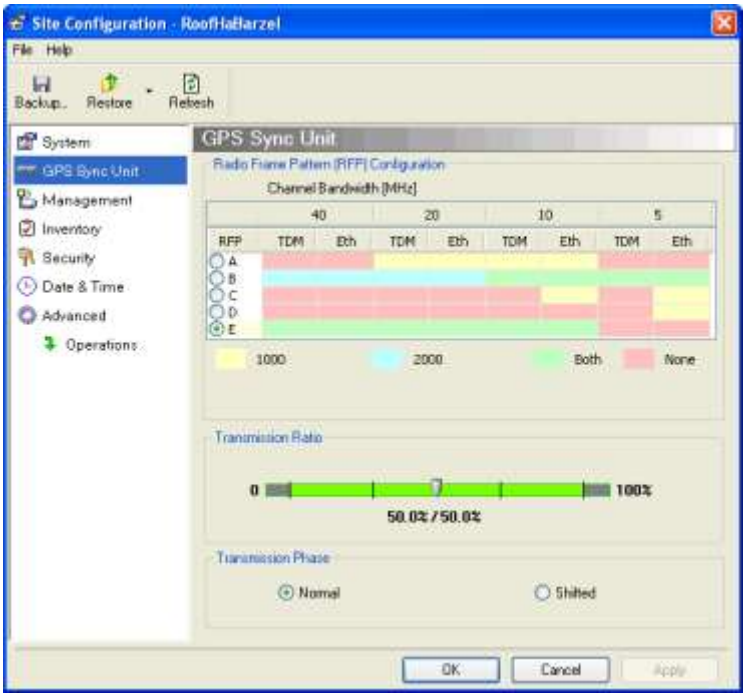


Figure J-8. Site Configuration: GPS Sync Unit

Note *The 1000 and 2000 labels refer to Older Intrepid and GE MDS Intrepid Series Radio respectively.*

4. Configure the RFP for HSS.

   The GSU is automatically configured as HSS Master (HSM).

Note *Ensure that no other collocated ODU is configured as HSM.*

If there are one or more GE MDS Intrepid Series Radios units, you must use RFP B or E.

The permitted RFPs are also dependent on channel bandwidth and are color-coded. Use the RFP/Channel Bandwidth combinations with this color For the following collocated radios:

Older Intrepid only

Newer GE MDS Intrepid Series Radios only

Older Intrepid and GE MDS Intrepid Series Radios together

None (unavailable)

There is a further restriction: If there are two distributed sites transmitting to each other, they must both use the same RFP. This requirement, together with use of shifted transmission phase, ensures that communicating distributed sites to not interfere with each other by transmitting simultaneously.

Two GSU managed sites transmitting with shifted transmission phase and using the same RFP, transmit one half a RFD apart (see *Figure J-3* above).

5. Set the Tx transmission ratio.

   Since the GSU is always HSM, it must be able to cater for hub site GE MDS Intrepid Ultra Series Radios based links. If you use asymmetric allocation, shifted transmission phase becomes unavailable and you cannot "cascade" links.

6. Choose the transmission phase. If you choose shifted phase then the Asymmetric Ratio selector is disabled.

7. Display the Management dialog box and configure the GSU IP address, subnet mask, default gateway and trap destinations.

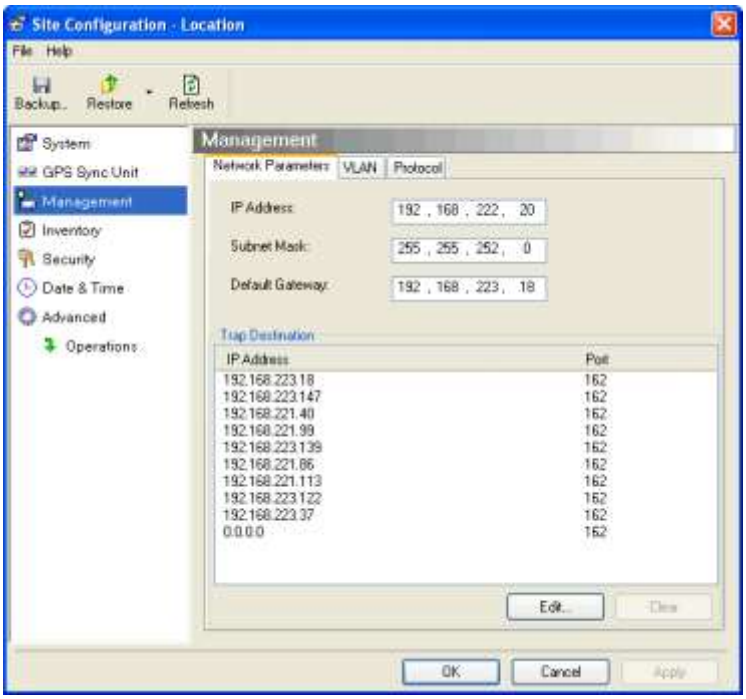


Figure J-9. Site Configuration: Management

8. Choose the units for latitude/longitude coordinates from the GSU tab of the Preferences tab (Advanced > Operations).

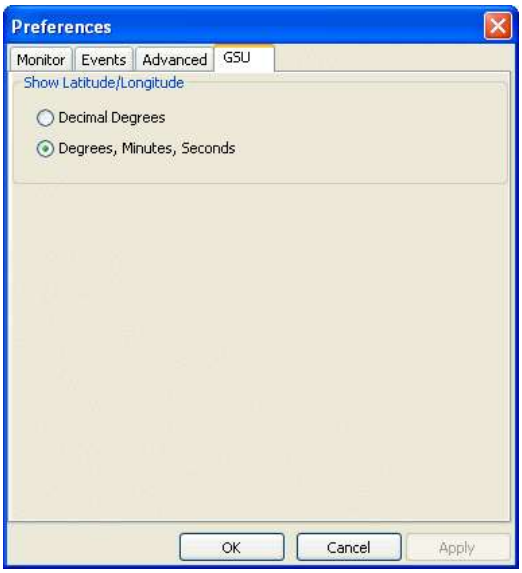


Figure J-10. Site Configuration: Operations, GSU Tab

9. Continue with configuration of the GSU, which is similar to a regular ODU.

IN CASE OF DIFFICULTY...

GE MDS products are designed for long life and trouble-free operation. However, this equipment, as with all electronic equipment, may have an occasional component failure. The following information will assist you in the event that servicing becomes necessary.

TECHNICAL ASSISTANCE

Technical assistance for GE MDS products is available from our Technical Support Department during business hours (8:00 A.M.–5:30 P.M. Eastern Time). When calling, please give the complete model number of the product, along with a description of the trouble/symptom(s) that you are experiencing. In many cases, problems can be resolved over the telephone, without the need for returning the unit to the factory. Please use one of the following means for product assistance:

Phone: 585 241-5510	E-Mail: gemds.techsupport@ge.com
FAX: 585 242-8369	Web: www.gemds.com

FACTORY SERVICE

Component level repair of this equipment is not recommended in the field. Many components are installed using surface mount technology, which requires specialized training and equipment for proper servicing. For this reason, the equipment should be returned to the factory for any PC board repairs. The factory is best equipped to diagnose, repair and align your unit to its proper operating specifications.

If return of the equipment is necessary, you must obtain a Service Request Order (SRO) number. This number helps expedite the repair so that the equipment can be repaired and returned to you as quickly as possible. Please be sure to include the SRO number on the outside of the shipping box, and on any correspondence relating to the repair. No equipment will be accepted for repair without an SRO number.

SRO numbers are issued online at **www.gemds.com/support/product/sro/**. Your number will be issued immediately after the required information is entered. Please be sure to have the model number(s), serial number(s), detailed reason for return, “ship to” address, “bill to” address, and contact name, phone number, and fax number available when requesting an SRO number. A purchase order number or pre-payment will be required for any units that are out of warranty, or for product conversion.

If you prefer, you may contact our Product Services department to obtain an SRO number:

Phone Number: 585-241-5540
Fax Number: 585-242-8400
E-mail Address: productservices@gemds.com

The equipment must be properly packed for return to the factory. The original shipping container and packaging materials should be used whenever possible. All factory returns should be addressed to:

GE MDS, LLC
Product Services Department
(SRO No. XXXX)
175 Science Parkway
Rochester, NY 14620 USA

When repairs have been completed, the equipment will be returned to you by the same shipping method used to send it to the factory. Please specify if you wish to make different shipping arrangements. To inquire about an in-process repair, you may contact our Product Services Group using the telephone, Fax, or e-mail information given above.

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