MRL

Broadband Wireless Transmission

User Manual

Version 1.8

MRL

User Manual

Note

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Information to User

Any changes or modifications of equipment not expressly approved by the manufacturer

could void the user's authority to operate the equipment and the warranty for such equipment.

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Regulatory Compliance

General Note

This system has achieved Type Approval in various countries around the world. This means that the system has been tested against various local technical regulations and found to comply. The frequency bands in which the system operates may be "unlicensed" and in these bands, the system can be used provided it does not cause interference.

FCC - Compliance

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

It is the responsibility of the installer to ensure that when using the outdoor antenna kits in the United States (or where FCC rules apply), only those antennas certified with the product are used. The use of any antenna other than those certified with the product is expressly forbidden in accordance to FCC rules CFR47 part 15.204.

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 void the product warranty and may expose the end user or the service provider to legal and financial liabilities. Resellers or distributors of this equipment are not liable for injury, damage or violation of regulations associated with the installation of outdoor units or antennas. The installer should configure the output power level of antennas according to country regulations and antenna type.

Indoor Units comply with part 15 of the FCC rules. Operation is subject to the following two conditions:

(1) These devices may not cause harmful interference.

(2) These devices must accept any interference received, including interference that may cause undesired operation.

Canadian Emission Requirements for Indoor Units

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numẻrique de la classe B est conforme ả la norme NMB-003 du Canada.

China MII

Operation of the equipment is only allowed under China MII 5.8GHz band regulation configuration with EIRP limited to 33 dBm (2 Watt).

India WPC

Operation of the equipment is only allowed under India WPC GSR-38 for 5.8GHz band regulation configuration.

Unregulated

In countries where the radio is not regulated the equipment can be operated in any regulation configuration, best results will be obtained using Universal regulation configuration.

Brief

Table of Contents

Full

Table of Contents

Chapter 4 Installation and Setup

Chapter 5 Getting Started

Chapter 6 Configuring the Link

List of Figures

List of Tables

MRL

Part 1: Basic Installation

Broadband Wireless Transmission

User Manual

Version 1.8

UM 2000-22/03.09

Chapter 1

Introduction

Welcome to MRL!

MRL's MRL family of wireless broadband products deliver carrier-class performance at the most competitive price.

MRL products pack legacy TDM and Ethernet services over the 2.3 - 2.7 GHz and 4.9 - 6.0 GHz spectrum bands, and comply with worldwide standards and regulations (including FCC and ETSI).

All of MRL's carrier-class MRL products meet the stringent performance and quality demands of cellular carriers and service providers. Delivering high capacity connectivity of up to 48 Mbps at distances of up to 80 Km/50 miles, the MRL products offer an unmatched combination of robustness and reliability at an affordable price.

About Version 1.8

Version 1.8 of MRL brings together incremental changes, fixes and several new features addded to the 1.790 release. For ease of use, changes and additions are marked with a changebar. Completely new appendixes are not. Here are the major changes and additions:

- **DFS Support:**

  This release of MRL adds compliance to the 5.4 FCC/IC requirements. Detailed installation directions are set out in **Appendix J**, which covers the installation of the 5.4 FCC/IC and relates exclusively to this model, replacing substantial portions of **Chapter 4**.

- **Hot Standby:**

  This version further enhances 1.790 with the inclusion of the MRL Hot Standby link backup feature.

  The MRL Hot Standby Link supports up to eight E1 services and is designed to provide high reliability high-capacity Point-to-Point Links. The MRL Hot Standby Link 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

The main features of the MRL Hot Standby Link are –

- Cut-over from the primary to the secondary link completely automatic
- Cut-over time no more than 50 ms
- Automatic restore to primary link as soon as it becomes available
- Supports up to eight TDM channels
- Supports an IDU-C with up to eight E1/T1 ports.

- **Software upgrade in MRL Manager**
- **The IDU-C supports SFP**

  Standard SFP FE modules are supported

Key Applications

MRL's MRL systems are ideally suited to meet the needs of cellular carriers, service providers and private networks (such as private and public enterprises, government, educational and financial institutions).

The MRL systems power a range of applications, among them:

- Cellular Backhaul
- Broadband Access
- Private Network Connectivity
- Video Surveillance

Cellular Backhaul

MRL products enable cellular carriers to expand their networks in both urban and rural areas quickly and cost-effectively.

MRL systems are ideally suited for a broad range of cellular backhaul deployment scenarios; they empower carriers to expand their presence into remote and low ARPU areas, provide enhanced overlay coverage in urban spots, and can serve as a temporary or backup backhaul solution.

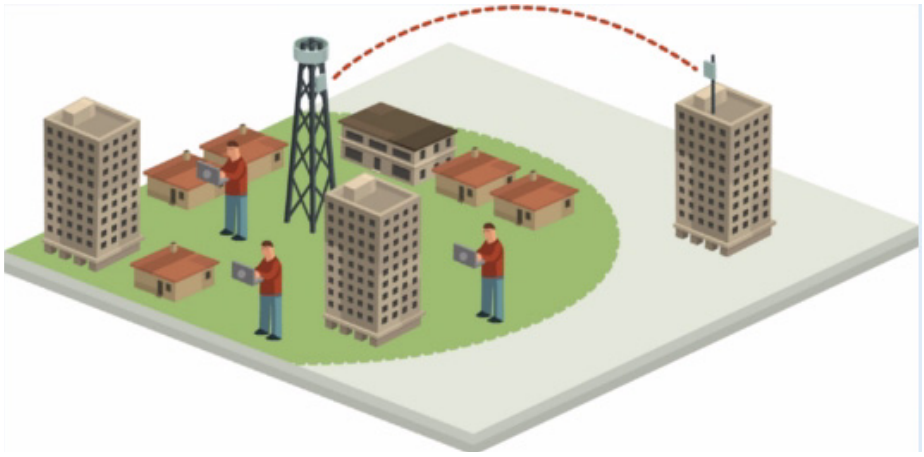


Figure 1-1: Typical Cellular Backhaul Application

Broadband Access

With MRL, service providers can expand their service footprint rapidly and affordably, and provide high-capacity services that match the ever-growing demand for high-quality, high-speed broadband.

MRL is the ideal solution for last mile access, and also powers WiFi backhaul and WMAX backhaul applications.

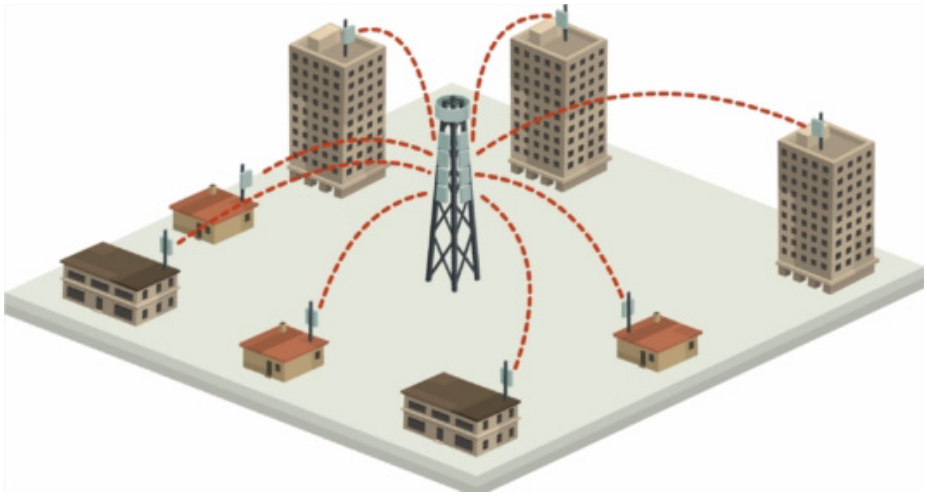


Figure 1-2: Typical Broadband Access Application

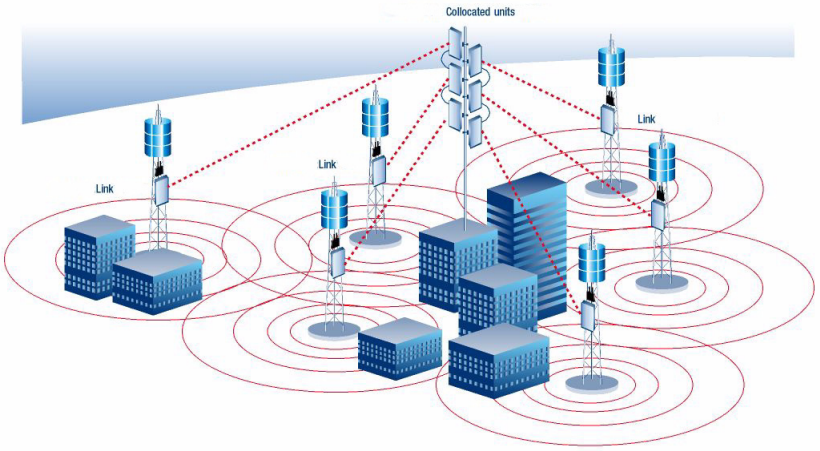


Figure 1-3: Typical WiFi Backhaul Application

Private Networks

MRL is the perfect solution for private networks such as enterprises, education, government and utility organizations that want to own and control their networks and eliminate the high recurring charges for leased lines/ cable. MRL's cost-effective solution enables organizations of all types to connect geographically dispersed buildings at ranges of up to 80 Km/50 miles.

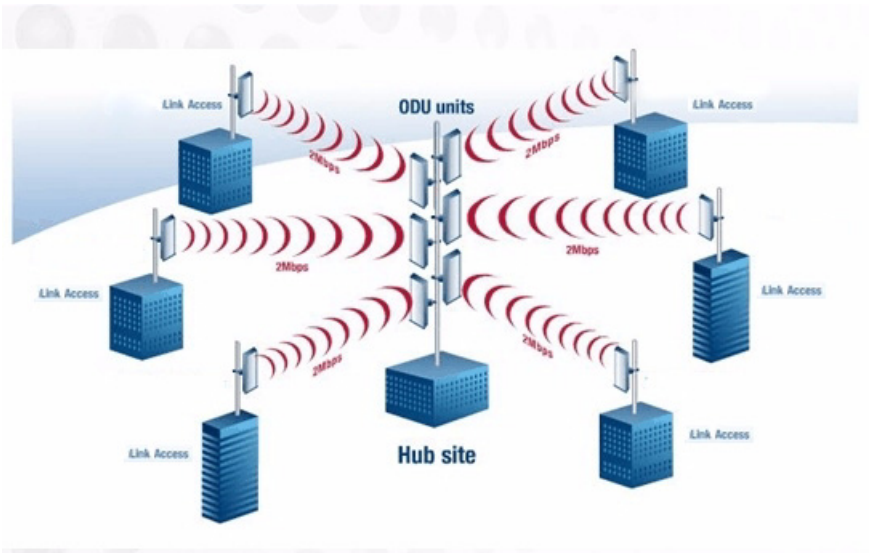


Figure 1-4: Multi Point-to-Point Enterprise Connectivity

Video Surveillance

MRL's MRL wireless broadband systems allow organizations and system integrators to deploy video cameras virtually anywhere while eliminating the costs and installation hassles of wire-based systems. Reliable, robust and affordable, the MRL systems support a variety of transmission topologies

such as Ring, Star and Daisy Chain to provide surveillance coverage of the most challenging environments.

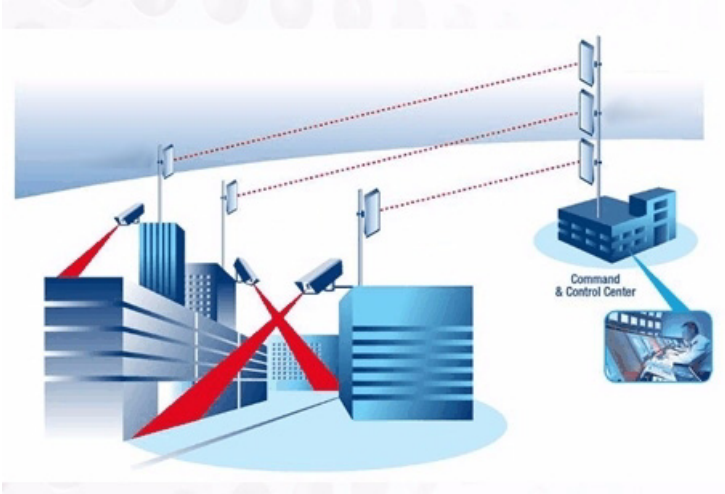


Figure 1-5: Multi Point-to-Point Video Surveillance Deployment

Private Networks

MRL is the ultimate solution for private networks such as enterprises, education, government and utility organizations that wish to own and manage their own networks and eliminate the costly recurring charges from service providers.

MRL's cost-effective solution enables a variety of organizations to connect geographically dispersed sites at ranges of up to 80km (50 miles).

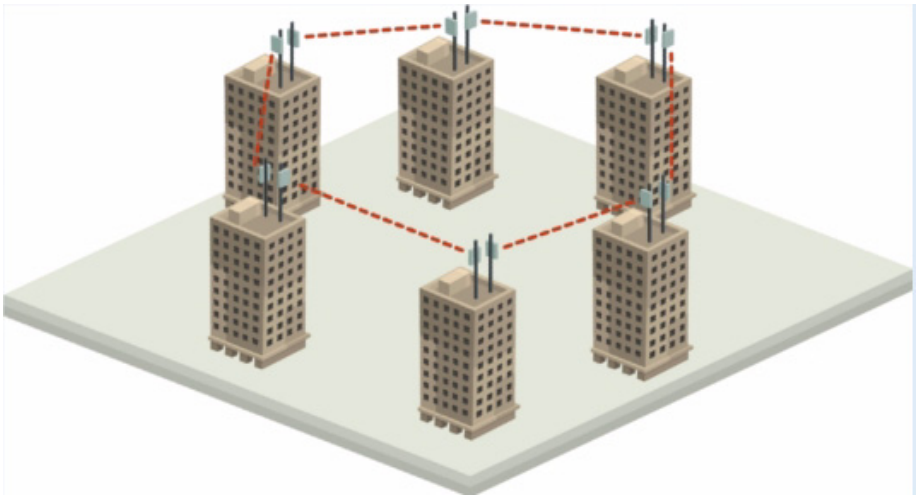


Figure 1-6: Private Network

MRL Key Features

The following represents some of the outstanding features that MRL provides:

TDM + Ethernet in one Solution

MRL systems deliver carrier-class TDM + Ethernet over one platform, making them ideal for a range of backhaul and access applications.

Simple Installation

MRL systems are extremely simple to install and maintain, and are typically up and running in less than an hour.

Advanced Air Interface

The MRL system design incorporates an exceptionally robust air interface based on patented technologies. The unique air interface protocol of MRL is designed to ensure non-stop, high quality transmission, even when encountering interference and harsh conditions.

Automatic Adaptive Rate

Automatic Adaptive Rate is a method of dynamically adapting the transmitted rate by changing both the signal modulation and coding. Automatic Adaptive optimizes the data throughput according to interference conditions, to optimize data throughput while maintaining service quality.

Unique Multi Point-to-Point Deployment

MRL's MRL products can be installed in a unique multi point-to-point architecture. Multiple units are deployed in one hub site location, from where they provide a dedicated, high-capacity connection to each remote site.

This unique concept builds on MRL Hub Site Synchronization (HSS) feature, which synchronizes the transmission of collocated MRL units, thus virtually reducing mutual interference commonly experienced with collocated TDD radios.

Enhanced Air Interface Security

MRL's AES 128-bit key encryption provides enhanced air interface security.

Advanced Management and Performance Monitoring

The MRL Manager software has full local and remote management capabilities. The user-friendly SNMP based management tool provides full end to end configuration, event log, and performance monitoring capabilities.

SFP support in the IDU-C

Standard SFP modules are used, enabling any type of Ethernet physical connectivity including various fiber connections. E3/T3 or E1/T1 over Ethernet SFPs can be used as well.

How to Use this Manual

This manual (MRLUser Manual version 1.8) contains instructions for both setting up and managing the MRL system. The following topics are covered:

- MRL Hardware Installation
- MRL Manager Software Installation
- Controlling and Monitoring the System Using the MRL Manager
- Troubleshooting

It is recommended that you first read the Overview in the next chapter as this provides an understanding of the various parts of the system and how the system works.

Chapter 2

Site Preparation

Planning the Link Site

Overview

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:

1. Preliminary survey - The proposed link is analyzed **in the office** using a topographic map.
2. Physical survey - The locations of the MRL indoor and outdoor equipment are determined **on-site**.
3. 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 MRL installation (**on-site**).

The Site Survey

Introduction

MRL 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.

MRL 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 the MRL.
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 **B** 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 the MRL or using the MRL Manager) to determine the expected performance.

Stage 2: Physical Survey

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

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 **B**).
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.

The IDU - ODU cable length limit is 100m, in accordance with IEEE 10/100BaseT standards.

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 MRL 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 1O ohm.
9. Review the results of the physical site survey. Decide if the site is suitable for the MRL wireless network installation.
   - If the site is suitable, continue with stage 3, the RF survey
   - If the site is not suitable, survey another site

Additional Outdoor Site Requirements

The ambient outdoor operating temperature should be -35 to 60°C (-31 to 140°F).

Additional Indoor Site Requirements

The following requirements guarantee proper operation of the system:

- For IDU-C units, allow at least 90 cm (36 ") of front clearance for operating and maintenance accessibility. Allow at least 10 cm (4 ") clearance at the rear of the unit for signal lines and interface cables
- The ambient operating temperature should be 0 to 50°C (32 to 122 °F) at a humidity of up to 90%, non condensing

Stage 3: RF Survey

The RF survey examines the wireless environment of the MRL installation site, to determine whether there are available channels within the MRL 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.

It is possible to install the MRL link and use the MRL 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.

Chapter 3

Overview

MRL System Components

The MRL point-to-point solution is made up of a number of key components.

Typically, each side of the link comprises an Indoor Unit (IDU), an Outdoor Unit (ODU) and an antenna. A CAT5e cable from the IDU to the ODU provides both Ethernet and Power. The link is managed via the MRL Manager application.

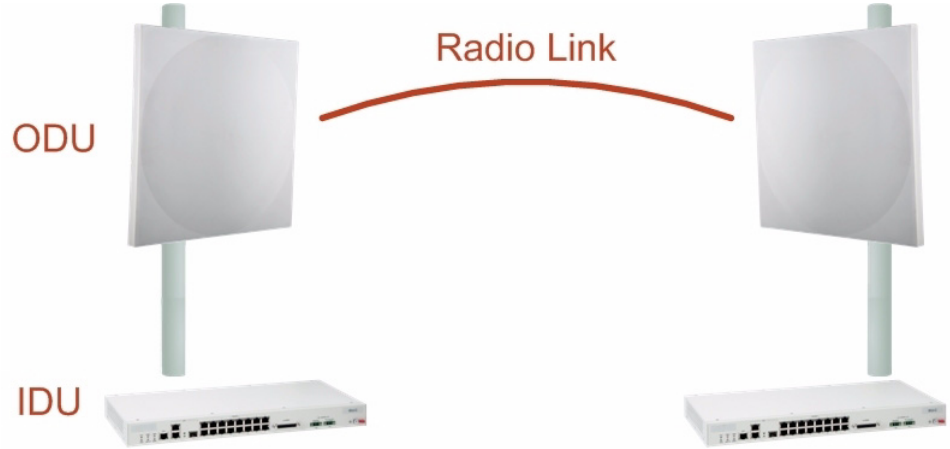


Figure 3-1: Example of Link Architecture

The Indoor Unit (IDU)

The IDU provides TDM and Ethernet ports to connect to the link. It also provides power to the ODU. The IDU is available in four configurations:

IDU-E

A compact, half 19 inch wide, 1U plastic unit, providing up to two Ethernet ports and up to two E1/T1 interfaces.

Figure 3-2: IDU-E Front Panel

Figure 3-3: IDU-E Back Panel

IDU-C

A 19 inch, 1U metal unit, providing two Ethernet ports, 0, 4, 8 or 16xE1/T1 interfaces (1-4 usable), and dry contact connector alarm.

Figure 3-4: IDU-C Front Panel

IDU-R

A compact, half 19 inch, 1U plastic unit for 1 x T1/E1 backup, providing in addition 2 Ethernet ports and an external alarms interface. IDU-R is an indoor unit used for automatic backup of leased lines. IDU-R monitors the status of leased lines, and in the event of a connection failure automatically switches to the radio link. The user configures which of the two links is the main link and which is the backup link.

IDU-R operates with all MRL outdoor units.

Figure 3-5: IDU-R Front Panel

Figure 3-6: IDU-R Back Panel

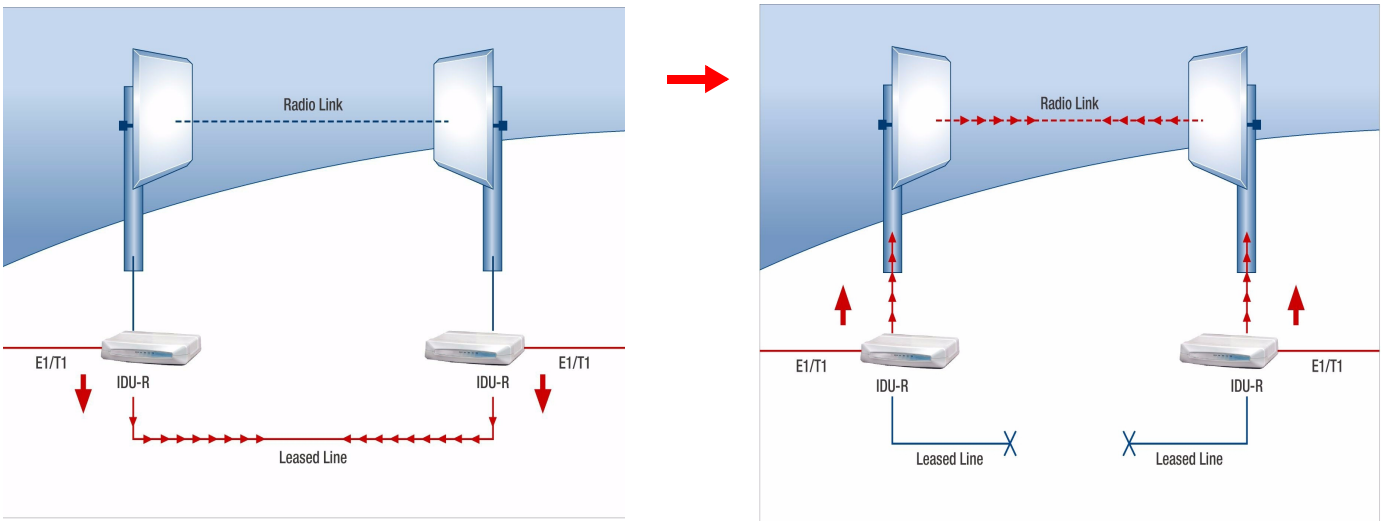


Figure 3-7: Backup link for E1/T1 connections

Power Over Ethernet Units

Power over Ethernet units provide Ethernet services only.

Power over Ethernet (PoE)

An extremely compact device, the Power Over Ethernet (PoE) provides Ethernet only services through one Ethernet port.

Figure 3-8: PoE

Note

The PoE can only be connected to ODU's that are PoE enabled, High End or Access ODU's.

PoE8

A 19 inch, 1U metal unit providing 8 Ethernet ports enabling connection to collocated Ethernet applications.

Figure 3-9: PoE8

O-PoE

Similar to the PoE, with weatherproof casing and sealed connectors that enables outdoor connectivity (a special mounting kit is supplied for attachment to a mast).

Figure 3-10: O-PoE Unit

The Outdoor Unit (ODU)

The ODU is the radio transceiver of the MRL system and is the main component of the system. The ODU connects to an antenna that enables radio communication and can be mounted on a pole or wall. The ODU connects to the IDU via a CAT5e cable.

ODUs are available in different frequencies and regulations in the ranges: 2.3-2.7GHz, 4.9-6GHz.

The ODU comes in two different form factors depending on the type of antenna:

- ODU with integrated 1ft flat panel antenna. This unit contains both the ODU and antenna as a single unit housed in a weatherproof casing.
- ODU with a connector for an external antenna. The unit is fitted with an N-type connector. An external antenna can extend the range of the link, and in some cases, may help to reduce environmental interferences.

Various external antennas are available for the MRL operating frequencies.

Figure 3-11: ODU with integrated antenna

Figure 3-12: Typically used External Antennas

There are three series of ODU's:

- MRL Access
- MRL
- MRL High End

The following table shows the differences between the systems:

Table 3-1: ODU Series Typical Characteristics

	MRL Access	MRL	MRL High End
Max Ethernet Throughput	2Mbps	18Mbps	18Mbps
Max. Range	20Km	80Km	80Km
Supported IDU devices	PoE	PoE and IDU	PoE and IDU
Services	Ethernet	Ethernet and TDM	Ethernet and TDM
HSS	+	-	+
Tx Power	18 dBm	18 dBm	25 dBm

MRL Manager

The MRL Manager is an SNMP based element and link management application which manages a complete link via a single IP address. It identifies the IP Address, Subnet Mask, and Trap Destination for each Site and also moni-

tors the Radio Interface - RSS [dBm] and Ethernet Service - Rx Rate and Tx Rate. The Manager software facilitates the Link installation and Link configuration between the ODU units. The intuitive, easy-to-use Manager has a graphical MS-Windows interface, and can be utilized locally and remotely.

MRL Manager provides:

- Planning tools such as a Link Budget calculator for calculating the expected performance of the MRL wireless link and the possible configurations for a specific link range.
- Installation Wizard
- On-line monitoring of air interface quality allowing the administrator to monitor the service and status of each link.
- On-line monitoring of equipment alarms and QoS
- Local and remote loopback testing
- Configuration settings
- On-line user manual and help files
- Over-the-air software upgrades

The MRL Manager can easily be integrated with any NMS system

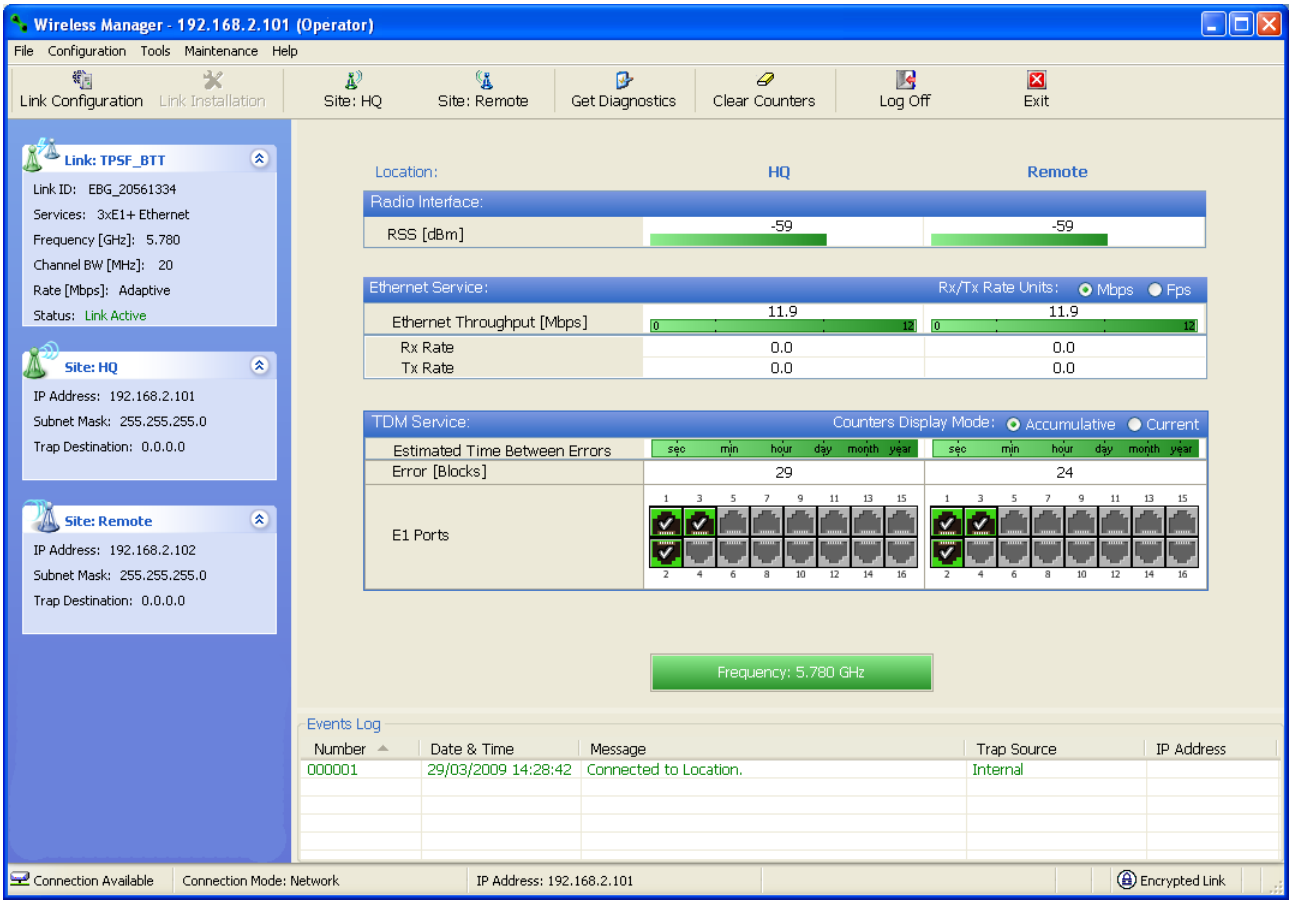


Figure 3-13: MRL Manager screen

(All Indoor Unit) AIND

The AIND - All Indoor unit offers a single enclosure for Radio and Multiplexer modules. It enables outdoor placement of only a passive element.

Figure 3-14: AIND - "All Indoor" unit connected to antenna

Technical Specifications

Air Interface

MRL is available in several different frequency band ranges that comply with ETSI, FCC and IC regulations.

Frequency Bands and Channel Bandwidth

Table 3-2: Configurable Transmission Options

Frequency Bands	5.825-5.875 GHz / 5.805-6.020 GHz			
	5.725-5.845 GHz			
	5.490-5.730 GHz			
	5.140-5.345 GHz			
	4.940-4.990 GHz			
	2.496-2.690 GHz			
	2.400-2.4835 GHz			
	2.300-2.340 GHz / 2.310-2.485 GHz			
Channel Bandwidth	5MHz, 10MHz and 20MHz (5MHz Resolution)			
Transmit Power	Configurable (max: 25dBm)			
Duplex Technique	TDD (Time Division Duplex)			
Sensitivity (dBm) @BER <10e-11 (20MHz)	-87	-84 -80	-79 -73	-66 -62
Rate (Mbps)	9	12 18	24 36	48 54
Modulation@OFDM (Adaptive)	BPSK	QPSK	16QAM	64QAM

Rates and Services Supported

MRL systems offer a variety of channel bandwidths, maximum throughput and supported services.

Table 3-3: Rates and Services Supported

Channel Bandwidth	5 MHz	10 MHz	20 MHz
Maximum Throughput	5.4 Mbps	10.3 Mbps	18 Mbps
Supported Services	1 E1/T1 + Ethernet	2E1s or 4T1s + Ethernet	4 E1/T1 + Ethernet
Ethernet Latency	8 msec	6 msec	3 msec
TDM Latency	8 msec	8 msec	8 msec

Before each installation you must use the Link Budget Calculator (**Appendix B**) to locate the supported rates and services for your particular product.

Regulations

MRL operation complies with the radio and environmental regulations listed in the following tables:

Table 3-4: Radio Regulations

FCC 47CFR	part 15 subparts B&C and E, part 27 and part 90
IC	RSS-210
ETSI	EN 300 328 and EN 301 893 V1.4.1:2007 DFS according to V1.5.1:2008
UK	VNS 2107
Australia	AS/NZS 4771
India	WPC GSR-38

Table 3-5: Environmental Regulations

Safety	EN 60950, IEC 60950, UL 60950, CAN-CSA C22.2 60950
EMC	EN 300 386, EN 301 489, EN 55022, EN 61000, EN 55024, AS/NZS CISPR 22, CAN/CSA-CEI/IEC CISPR 22-02, FCC 47CFR class B part 15 sub-part B
Environmental	IEC 60721 class 4M5 IP67

Ethernet Services

The MRL LAN port provides 10/100BaseT interfaces with auto-negotiation and transparent VLAN support. Traffic handling is provided by a MAC level self learning bridge. Ethernet services include:

- 1 or 2 Ethernet interfaces in the indoor units
- 10/100BaseT with auto-negotiation (IEEE 802.3)
- Layer 2 Ethernet bridge
- Self-learning of up to 2047 MAC addresses (IEEE 802.1Q)
- Support of 1+1 applications (HUB/Bridge selectable mode)
- Up to 18 Mbps symmetrical net throughput
- VLAN transparent
- Latency < 3msec
- Retry mechanism for loss-less connection (Fast ARQ)

TDM (E1/T1) Services

The MRL TDM interface accepts E1 or T1 traffic, supporting unframed operation (E1 and T1) and AMI and B8ZS zero suppression (T1). TDM services include:

- 1 to 4 E1/T1 interfaces in the indoor units
- Standard E1/T1, compliant with ITU-T standards
- Unframed E1/T1
- BER < 1 x 10-11 @ sensitivity threshold
- Accurate clock recovery mechanism (<50 PPB)
- One way delay < 8msec
- Advanced clock configurations
- Configurable Jitter buffer

Technical Specification Summary

Table 3-6: Technical Specification Summary (Sheet 1 of 4)

Air Interface	*Duplexing Method*	Time Division Duplex (TDD)
	Capacity	Configurable up to 48 Mbps
	Modulation	OFDM - BPSK, QPSK, 16QAM, 64QAM
	Channel Resolution	5/10/20 MHz[a]
	Transmitter Power	Up to 25dBm, depending on the product
	Range	Up to 41 km (25.5 miles) Up to 80 km (50 miles) with an external antenna. ACCESS versions up to 20 km.
	Frequency Bands [GHz]	2.3-2.7GHz, 4.9-6GHz.
Antennas	***(see Appendix N, Antenna)***	

Table 3-6: Technical Specification Summary (Sheet 2 of 4)

LAN Interface	*PHY*	Up to 2 10/100BaseT, auto-sensing
	Framing/Coding	IEEE 802.3/U
	Bridging	Self-learning, up to 2048 MAC addresses
	Line Impedance	100
	VLAN Support	Transparent
	Frame Size	1536 bytes max for IDU 1800 bytes max for POE
	Connector	RJ-45
E1 Interface	*Data Rate*	Unframed (transparent) 2.048 Mbps
	Line Code	HDB3
	Connector	RJ-45
	No. of Ports	IDU-E: 1 or 2 IDU-C: 4
T1 Interface	*Data Rate*	Unframed (transparent) 1.544 Mbps
	Line Code	AMI, B8ZS
	Connector	RJ-45
	No. Of Ports	IDU-E: 1 or 2 IDU-C: 4
Indicators	*PWR (green)*	Power status (IDU-E only)
	IDU (green)	IDU-C status
	ODU (green/red)	ODU-to-IDU link status
	LINK (green/red)	Link status
	SERVICE (green/red)	E1/T1 signal status

Table 3-6: Technical Specification Summary (Sheet 3 of 4)

Power	*Source*	IDU-E: 100-240 VAC via external AC/DC converterIDU-C: 100-240 VAC via AC cable -20 to -60 VDC O-PoE: 100-240 VAC via attached (pigtail) AC cable PoE-8: 100-240 VAC via AC cable -20 to -60 VDC Max **Note:** Both AC and DC power sources can be connected simultaneously but only one source will supply the power	
	Power Received bythe ODU	-42 to -60 VDC	
	Power Consumption	ODU plus IDU-E or IDU-E-AL or IDU-R - 10W maxODU plus IDU-C - 14W max AIND - 14 max O-PoE plus ODU - 25W max PoE-8 plus 8 ODU units - 60W max	
	Connector	IDU-E 2-pin IDU-CAC - 3-pin IEC connector DC - 3-pin terminal block	
Alarm Connector	*Connector*	DB-9 female for IDU-C/AIND/PoE-8 DB-25 female for IDU-E-AL/IDU-R	
	Electrical Characteristics	Dry Contact, 30V/2A Max input current, 0.01A at 0.5W (R=5K)	
Sync Connector	*Connector*	RJ-11 for AIND	
Physical	***Outdoor Unit***		ODU with integrated antenna
	Height	24.5 cm / 9.3 in	30.5 cm / 12 in
	Width	13.5 cm / 5.13 in	30.5 cm / 12 in
	Depth	4.0 cm / 1.57 in	5.8 cm / 2.3 in
	Weight	1.0 kg / 2.2 lb	1.5 kg / 3.3 lb
	Indoor Unit	**IDU-E**	**IDU-C/AIND/PoE-8**
	Height	4.5 cm (1.7 in) 1U	4.5 cm (1.7 in) 1U
	Depth	23.5 cm (9.3 in)	29[b] cm (11.5 in)
	Width	16.5 cm (6.7 in)	43 cm (17.7 in)
	Weight	0.5 kg (1.1 lb)	1.5 kg (3.3 lb)

Table 3-6: Technical Specification Summary (Sheet 4 of 4)

Environment	***Outdoor Unit***	
	Enclosure	All-weather case
	Temperature	-35° to 60° C (-31° to 140V F)
	Indoor Unit (IDU-E, IDU-E-AL, IDU-R, and IDU-C)	
	Temperature	-0° to 50° C (32° to 122° F)
	Relative Humidity	Up to 90%, non-condensing
	Indoor Unit (PoE-8)	
	Temperature	-0° to 45° C (32° to 113° F)
	Relative Humidity	Up to 90%, non-condensing
	All Indoor Unit (AIND)	
	Enclosure	IDU-C indoor unit
	Temperature	-35° to 60° C (-31° to 140° F)

a. ETSI systems do not support 5/10. BRS systems Single, Double and Quad
b. The new IDU-C illustrated in this manual is only 21 cm (8.5 in) deep

Chapter 4

Installation and Setup

This section describes the installation, alignment, and setup procedures for a MRL system.

Site Requirements and Prerequisites

For the IDU units, allow at least 90 cm (36 in) of frontal clearance for operating and maintenance accessibility. 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 -45 to 60 C/-49 to 140 F (ODU), or -5 to 45 C/23 to 113 F (IDU) at a relative humidity of up to 90%, non condensing.

Package Contents

The MRL packages include the following items:

ODU package containing:

- ODU
- Mast/Wall mounting kit plus mounting instructions
- CD-ROM [MRL Manager, Installation and Operation Manual, and Link Budget Calculator]
- Self adhesive label showing the MAC address and the alternative community string KEY. Keep this label safe.

IDU-E or IDU-R package containing:

- IDU-E or IDU-R
- AC/DC Converter
- IDU wall-mounting drilling template
- Self adhesive label showing the IDU LED operation
- Spare RJ-45 connector

IDU-C Package containing:

- IDU-C
- For legacy AC modelsl, 110/240 VAC with IEC 60320 socket cable

- For DC model, two 3-prong terminal block connector (green)
- 19" mounting kit
- Spare RJ-45 connector

PoE-8 Package Containing:

- PoE-8
- 110/240 VAC with IEC 60320 socket cable
- 3-prong terminal block connector (green)
- 19" mounting kit
- Spare RJ-45 connector

External antenna (if ordered)

- 1m RF cable
- Mounting kit
- ODU/IDU cable at length ordered (optional)

O-PoE package contains:

- O-PoE
- Mast/Wall mounting kit plus mounting instructions
- Spare RJ-45 connector

The foregoing lists are intended to provide a general package description. MRL reserves the right to make changes from time to time. For any delivered product, the enclosed packing list is binding.

Additional Equipment Required

The following is a list of the equipment required for installing the MRL hardware.

- RJ-45 crimp tool (if pre-assembled ODU/IDU cable is not used)
- Drill (for wall mounting only)
- IDU and ODU 10AWG grounding cables
- O-PoE 10AWG grounding cable
- 13 mm (½) spanner/wrench
- ODU to IDU cable if not ordered (outdoor class, CAT-5e, 4 twisted pairs 24AWG)
- ODU to O-PoE both cables (ETH and PoE) if not ordered (outdoor class, CAT-5e, 4 twisted pairs 24AWG)
- Cable ties
- Laptop running Windows 2000 or Windows XP.

Installation Sequence

The following steps are required to install the MRL system:

1. Install the management program on the network management station/ laptop. see **Installing the MRL Management Software** on page **4-4**

2. Mount the ODU at each site (and antenna if external antenna is used). see **Mounting the ODU** on page **4-4**
3. Connect the ODU to the IDU at both sites. see **Connecting the ODU to the IDU** on page **4-5**
4. Connect the Ground to the IDU, IDU-C, PoE-8 or. **page 4-7**.
5. Connect the power. see **Connecting Power to an IDU** on page **4-8** see **Connecting Power to an O-PoE** on page **4-8**
6. Align the ODU/antennas. see page **4-8**.
7. Run the Installation wizard from the management program.see page **4-10**.
8. Connect user equipment to the local and remote IDUs. see page **4-13**.

The following diagram illustrates a typical installation of MRL radio site with an external antenna. It may be viewed as generic for all MRL radio products.

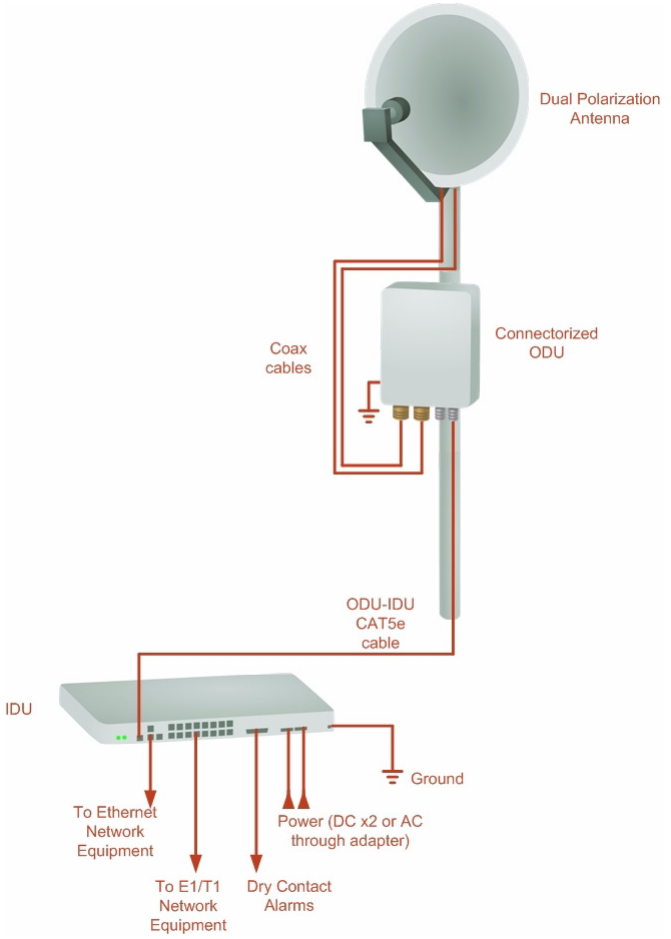


Figure 4-1: Typical Installation Diagram (with external antenna)

The installation steps are detailed in the following sections.

Installing the MRL Management Software

Minimum System Requirements

The MRL Manager application is distributed on a CD. Operating system specific PC resources required by the application are set out in **table 4-1** below:

Table 4-1: PC Requirements for the MRL Manager Application

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

Requirements common to all systems are:

- Hard disk: 1 GB free space
- Network: 10/100BaseT NIC
- Graphics: 1024x768 screen resolution with 16 bit color
- Microsoft Explorer version 5.01 or later

Installing the Software

➢ **To install the MRL management program:**

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

   The MRL Installation starts automatically.

2. Follow the on-screen instructions of the installation wizard to complete setup of the MRL Management program in the desired location.

Any PC running the MRL management application can be used to configure MRL units.

Mounting the ODU

The ODU is the transceiver element of the MRL system. The ODU can be mounted on a mast or a wall. In both installations, the supplied mounting kit is used to secure the ODU.

Appendix A, **Mast and Wall Installation** describes the mast/wall installation instructions.

A MRL link operates in pairs of two ODUs with the same configuration. Both ODUs must be installed, and the antennas aligned for maximum throughput.

➢ **To mount the ODU:**

1. Verify that the ODU mounting brackets are properly grounded.
2. Mount the ODU onto the mast or wall. Ensure that the unit is oriented so that the cable connectors are at the bottom. (If they are on top, water

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 mast. For grounding the O-PoE, connect the grounding cable from the dedicated earth terminal (screw at the side of the enclosure) to an external protective ground conductor or to a grounded mast.

Warning

Only a qualified person using the proper safety equipment should climb the antenna mast. Only trained professional installers should be used when installing or dismantling ODUs and masts.

may penetrate into the unit causing damage.) Refer to **Appendix A**, **Mast and Wall Installation** for the ODU or O-PoE mounting instructions.

3. Connect the ground cable to the chassis point on the ODU.
4. Attach the ODU-IDU cable to the ODU RJ-45 connector. If making own ODU-IDU cable, refer to **Appendix L**, **Wiring Specifications** for the connector pin-out.
5. Screw in the cable glands to ensure hermetic sealing of the ODU.
6. Secure the cable to the mast or brackets using UV-rated cable ties.
7. Repeat the procedure at the remote site.

Do not tightly secure the ODU to its mounting brackets until the alignment process of the antenna is complete.

Note

When installing the ODU, check that there are no direct obstructions in front of the ODU or interference from man-made obstacles.

For O-PoE UL Listed parts and components must be used for installation. Use UL listed devices having an environmental rating equal to or better than the enclosure rating to close all unfilled openings.

Caution

Connecting the ODU to the IDU

The ODU-IDU cable conducts all the user traffic between the IDU and the ODU. The ODU-IDU cable also provides -48 VDC supply and Ethernet to the ODU. The maximum length for one leg of the ODU-IDU cable is 100m (328 ft) in accordance with 10/100BaseT standards. When using an O-PoE or PoE-8, the maximum length for two legs of the O-PoE or PoE-8 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. If the ODU-IDU cable was not ordered, use

Cat. 5e 24AWG shielded cable. Wiring specifications are given in **Appendix L, Wiring Specifications**.

➢ To connect the ODU to the IDU:

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

The figures below illustrate typical IDU panels. You may have differences in your panels depending on the hardware ordered.

Figure 4-2: Typical IDU-E Rear Panel

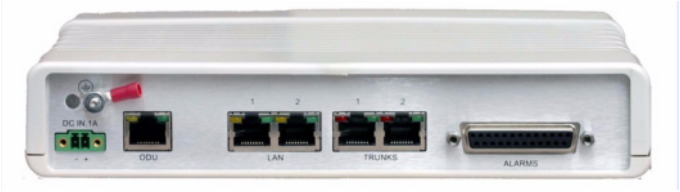


Figure 4-3: IDU-R Rear Panel

Figure 4-4: IDU-C

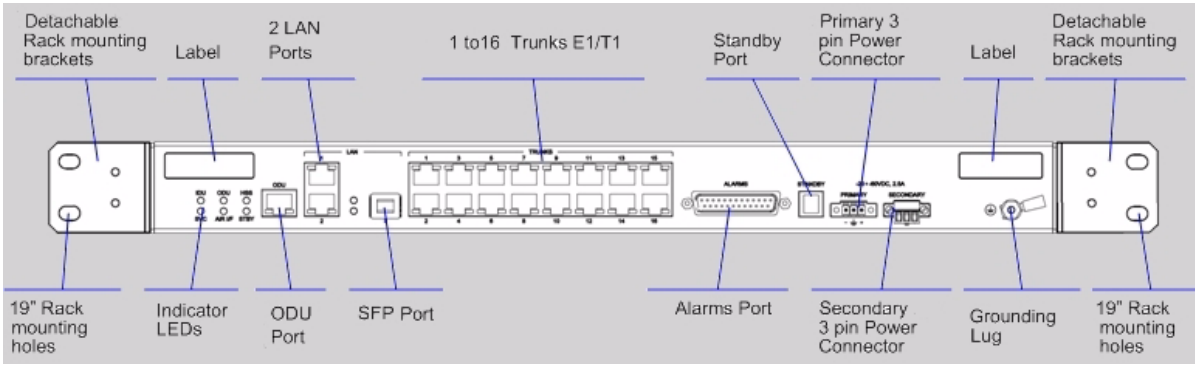


Figure 4-5: Typical IDU-C Front Panel

Figure 4-6: AIND All Indoor Radio Unit

Figure 4-7: PoE-8 Unit

Figure 4-8: O-PoE Unit

Note

Panels may be fitted with different connector combinations than shown, depending on the model ordered.

IDU-R Installation

Installation of an IDU-R unit differs from other IDU models in one respect: At the rear of the IDU-R (see **Figure 4-7:** above) there are two jacks labeled "Trunks". For each IDU-R, the E1 cable from outside should be plugged into one of the trunks, and the E1 cable to the other station should be plugged into the second trunk, as in the left hand side of **Figure 4-8:** above.

Apart from the above difference, the link installation including the remaining part of the IDU installation and connection to the ODU proceeds as described as above.

Connecting the Ground to the IDU

Connect an 18AWG grounding cable to the grounding terminal of the device. The device should be permanently connected to the ground.

Connecting Power to an IDU

AC power is supplied to the MRL IDU through a standard IEC 60320 connector.

AC power should be supplied via a 1.5m (5 ft) standard power cable terminated by a IEC 60320 socket. A cable is provided with the unit.

To connect AC power to an IDU:

1. Connect the power cable socket to the power connector on the MRL front panel.
2. Connect the power cable plug to the mains outlet.

   The unit turns on automatically upon connection to the mains power.

To connect DC power to an IDU:

- A special 3-prong socket for DC power connection is supplied with the unit.

Connecting Power to an O-PoE

AC power is supplied to the O-PoE via a 3m (10 ft) 3 wire AC cable attached to the unit (pigtail). The AC cable is provided with no termination.

To connect AC power to an O-PoE:

- Connect the power cable to a protected/shielded AC mains outlet.

The AC mains outlet should be provided with circuit breaker rated 5A according to the local national electrical code.

The unit will be turned on automatically upon connection to the mains.

To maintain Overvoltage (Installation) Category II, install a suitable surge suppressor device in the branch circuit to limit expected transients to Overvoltage Category II values.

The limits are based on IEC60664 and are also located in Table 2H of UL60950 (for mains≤ 150V, the transient rating is 1500V; for 150V < mains ≤ 300V, the transient rating is 2500V; for 300V < mains ≤ 600V, the transient rating is 4000V).

Aligning Antennas with the Beeper

You may perform the antenna alignment using the ODU's audible tone.

The method is **not** suitable for the following models:

Model	See Reference
BRS	**Appendix I**

Model	See Reference
5.4 FCC/IC	**Appendix J**
AIND	**Appendix G**

To speed up the installation time, alignment of a MRL system should be performed by two teams simultaneously, at site A and at site B.

To align the ODUs using the alignment tone:

1. Verify that power is connected to the IDUs at both sites.

Warning

Do not stand in front of a live ODU.

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.

2. Verify normal operation of the IDU by the LED indications on the front panel. see **IDU Front Panel Indicators** on page **5-1**
3. Direct the antenna of site B in the direction of the site A. This is simplified if a previous site survey has been completed and azimuths are known.
4. Make an azimuth sweep of 180 degrees with the site A ODU so that the strongest signal from site B can be detected.
5. Slowly turning the site A ODU back towards the position of Site B, listen to the tone until the best signal is reached. See the following figure for audible signal variations.

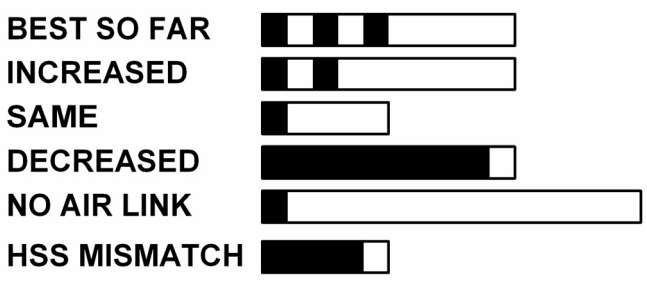


Figure 4-9: Beeper Sequence for ODU Alignment

Three beeps and a pause is the best signal

Note

Two beeps and a pause, signal quality increased

One beep and pause is no signal change

Any other signal detects no signal between ODUs.

6. Secure the site A ODU to the mast/wall.

7. At site B, adjust the ODU slowly whilst listening to the beeper sequence until the best signal is attained.
8. Secure the site B ODU to the mast/wall.
9. Monitor the link quality for about 15 minutes to verify stability.

Installing the Link

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

- see **Appendix H, Hub Site Synchronization** for HSS screens.
- see **Appendix J, 5.4 FCC/IC Installation Procedure**

To install the link:

1. Verify that there is IP connectivity between the management station/laptop and the IDU, and that theMRL Manager application is running.
2. With BRS systems you need to activate the link at both sites. See **Appendix I, BRS Installation Procedure** for method. Once the link is activated, continue installation from this point.
3. In the toolbar, click the Link Installation button. The Link Installation button is only accessible if antennas are aligned. Align antennas if this box is "grayed out".

   The Installation wizard opens:

Figure 4-10: Link Installation Wizard

4. Click Next to proceed with the installation procedure.

   The system dialog box opens:

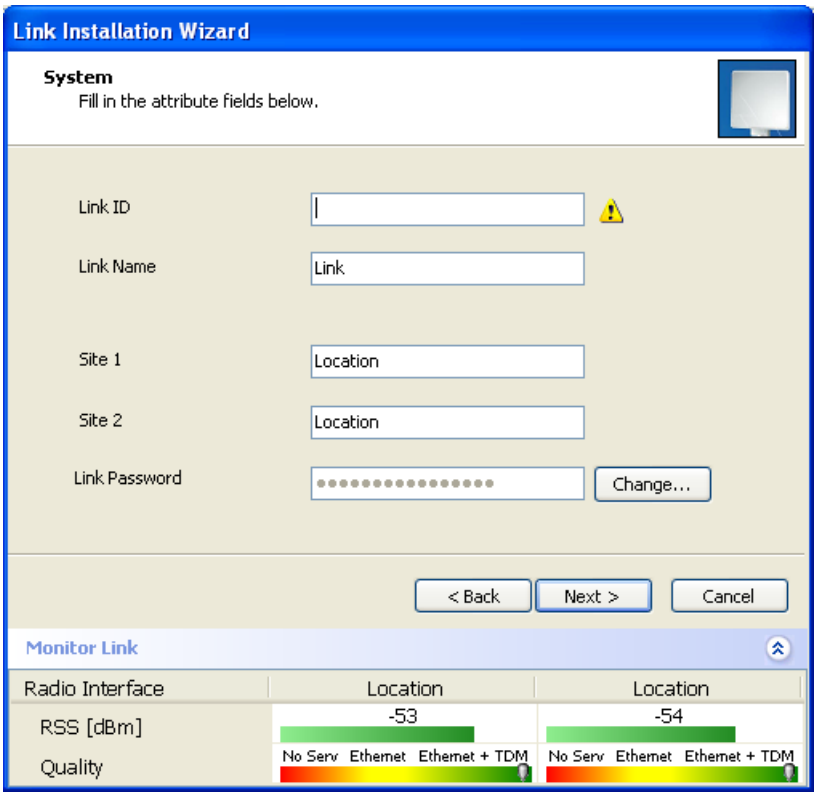


Figure 4-11: : Installation Wizard, System dialog box

5. Enter a Link Name (formerly SSID, must be unique for each link in the area). The Link Name must include at least eight alphanumeric characters. Up to 24 characters are allowed.You should use an Link Name composed of both alphabetic and numeric characters.

Note

Both sides of a link must have the same Link Name number for data transmission to take place.

6. Enter a Link Name for the link identification.
7. Enter a name for site 1 (the site to which your laptop is connected).
8. Enter a name for site 2 (remote site).
9. Optionally enter a new Link Password (version 1.400 and after). see **Changing the Link Password** on page **8-2** for details on the Link Password.

Note

If the Link Password is incorrect a link is established but configuration cannot be performed and no services are available. A new link password may be obtained from Technical Support or use the alternative password supplied with the product. see **Changing the Link Password** on page **8-2** for more details.

10.Click Next.

The default link with a rate of 9 Mbps is evaluated.

The Channel Setting dialog box appears. This dialog box may be different according to the version that you have purchased.

Changing the Link Password

The default password is Wireless-Bridge. Optionally, you can change the link password as explained here.

To change the Link password:

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

   The Change Link Password dialog box opens.

Note

Use the Hide Characters check box for maximum security

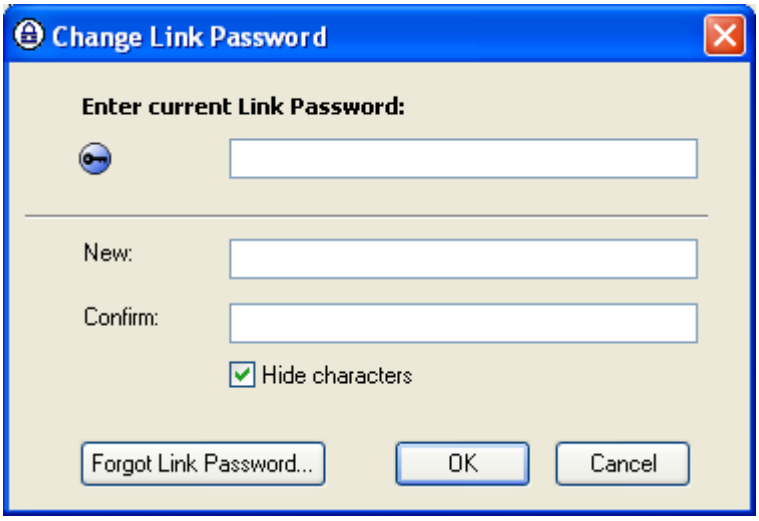


Figure 4-12: Change Link Password dialog box

2. Enter the default link password wireless-bridge.
3. Enter a new password.
4. Retype the new password in the confirm field.
5. Click **OK**.
6. Click **Yes** when asked if you want to change the link password.
7. Click **OK** at the successful message.

Note

Restoring Factory Defaults returns the Link Password to wireless-bridge.

Connecting the User Equipment

The IDU is a standalone desktop, wall-mounted, or rack-installed unit. See figures **4-4** and **4-5** forthe front panel of the IDU-C.

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

1. Connect user E1/T1 traffic to the IDU panel RJ-45 port designated TRUNK. There may be multiple Trunk ports available depending on unit ordered. Refer to **Appendix L**, **Wiring Specifications**, for the connector pinout.
2. Connect user hub/router or any other compatible device to the IDU panel RJ-45 port designated LAN. There may be multiple LAN ports available for connecting to different LANs depending on the IDU unit ordered.
3. Refer to **Appendix L**, **Wiring Specifications** for the connector pinout.

Use a straight cable for router connection.

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

Selecting Channels

MRL systems later than version 1.300 have a feature called Automatic Channel Select, which allows you to define several alternative frequency channels if interference is detected on the channel in use.

For the ETSI version, skip to **page 4-15**; for the BRS version, skip to **page 4-16**; for the 5.4 FCC/IC version skip to **Appendix J**.

MRL with Automatic Channel Select

Automatic Channel Select (ACS) gives MRL the ability to change frequency channels automatically if interference is detected on the current operating channel.

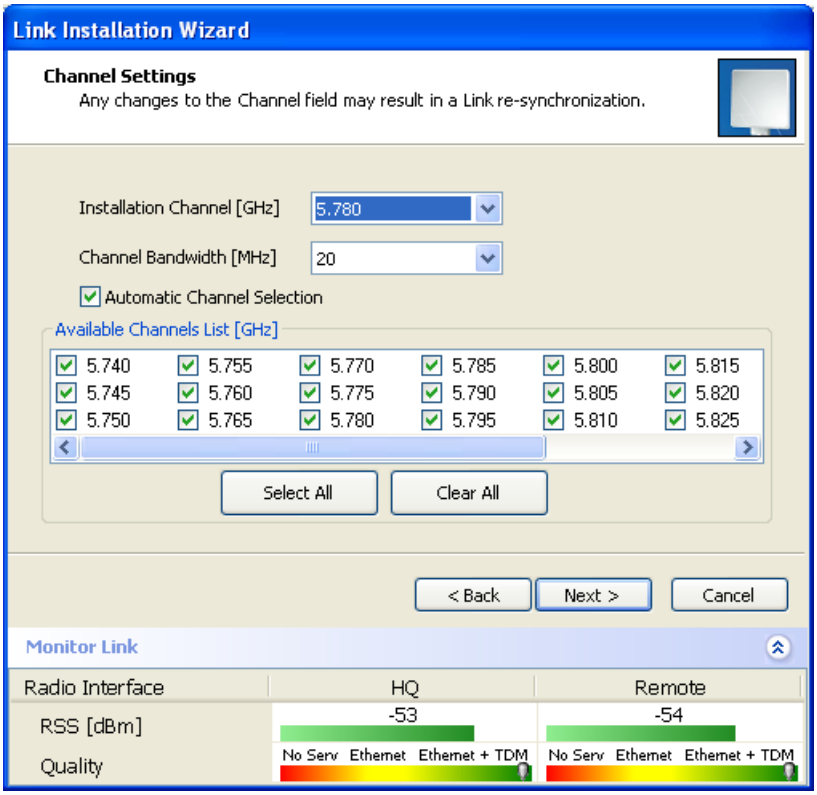


Figure 4-13: Channel Select dialog box - Automatic Channel Select

To select channels to be used by the link:

1. Select the main frequency from the Installation Channel menu.
2. Select the required Channel Bandwidth 5, 10, or 20 MHz. Default is 20 MHz.

   When changing the channel bandwidth, the MRL Manager repeats evaluation of the link.
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.

   Selecting a new channel causes the system quality to change. The quality bar shows the adjustment until the system finds the best quality link.

	Quality	Service
0.1% - 0.4%	80-99%	TDM + Ethernet
0.4% - 2.0%	77- 56%	Ethernet
2.0% - 50.0%	44 - 2%	Antenna Alignment or replace Channel

5. If you are not satisfied with the channel that is selected automatically, click Reselect Channel.

   A new channel is selected from one of the Available Channels that has been defined.

6. Click **Next**.

   The Evaluating Rate box appears. When the optimum rate for the link is selected the Service Parameters dialog box opens. Skip to page 4-17to set the Service parameters.

Any changes to the frequency settings cause the link to re-synchronize. A short loss of service will occur during re-synchronization.

MRL 5.4 GHz ETSI Version

In accordance with ETSI, if MRL detects Radar interference it changes the frequency channel automatically. This feature is termed Dynamic Frequency Selection (DFS). In this version, the Automatic Channel Selection is selected by default and a minimum of two channels must be defined as available.

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

1. Select the main frequency from the Operating Channel menu.
2. Select the Bandwidth required.

Automatic Channel Selection is selected by default.

3. Click at least two check boxes in the Available Channels List of all the allowable channels that can be automatically selected.

Installation will not continue until at least two channels are defined.

   Selecting a new channel causes the system quality to change. The quality bar shows the adjustment until the system finds the best quality link.

   Any channel selected is evaluated for 60 seconds; therefore this selection process may take a few minutes.

4. 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 has been defined.

5. Click Next.

   The Evaluating Rate box appears. The optimum rate for the link is selected.

   The Service Parameters dialog box opens. Proceed to page 3-40.

MRL™ BRS Version

Note

Both sites in a BRS Link must be configured identically.

To Configure BRS Channel Settings:

1. Set the Band Plan.
2. Select the Bandwidth required,

   Single Band (5 MHz)

   Double Band (10 MHz)

   Quad Band (20MHz)
3. Select the Frequency from the pull-down menu.
4. Click Next. The system is re-synchronized to the changes.

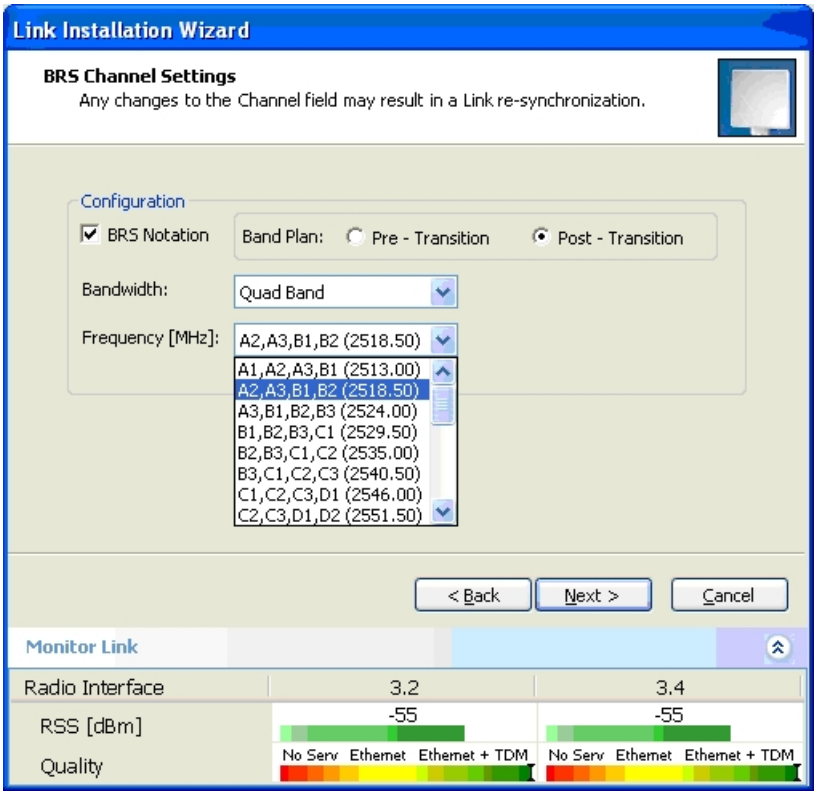


Figure 4-14: BRS Channel Settings Post-Transition

MRL™ 5.4 FCC/IC Version

See **Appendix J** for complete installation details.

Selecting the Service Parameters

You define the type of service required, Ethernet Only or Ethernet with TDM in the Services screen as shown below. Notice that the Distance between the sites automatically appears in the Distance box (from Version 1.600).

Note

MRL ACCESS versions are Ethernet Only.

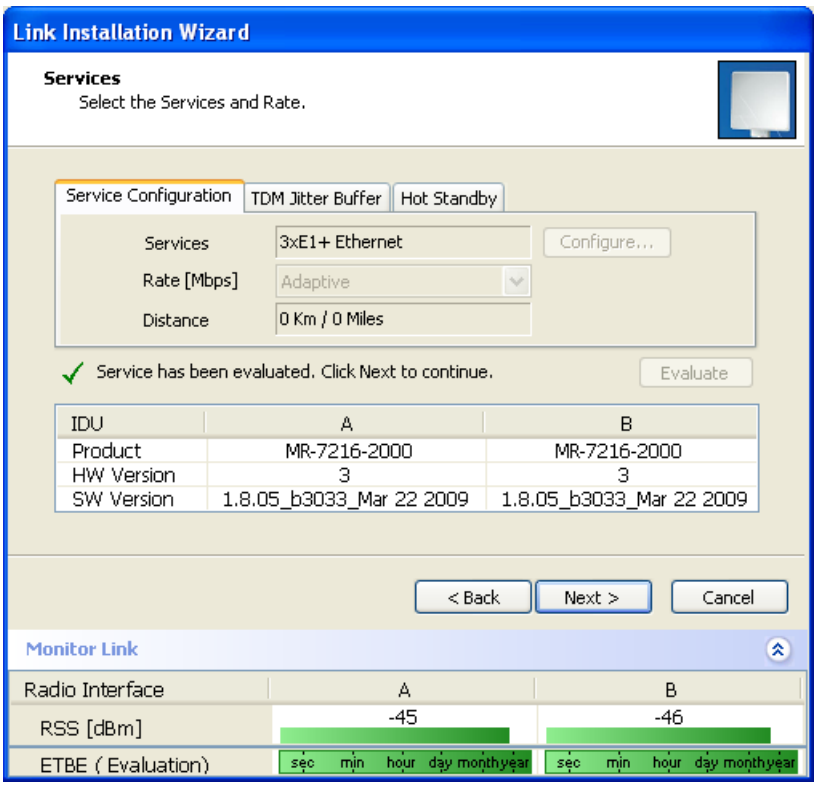


Figure 4-15: Installation Wizard, Service dialog box

To select E1/T1 services and rates:

1. If you are using Ethernet only, skip to step **5.** below.
2. In the Services box click Configure to select a service. The service selection dialog is displayed:

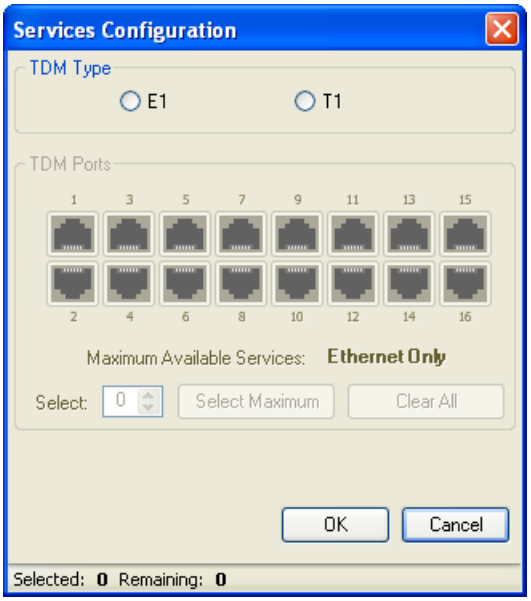


Figure 4-16: Services Section dialog

3. Choose E1 or T1. We show E1 first:

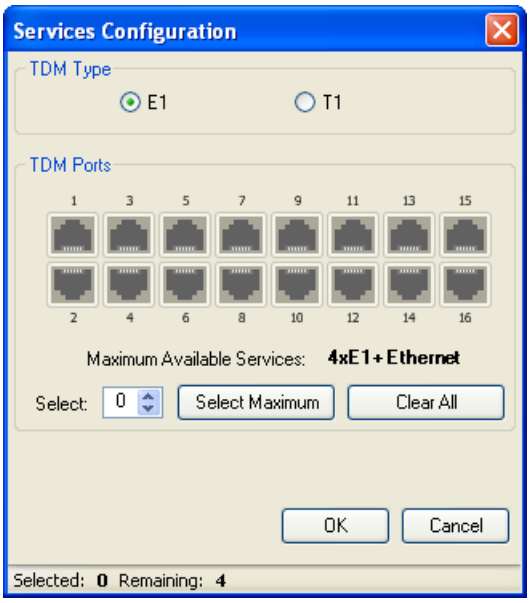


Figure 4-17: Number of services (E1)

4. Choose the required services either by clicking the ports to be used, the selector wheel or the Select Maximum button. The selected borts are colored blue:

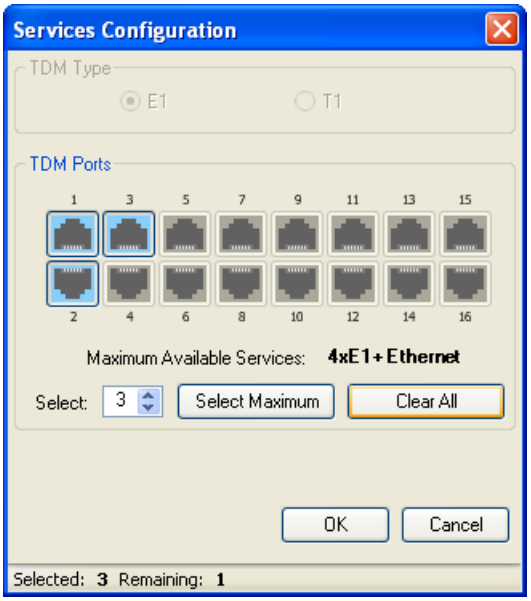


Figure 4-18: Services selected

Click OK to see the results of your choice:

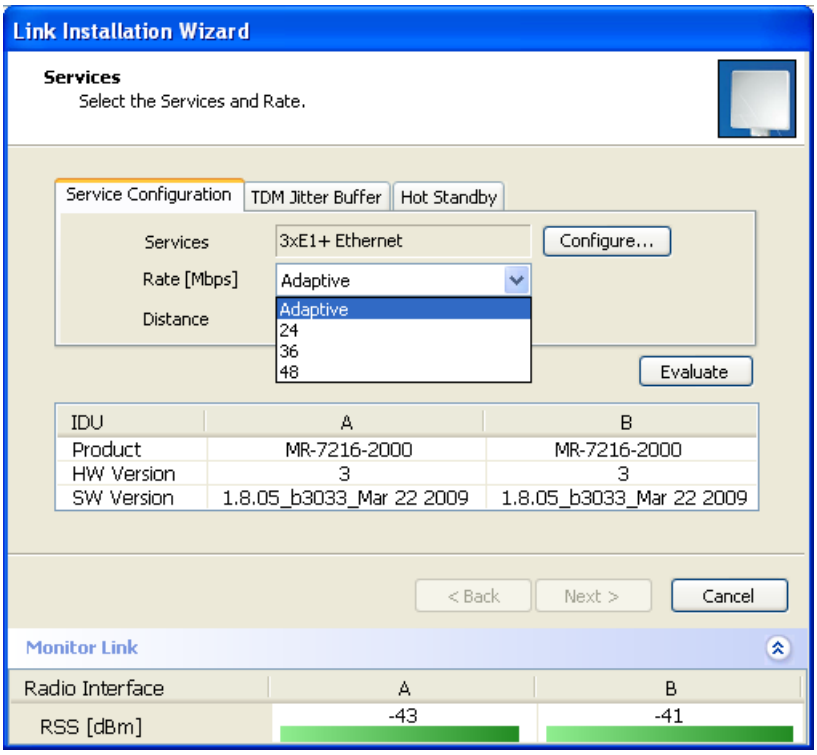


Figure 4-19: Results of service selection with rates displayed for next step

Note

The available bandwidth depends on the number of E1/T1 ports selected.

5. In the Rate box, select the required transmission rate.

   If Adaptive is selected (refer to **page 1-6** for information about Automatic Adaptive Rate), MRL constantly monitors and adjusts the transmis-

sion rate to ensure maximum throughput for the link at the highest quality. ACCESS versions are preset to adaptive and the rate selection is disabled.

6. Click the **Evaluate** button. The optimum transmission rate for the selected services is evaluated. **Figure 4-2** shows the rates used by MRL.
7. Click **Next**.

   If TDM services were selected, then the first of two TDM parameters dialog boxes appears(**Figure 4-16**).

ACCESS versions do not have TDM services. Instead, ACCESS versions operate at a default rate of 2 Mbps.

If Ethernet Only was selected, then the Finish screen appears (see **figure 4-25, Installation Wizard, Finish Screen**) showing a summary of the link configuration, the alignment is complete.

Table 4-2: Rates per Bandwidth

Modulation/FEC	5 MHz	10 MHz	20 MHz
BPSK / ¾	2.25 Mbps	4.5 Mbps	9 Mbps
QPSK / ½	3 Mbps	6 Mbps	12 Mbps
QPSK / ¾	4.5 Mbps	9 Mbps	18 Mbps
16QAM / ½	6 Mbps	12 Mbps	24 Mbps
16QAM / ¾	9 Mbps	18 Mbps	36 Mbps
64QAM / 2/3	12 Mbps	24 Mbps	48 Mbps
64QAM / ¾	13.5 Mbps	27 Mbps	

Setting the Clock Configuration

If TDM services are selected then the TDM parameters dialog box appears. (TDM is not relevant in MRL ACCESS versions.)

The TDM Parameters dialog box contains five working modes; select the appropriate clock mode according to your application. Choosing one of these modes sets the TDM clock behavior on both sides of the link. The user equipment must be configured as described in the following table.

Table 4-3: TDM Clock Modes

	Unit Clock Mode		User Equipment Side	
	Local Unit	**Remote Unit**	**HQ side**	**Branch side**
1	Transparent	Transparent	Internal/Recover	Internal/Recover
2	Loop Time	Recover	Internal	Recover
3	Recover	Loop Time	Recover	Internal
4	Internal	Recover	Recover	Recover
5	Recover	Internal	Recover	Recover

Transparent/Transparent

MRL transparently regenerates the clock from line clock side to Tx clock on the opposite side of the link.

Loop time/Recover

The local unit receive clock is the transmit clock on both sides of the link.

Recover/Loop time

The remote unit receive clock is the transmit clock on both sides.

Internal/Recover

The local unit internal oscillator generates the clock while the remote unit recovers this clock.

Recover/Internal

The remote unit internal oscillator generates the clock while the local unit recovers this clock

The Line code option is used with T1 Systems.

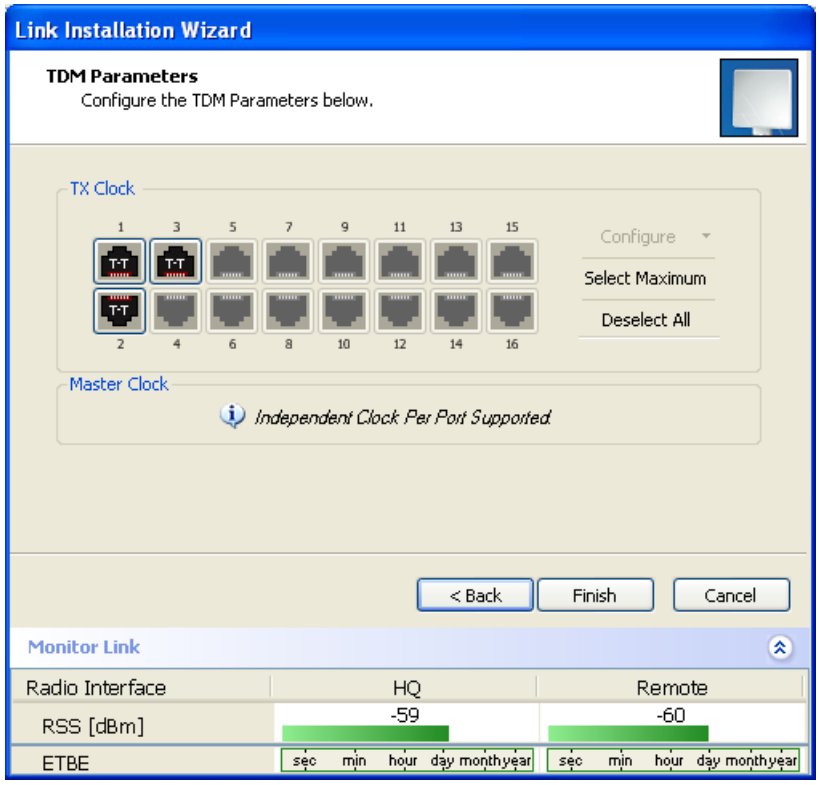


Figure 4-20: TDM Parameters dialog box

Note

This dialog box is available with IDU-E and IDU-C units; it is activated after TDM service is chosen in the previous Service dialog box. In Ethernet only services, the TDM dialog box does not appear.

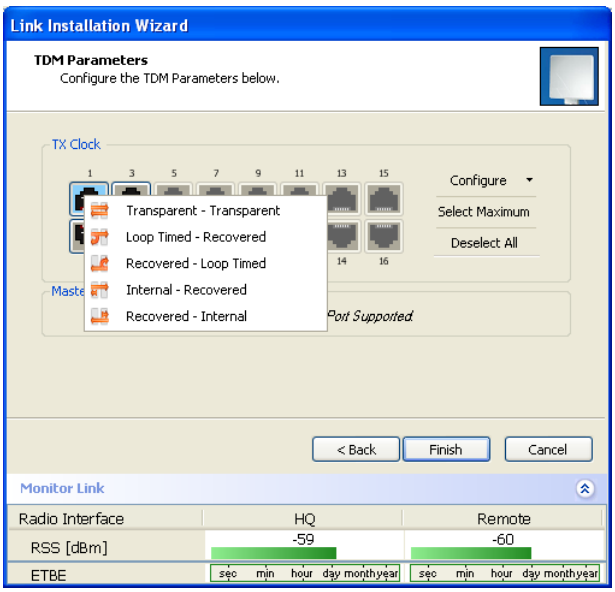


Figure 4-21: Defining the service types

Setting the T1 Line Code

If you are using T1 services, the windows of **Figure 4-20** and **Figure 4-21**are slightlt different. Here is the T1 equivalent of **Figure 4-20**:

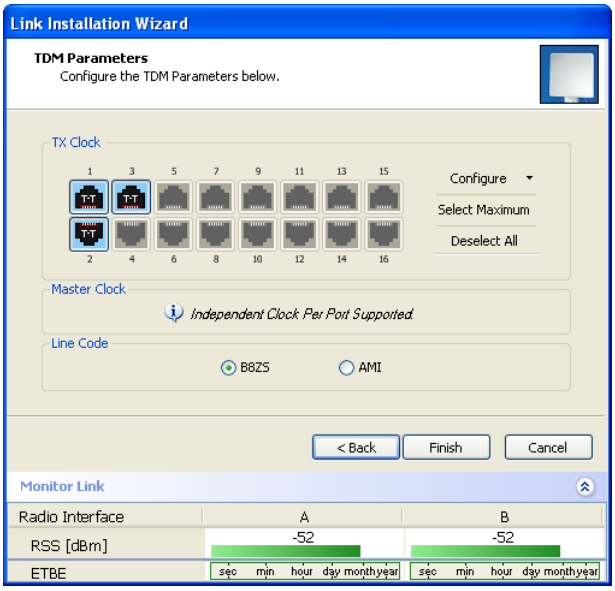


Figure 4-22: TDM Parameters dialog box - T1 services

The T1 line code can be set as B8Zs or AMI in the TDM Parameters dialog box.

The default is B8ZS.

To change the line code:

- In the TDM Parameters dialog box, **Figure 4-22**, set the line code to B8ZS or AMI.

Setting the TDM Backup (for IDU-R only)

IDU-R units have two E1 trunk lines, one for MRL air interface via the ODU, and the second external equipment such as a PBX. The TDM backup screen is displayed in IDU-R systems only.

The external equipment status is displayed on the Main window of the MRL Manager in IDU-R systems.

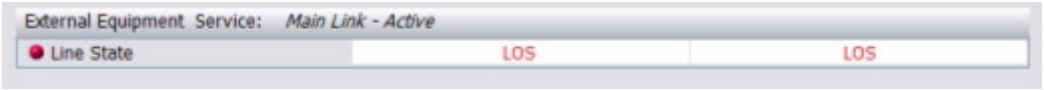


Figure 4-23: External Equipment Status

To use the Backup Mode:

1. Click Enabled Backup Mode.
2. Set which link is backup link; either MRL or the external equipment.

   The second link becomes the main link.

To disable the Backup mode:

1. Click Disable Backup Link
2. Set which link is the Main Link; either MRL or the external equipment.

   Figure 4-24 shows the TDM Backup Service window.

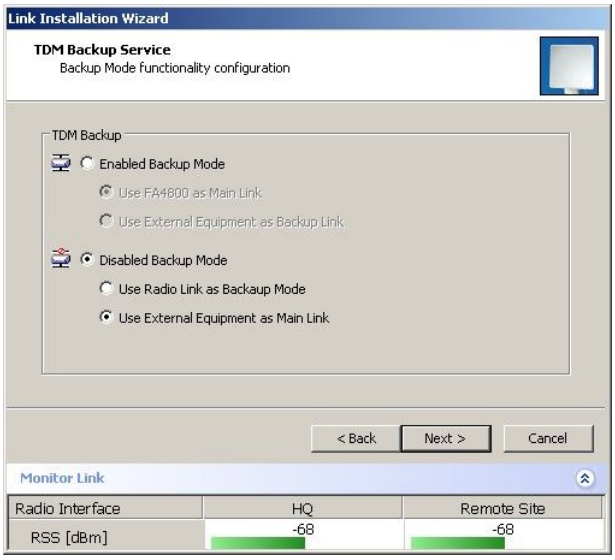


Figure 4-24: TDM Backup Service, IDU-R units only

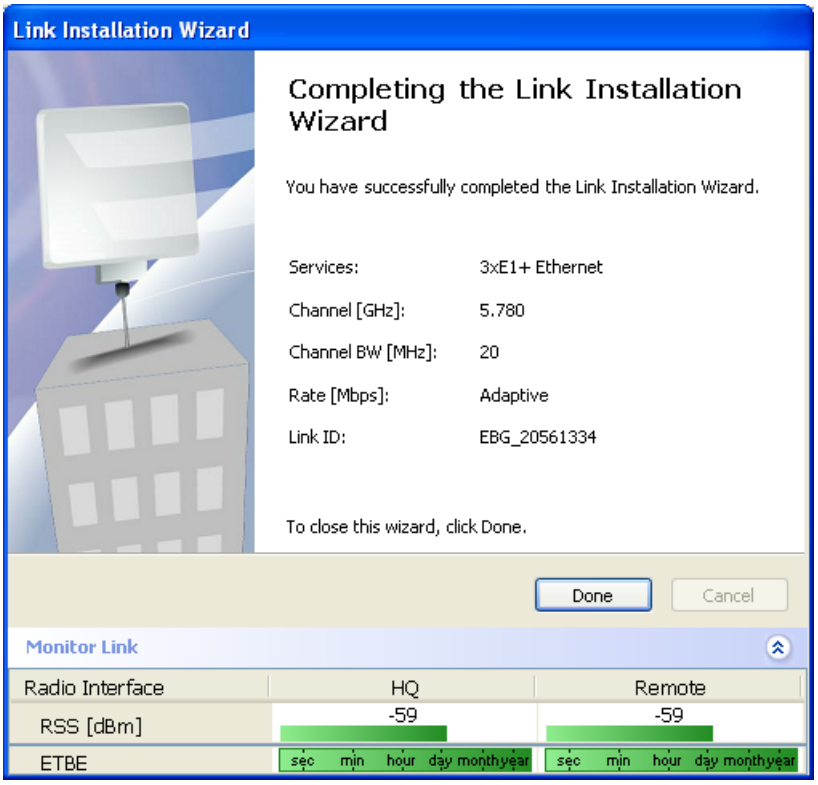


Figure 4-25: Installation Wizard, Finish Screen

3. Click **Finish** to complete the installation wizard.

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

Verify that the Radio Signal Strength (RSS) numerical value is relative to the expected results that were determined by the Link Budget Calculator (**Appendix B**).

Chapter 5

Getting Started

This section provides the following information for MRL:

- Turning the system on and off
- Starting the MRL Manager software
- Controls and indicators
- Normal Indications
- Default settings
- Technical Specifications

Turning On MRL

➢ **To turn on MRL:**

- Connect the AC/DC converter to the IDU power connector and to the mains. See **Chapter 4**, **Connecting Power to an IDU** for full instructions on connecting the power.

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

Controls and Indicators

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

IDU Front Panel Indicators

The front panel of the IDU-C and IDU-E includes a series of LED indicators that show the operating status of the unit.

The following figure shows the IDU-E front panel:

Figure 5-1: IDU-E Front Panel

The following table describes the indicators:

Table 5-1: Front Panel LEDs

Name	Color	Function
PWR	Green	ON –Power supply is ON (IDU-E only)
IDU	Green	ON – IDU operational
With Ethernet only	Green	ON – During power-up only
With TDM	Orange	ON - During power-up only
	Red	ON – Failure
ODU	Green	ON – ODU-to-IDU communication link is operating
	Red	ON – ODU-to-IDU communication link is disrupted
LINK	Green	ON – Wireless link is synchronized
	Orange	ON – During installation mode only
	Red	ON – Wireless link lost synchronization
SERVICE	Green	ON – E1 or T1 line is synchronized
	Orange	ON – Alarm detected at the remote interface ON – Local or Remote loopback
	Red	ON – Alarm detected at the local interface

ODU/LAN Indicators

The ODU/LAN and TDM connectors (IDU-E rear panel, IDU-C front panel) have LED indicators that show the operating status. The following tables describe the indicators.

Table 5-2: ODU/LAN LEDs

Name	Color	Function	Location
LINK	Green	On – Good Ethernet link integrity	ODU/LAN connectors
ACT	Orange	Blinks according to the Ethernet traffic	ODU/LAN connectors

IDU Back Panel Indicators

Table 5-3: TDM Traffic Indicators

Function	Green LED	Red LED
OK	On	Off
AIS	Off	On
LOS	On	On
Loopback	On	Blinking

Upon turning on MRL, the PWR LED in the IDU-E front panel lights to indicate that MRL is on. **table 5-4** shows the correct status of the indicators at power-up.

Table 5-4: Indicators at Startup

Indicator	Color	Status
PWR	Green	ON (IDU-E only)
IDU		
With Ethernet only	Green	ON for short duration during startup
With TDM only	Orange	ON for short duration during startup
	Green	For normal operation after successfully connecting the ODU to the IDU.
ODU	Green	ON shows normal operation
LINK	Orange Green	ON for short duration during startup ON shows normal operation
SERVICE	Green	ON shows normal operation OFF when Service is configured for Ethernet only

If the above LED indications do not appear following initial power turn-on, refer to Chapter 5 for the diagnostic test instructions.

ODU Indicators

Color	Function	Location
Green	Blinking – Good Ethernet link integrity	IDU/LAN connectors
Orange	On - during power on self test	IDU/LAN connectors

Default Settings

Table 5-5 lists the default settings of the MRL configuration parameters.

Table 5-5: Default Settings

Parameter	Default Value
ODU IP Address	10.0.0.120
Subnet Mask	255.0.0.0
Manager Login password	Admin
Link Name	–
Link Password	Wireless-bridge
Rate	Adaptive
Services	Ethernet
Ethernet Configuration	Auto Detect
Radio Link Failure Actions	No action
Bridge	Non PoE systems: Hub Mode, Aging time = 300 sec PoE systems: Bridge Mode
Community values	Read-write – netman Read-only – public

Starting the MRL Manager Software

➢ To start the MRL Manager:

1. Connect the management station to the LAN.
2. Double-click the MRL Manager icon on the desktop, or click Start > Programs > MRL Manager.

   The Login dialog box appears.

Figure 5-2: Login Screen

3. For IP Address do one of the following:
   - Type an IP address for the ODU (for Network mode), OR
   - Click Local Connection (if you are connected directly to the IDU LAN port).

   The default IP address for the ODU is 10.0.0.120. The Subnet mask is 255.0.0.0. For Versions 1.700 and greater, any valid subnet mask may be used.
4. Enter the password.

The actual IP address may be defined during link configuration (see **Defining the Management Addresses** on page **6-14**) or stand-alone (see **Appendix D**, **Preloading an ODU with an IP Address**).

Default password - admin (see **Changing the Management Password** on page **8-1**).

5. If you are a user with Read-Write permission, click Options to define your user type and enter the community options.

   User type access is are shown in the following table:

Table 5-6: User Access Level

User type	MRL Model	
	5.4 FCC/IC	Others
Observer	Read-only	
Operator	Configure	Install and Configure
Installer	Install	

MRL is protected with Community passwords. A user may be defined with read-only permission or with read-write permission. see **MRL Manager Community Strings** on page **6-21** for more details.

For what follows, it is assumed that you have set the IP addresses of both ODUs. For the purposes of illustration, we will use the following IP addresses:

Note

Our managing computer has its NIC set to IP address 192.168.2.100. The log-on ODU is set to IP address 192.168.2.101 and the over-the-air ODU is set to 192.168.2.102. The Subnet Mask for both sites is 255.255.255.0 and the Default Gateway is left unset. We will maintain this arrangement throughout the remainder of this manual.

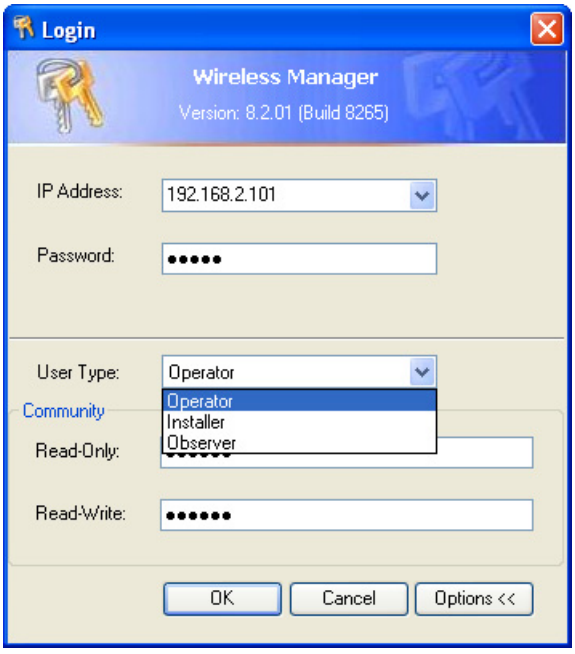


Figure 5-3: Login Screen with User Type and Community Options Visible

- If 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.

The MRL Manager main screen is displayed (See **Figure 5-6**).

Note

With BRS and 5.4 FCC/IC systems the link must be activated at both sites when installing for the first time. A red Inactive Link box appears in the center of the Manager screen. Activation is performed later.

Login errors

Incorrect IP address

Attempting to connect to an unsupported device will result in the following error message:

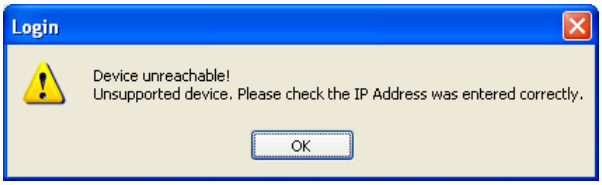


Figure 5-4: Unsupported device

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

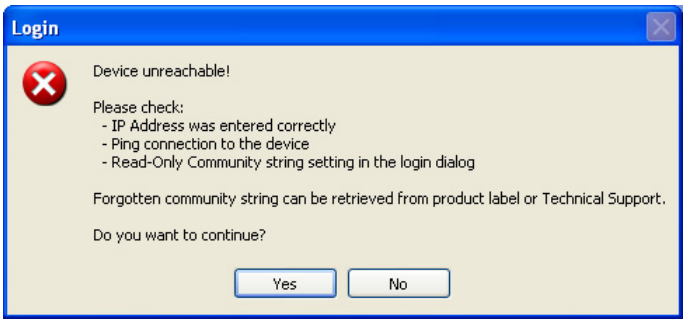


Figure 5-5: Unreachable device

Incorrect password

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

Continuing with normal installation

Upon successful login, the MRL Manager main screen is displayed:

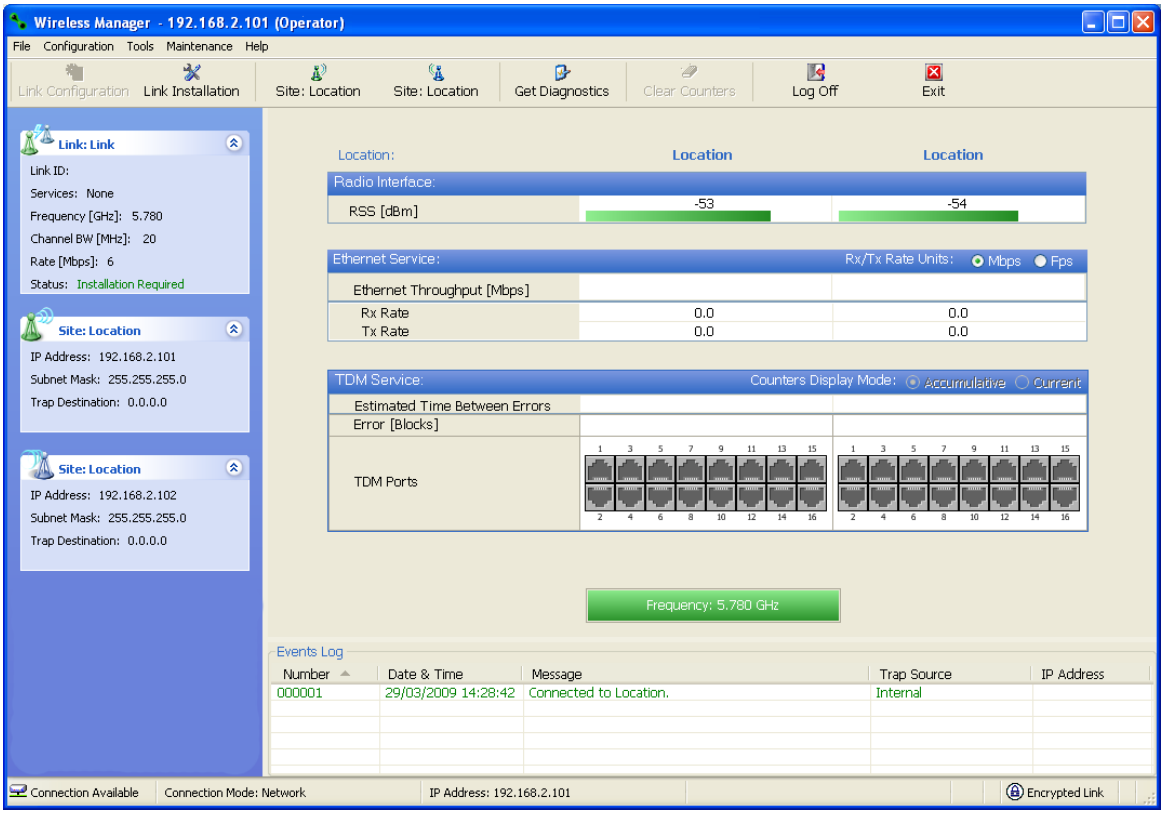


Figure 5-6: MRL Manager Main Screen

Over the Air Connection indication

During the login the Manager reports on over the air connection.

Note

Over the Air connection to remote unit is not recommended

- Select the relevant option for your login requirements.

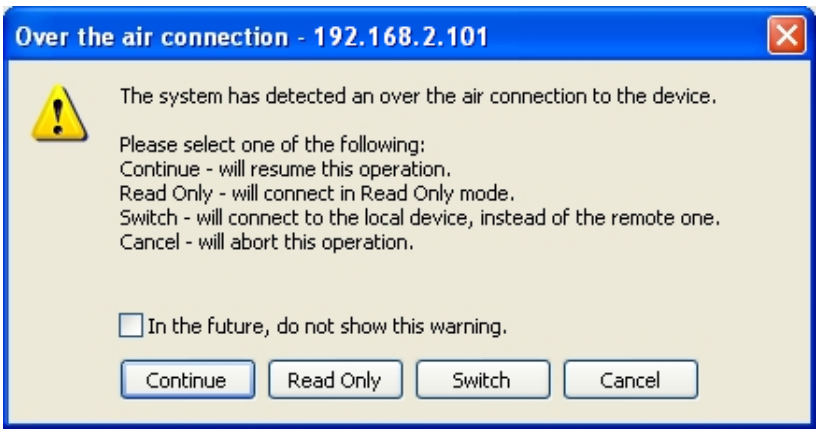


Figure 5-7: Over the Air Connection

Managing MRL

Figure 5-8

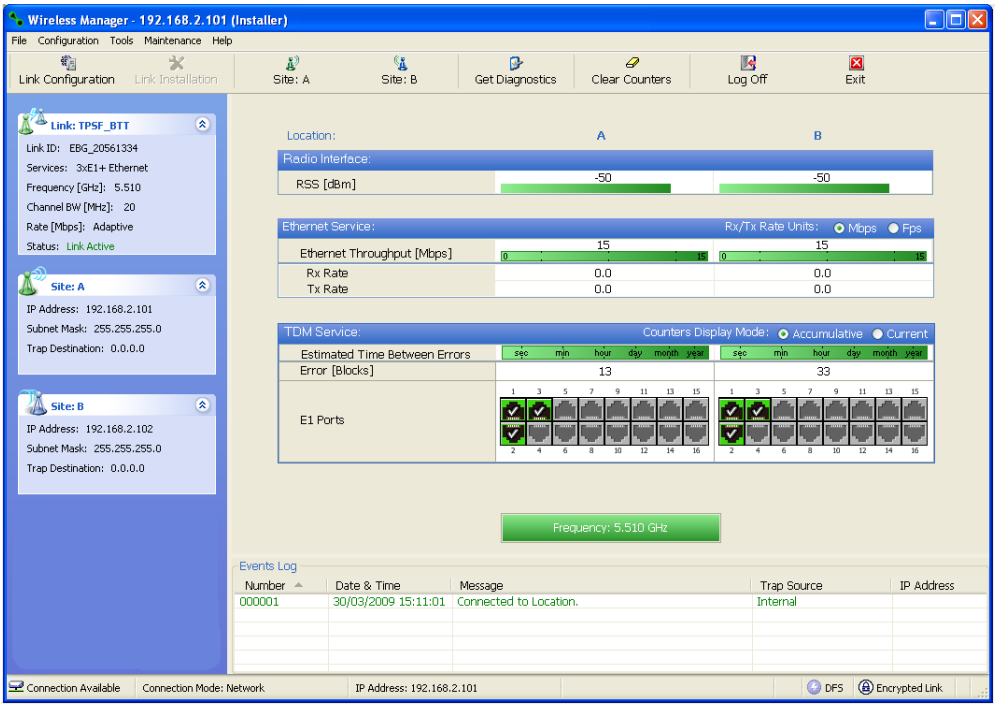


Figure 5-8: Main window, wireless link is active

The MRL Manager Main screen consists of the following elements:

Toolbar buttons

Link Configuration	Changes configuration parameters of operating wireless link; assigns text files for storing alarms, statistics and configuration data
Link Installation	Performs preliminary configuration of the system This button is disabled once a link is defined.
Clear Counters	Clears error counters (available with TDM only)
Log off	Logs off MRL Manager
Exit	Exits MRL Manager

Menu bar

File	Log off, and exit
Configuration	Use for link configuration, individual site configuration or link installation
Tools	Accesses Performance Monitoring Report, Active Alarms, Change password, Event log handling, Set Preferences
Maintenance	Provides the following functions: Clear counters, Loopbacks, System Reset.
Help	Provides MRL Manager Help, Link Budget Calculator, Get Link Information About MRL

Link details pane

- Summarizes information on the radio frequency, IP address, type of TDM service, number of assigned E1 or T1 timeslots, and IP details of the local and remote MRL units.

Monitor pane

- Displays the link quality between local and remote devices and the following statistics
- Radio signal strength (RSS) in dBm

  Current Ethernet bandwidth in Mbps. This is not the actual traffic rate, but the maximum capacity (Net symmetrical Throughput "Full-Duplex") that can be supported currently, (See **Figure 5-9**).

  The scale on the bar varies depending on the link distance and air interface quality.
- Local/remote receive and transmit traffic rate, in Mbps or Fps (frames per second).
- TDM status: The Estimated Time Between Errors bar gives an indication of the TDM quality. The ETBE constantly calculates the expected TDM ratio according to the current air interface conditions
- Link Status: Shows the channel frequency. The color of the box indicates the status
  - Green is an active link
  - Red is an inactive link
  - Magenta shows an authentication or compatibility problem
  - Brown shows severe compatibility problem.
- Event log – stores alarms generated by local and remote units.

Status Bar

Displays the following icons:

- Connectivity icon showing how the device is connected to the Ethernet.
- Network connection to the local unit – using IP of the local unit
  - Over the Air connection - using IP address of the remote for over the air connection
  - Local mode using broadcast - direct connection to IDU LAN port without IP address. This mode is only recommended when the managed PC is connected directly to the IDU (no network involved) the managed PC must have a static IP configured. (No DHCP)
- Encryption icon showing if the link is encrypted

 encrypted link

 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

☐ No Encryption – an older release is used. No encryption is available

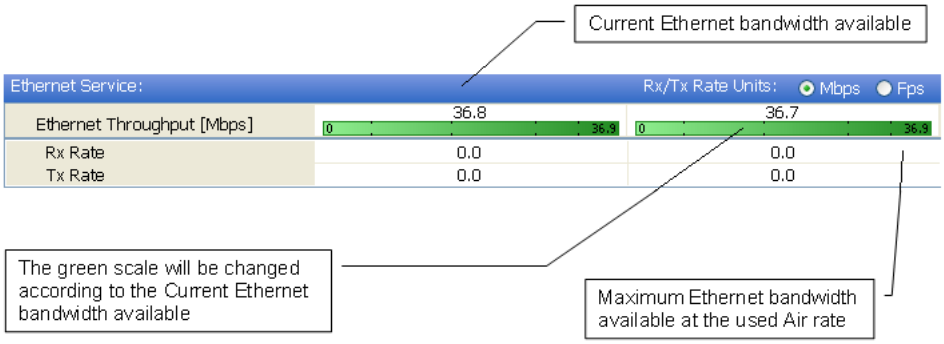


Figure 5-9: Ethernet Bandwidth Indication

To change link configuration parameters:

1. In the Main menu, click **Configure Link**.

   The Configure Link wizard appears. see **Link Configuration Wizard** on page **6-1** for configuration details.

2. Click **Next**.
3. Continue through the configuration wizard and define the Link name and ID, Channel, Rate and Services.
4. Once you finish changing configuration parameters, click **Finish**.

   The system takes a few seconds to activate the link with the new configuration.

Turning Off MRL

To turn off MRL:

1. Exit the management application.
2. Remove the AC/DC converter power cord from the mains.

Chapter 6

Configuring the Link

This chapter describes configuration procedures, which are performed after the physical installation of the local and remote MRL units and after the Installation Link wizard has been run. A Link Configuration wizard is used to redefine the configuration parameters if necessary. Both the HQ and sites in the link are defined simultaneously (both sides of the link are defined simultaneously).

The following parameters are configured via the Site Configuration Wizard:

- System parameters
- Frequency channel
- Air interface rate
- Service parameters
- TDM
- Hub Site Synchronization Settings.

The following parameters are configured via the Configuration dialog box.

- Transmit power
- Management and trap addresses
- Bridge mode
- Ethernet mode
- Community values.

For HSS screens see **Appendix H**, **Hub Site Synchronization**.

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

Link Configuration Wizard

Configuring System Parameters

➢ **To change general parameters:**

1. In the Main menu, click the Link Configuration button.

   The Configuration wizard opens:

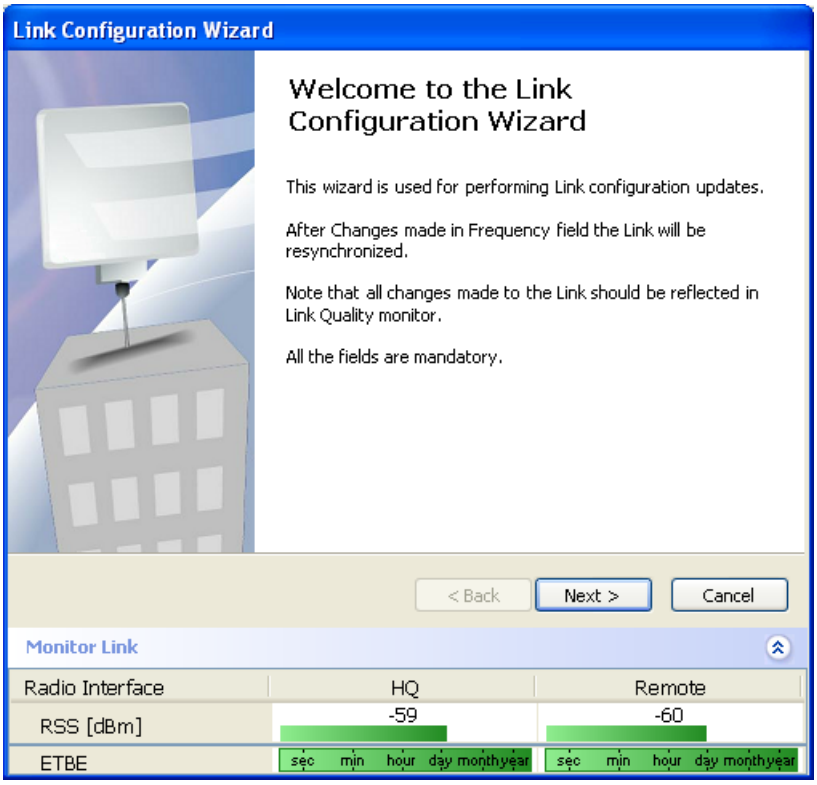


Figure 6-1: LInk Configuration Wizard

2. Click **Next**.

   The Link Configuration dialog box appears:

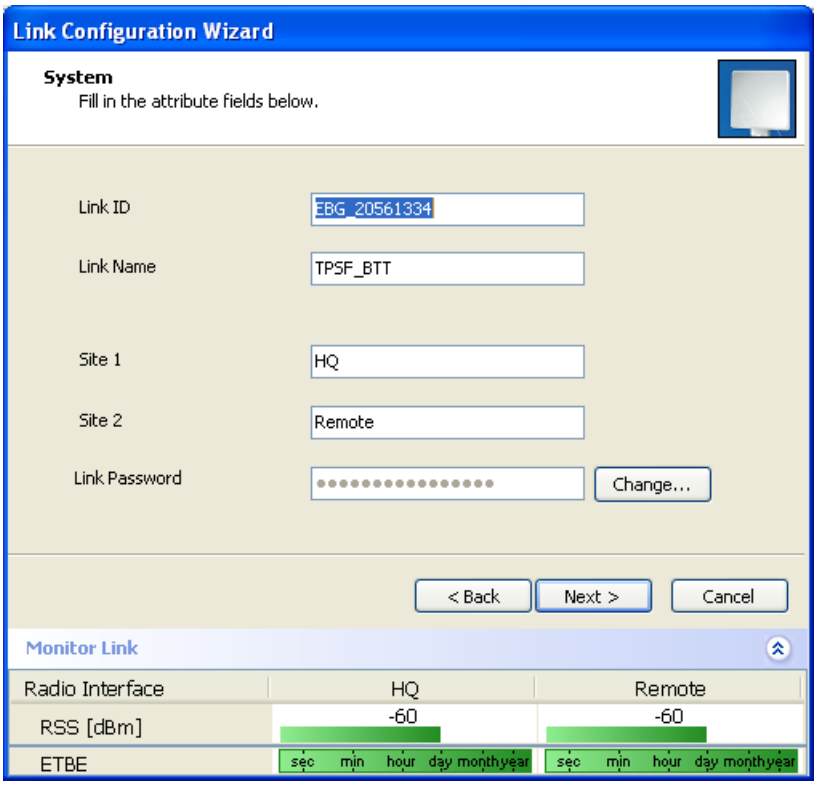


Figure 6-2: Link Configuration, System dialog box

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

   The Channel Settings dialog box appears.

Selecting Channels: Automatic Channel Select

You are required to define the operating frequency channel. Newer versions have a feature called Automatic Channel Select (ACS). This allows you to define several allowable frequency channels to which you can change if interference is detected on the channel in use. ACS performs channel monitoring and selects the channel with the lowest interference for the transmission.

Automatic Channel Select enables coexistence with any radar system that may be active in the area.

For the ETSI version, skip to **page 6-4**; for the BRS version, skip to **page 6-6**; for the 5.4 FCC/IC version skip to **Appendix J**.

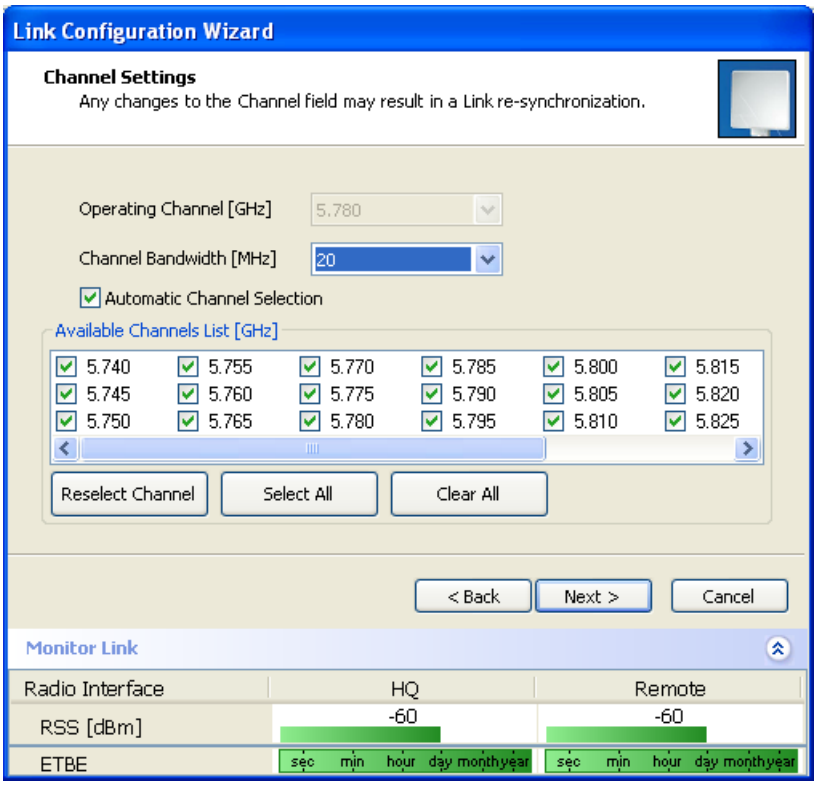


Figure 6-3: Channel Select dialog box - Automatic Channel Select

To define automatic channel selection:

1. Select the main frequency from the Operating Channel menu.
2. Select the required Bandwidth 5, 10, or 20 MHz.
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.

By clicking Reselect Channel, the ODU scans the selected channels looking for radio frequency activity. Once it determines which of the channels is free of RF signal activity, it locks onto it. If you require a different channel than the one selected, you must first remove the operating channel that the ODU finds most free of RF signal activity from the available channel list.

6. Click**Next**.

   The Rate Select box appears.

If you have the standard version, proceed to **Configuring Service Parameters**, **page 6-7**. For the ETSI version, proceed to the next section; for the BRS version, skip to **page 6-6**

The 5.4 GHz ETSI Version

In accordance with ETSI, unlicensed wireless data equipment is not allowed to interrupt radar services. Therefore, if the ETSI Version detects Radar activity, it automatically changes the 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 any transmission, MRL probes a channel for Radar signals for a period of 60 seconds.

In the 5.4 GHz ETSI version, the Automatic Channel Selection is selected by default and a minimum of two channels must be defined as available.

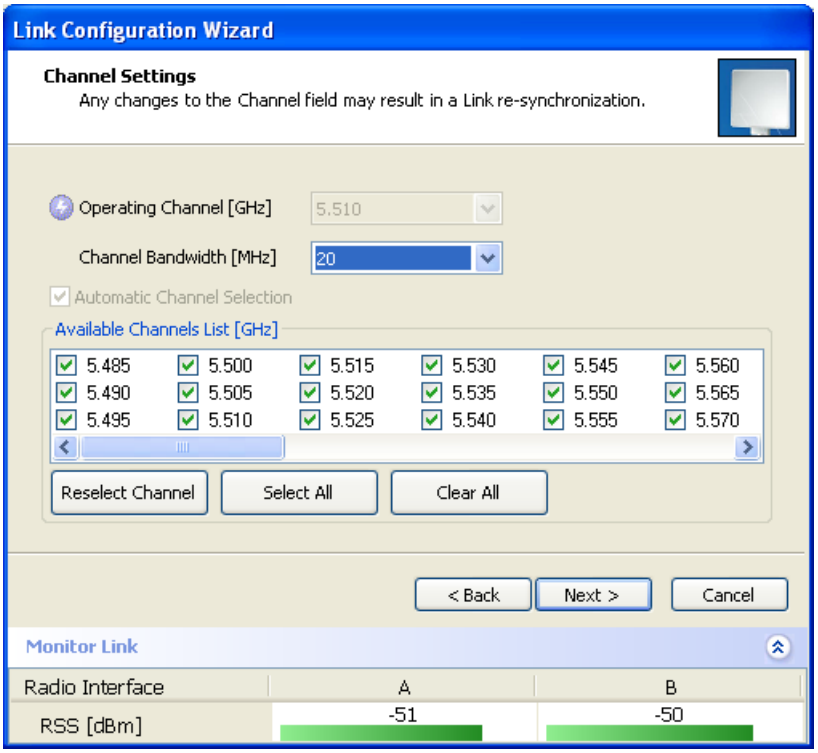


Figure 6-4: Channel Select dialog box (DFS, ETSI requirement)

The sign on the configuration Wizard and Status bar indicates that the radar detection is on.

To define automatic channel selection in the 5.4 ETSI version

1. Select the main frequency from the Operating Channel menu.

Note

Automatic Channel Selection is selected by default.

2. Click at least two check boxes in the Available Channels List of all the allowable channels that can be automatically selected.

Note

Installation will not continue until at least two channels are defined.

Selecting a new channel causes the system quality to change. The quality bar shows the adjustment until the system finds the best quality link.

Any channel selected is evaluated for 60 seconds; therefore this selection process may take a few minutes.

3. 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.

The reselection process may take a few minutes.

4. Click Next.

   The maximum rate is selected according to the link conditions

   The quality bar may fluctuate until the system finds the best quality link.

5. Click Next.

   The Service Parameters dialog box appears. Proceed to page 6-7.

BRS Version: Configuring BRS Channel Settings

Both sites in a BRS Link must be configured identically.

To Configure BRS Channel Settings:

1. Select the Band Plan: Pre-Transition or Post-Transition.
2. Select the Bandwidth required.
   - Single Band (5MHz)
   - Double Band (10MHz)
   - Quad Band (20MHz)
3. Select the Frequency.
4. Click Next. The system is re-synchronized to the changes.

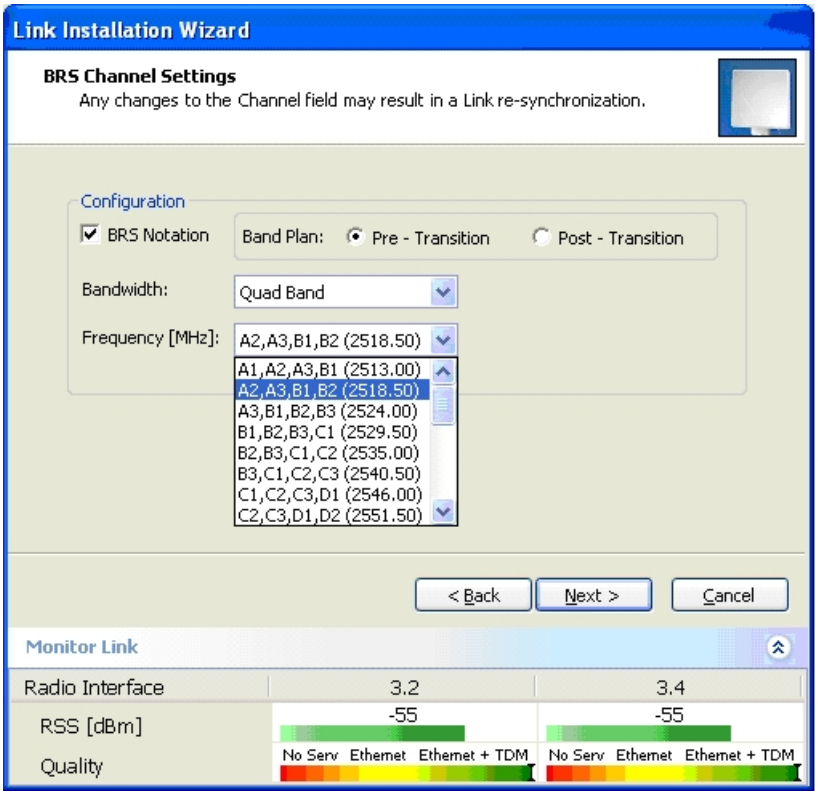


Figure 6-5: BRS Channel Settings Post-Transition

The 5.4 FCC/IC Version

See **Appendix J** for details.

Configuring Service Parameters

You define the type of service required, Ethernet Only or Ethernet with TDM. The bandwidth remaining available for Ethernet if TDM services are required is shown in the dialog box.

Note

ACCESS versions are Ethernet Only.

In the Service Parameters dialog box select the number of E1 connections (x1 or x2 for IDU-E, or x4 for IDU-C). Define the required transmission rate, and the distance between the sites.

➢ **To configure E1/T1 and Ethernet services:**

1. In the Service dialog box, select one of the following:
   - Ethernet plus a number of E1/T1 channels (See **Figure 6-6**).
   - Ethernet data only.
2. Select the transmission rate required.
   - Adaptive
   - 9 Mbps
   - 12 Mbps

- 18 Mps
- 24 Mbps
- 36 Mbps
- 48 Mbps

The default rate is Adaptive. ACCESS versions only operate in Adaptive mode.

Adaptive Modulation - The system changes modulation automatically depending on channel characteristics in order to guarantee continuation of service. The adaptive modulation enables the user to maximize Ethernet throughput without degradation of the TDM service quality. When Ethernet only service is used, the adaptive modulation enables improving the Ethernet performance in case of air performance degradation (periodical interference or RSS changes).

In event of interference at one site, there is no need to use a lower modulation at the other site (as in previous versions). In such a case the actual rate changes automatically only at the problematic site, while the second side of the link maintains the highest rate possible (Asymmetric).

Adaptive modulation can be changed in both Installation and Configuration wizards.

For versions 1.6 and greater, distance between the sites is automatically measured.

If TDM services are selected, then the Evaluate icon shows on the screen while the maximum rate is evaluated.

When evaluation is complete the icon changes and the following message is shown:

Service has been evaluated, click Next to continue.

3. Click **Next**.

   The TDM Parameters dialog box or the Finish screen appears depending on which services were selected.

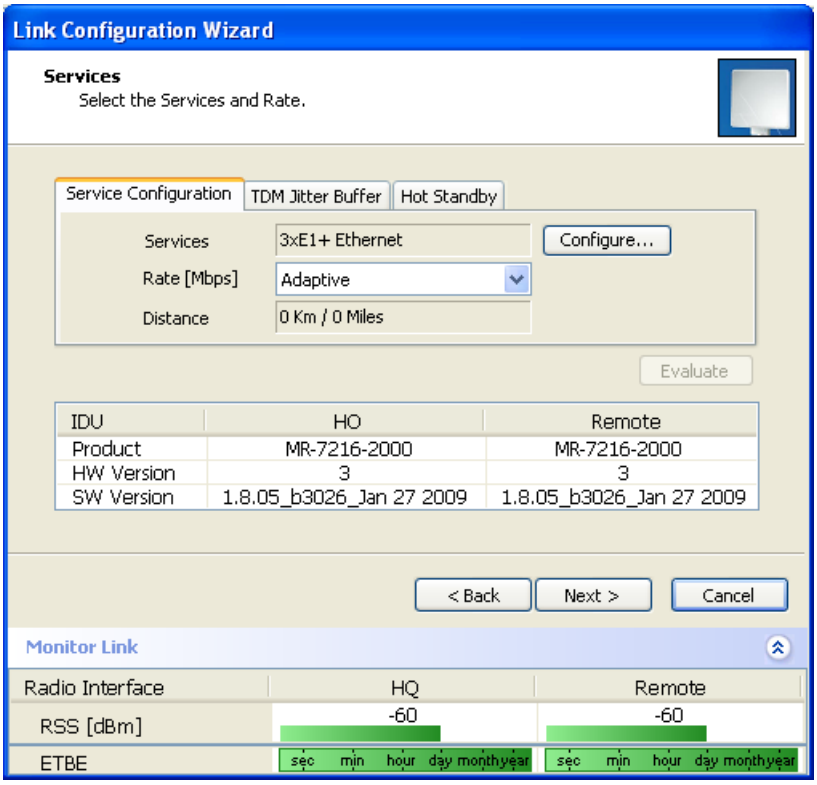


Figure 6-6: Services Dialog Box, E1/T1 Interface

Configuring TDM Operation

TDM configuration follows the same procedure as described in **Chapter 4**, **Setting the Clock Configuration**.

Setting the TDM Backup (IDU-R only)

The IDU-R units have two E1/T1 trunk lines, one for MRL air interface via the ODU, and the second external is for peripheral equipment- I.E. PBX. The external equipment status is displayed on the Main screen of the Manager in IDU-R systems.

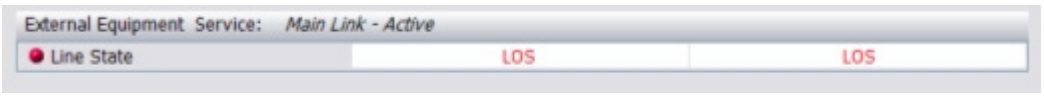


Figure 6-7: IDU-R - External Equipment Status

To use the Backup Mode:

1. Click Enabled Backup Mode.
2. Set which link is backup link; either the link or the external equipment.

   The second link becomes the main link.
3. Click Next to continue.

To disable the Backup mode:

1. Click Disable Backup Link
2. Set which link is the Main Link; either the link or the external equipment.

3. Click Next to continue.

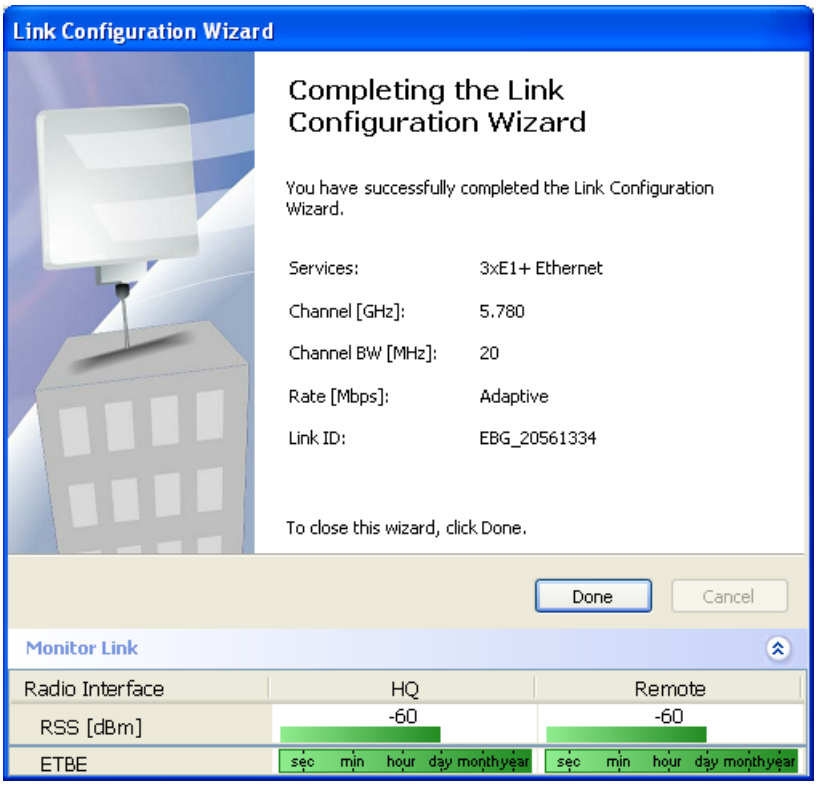


Figure 6-8: Configuration Link, Finish screen

The Finish screen appears, showing a summary of the link configuration (See **Figure 6-8** above).

4. Click Finish to complete the configuration wizard.

The Main screen is displayed.

Configuring the Site

Editing the Configuration Parameters by Site

You can edit the configuration parameters for each site individually. The following functions are available from either the left side of the dialog box, or the buttons on the top of the dialog box (See **Figure 6-9**).

Functions 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
Inventory	View the hardware and software inventory.
Management	Configure the IP address, Subnet Mask, Default Gateway, and the Trap Destination.
Security	Change the Values and the Link Password.
Date and Time	Set the date and time of the server and of the System.
Advanced	Configure the Bridge, define the LAN connection and set the external alarm inputs.

Functions at the top of the dialog box:

Backup	Save a backup.ini file with the current configuration.
Restore	Load the backup.ini file created by the backup.
Installation Mode	Return to Installation Mode for the entire link. Selecting the Mute check box before clicking the Install Mode button mutes the Beeper.
Mute	Mutes the alignment tone at startup. Reactivate the beeper during alignment.

To edit the Configuration Parameters:

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

   The Configuration dialog box opens. (See **Figure 6-9**)

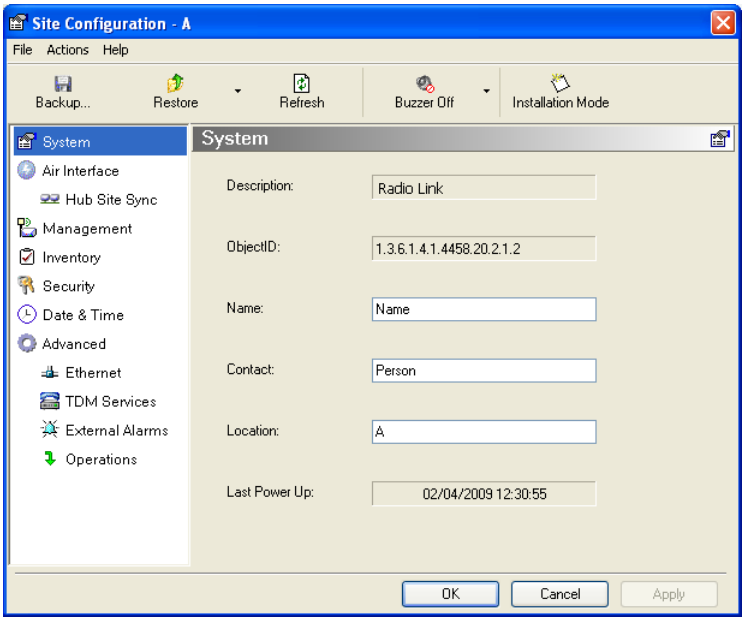


Figure 6-9: Configuration Dialog Box

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

Changing the Transmit Power

Each site can have a different transmit power level.

➢ **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 6-10**)
4. Select the required Transmit Power Level. For available power limits for each system, see Product Specification Table leaflet supplied with the product.
5. Click Apply to save the changes.

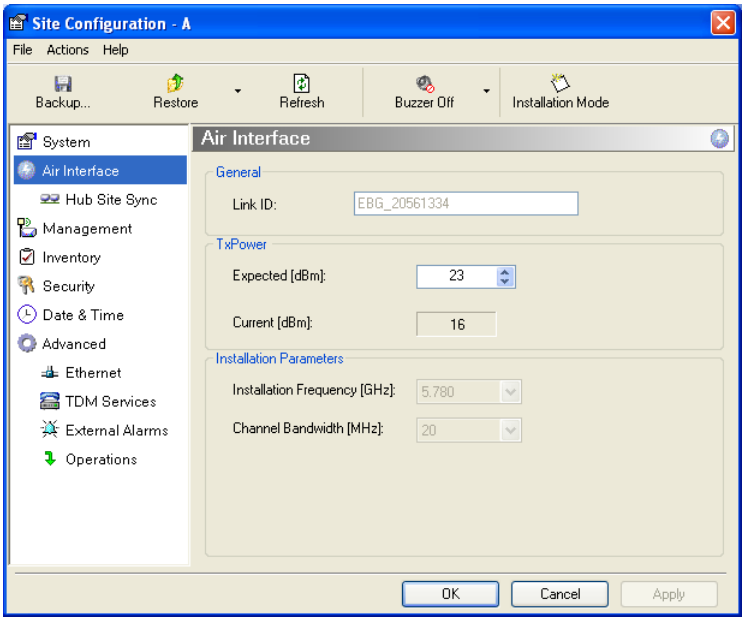


Figure 6-10: Changing the Transmit Power

If the Current dBm exceeds the Expected dBm, a Tx Power Limits guide is displayed:

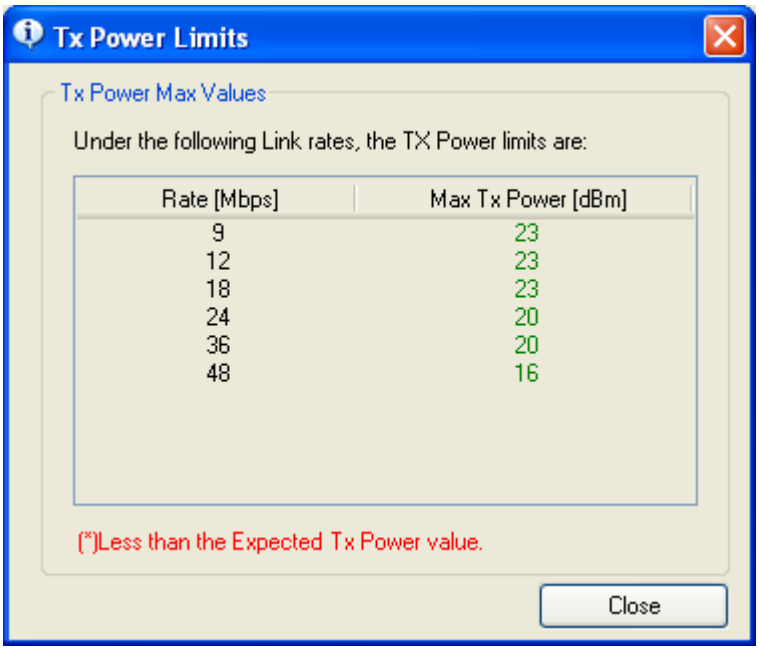
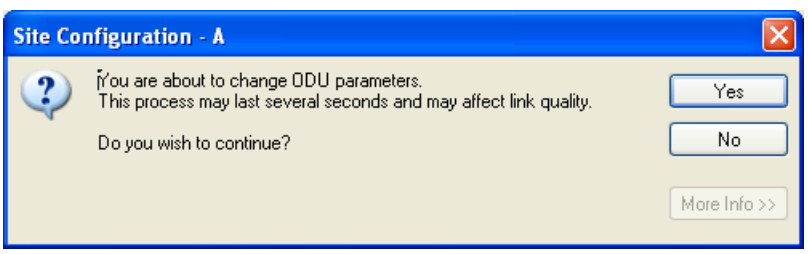


Figure 6-11: Tx Power Limits guide

As soon as the Expected dBmfalls within the required range a confirmation window is displayed:



If you click Yes, the change will be effected with a short reduction of link quality.

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:

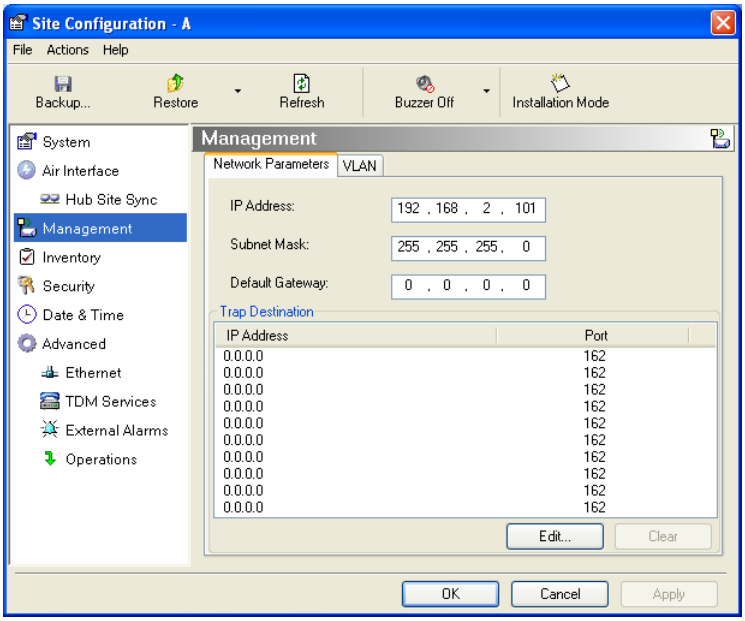


Figure 6-12: Management Addresses - Site Configuration dialog box

3. Select Management.
4. Enter the IP address of the ODU in the IP address field.

If performing configuration from the MRL Manager, the IP address is entered in the login screen.

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.

Configuring VLAN Settings

VLAN Management enables separation of user traffic from NMS Traffic. The user decides if such a separation is required. Both the HQ and Remote site are configured with VLAN Management.

To enable VLAN management:

1. Click Configuration from the main menu.
2. Select which site to configure (HQ or Remote site).
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.

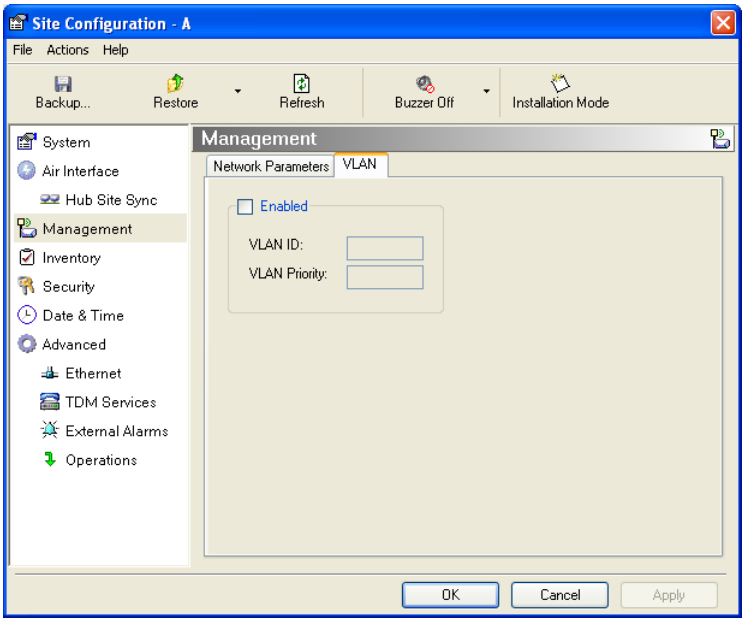


Figure 6-13: Configuring VLAN Settings

Warning

Changing this parameter causes the management application to immediately disconnect. In order to avoid problems, it is recommended to verify the change by setting the VLAN only to one ODU, and only after verifying the VLAN network operation, change the other VLAN setting can be changed.

Troubleshooting:

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

- Reset the device.

In the first two minutes both VLAN and no VLAN connections are available.

Setting the Date and Time

The ODU maintains a date and time value. The date and time value should be synchronized with any Network Time Protocol (NTP) version 3 compatible server[1]. 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.

The NTP uses UDP port 123. If a firewall is configured between the ODU and the NTP server this port must be opened.[a]

It can take up to 8 minutes for the NTP to synchronize the ODU date and time.

a. Windows XP command w32tm /stripchart /computer:<server IP> can be use to check the NTP server connectivity

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:

1. Windows XP is configured by default as a server.

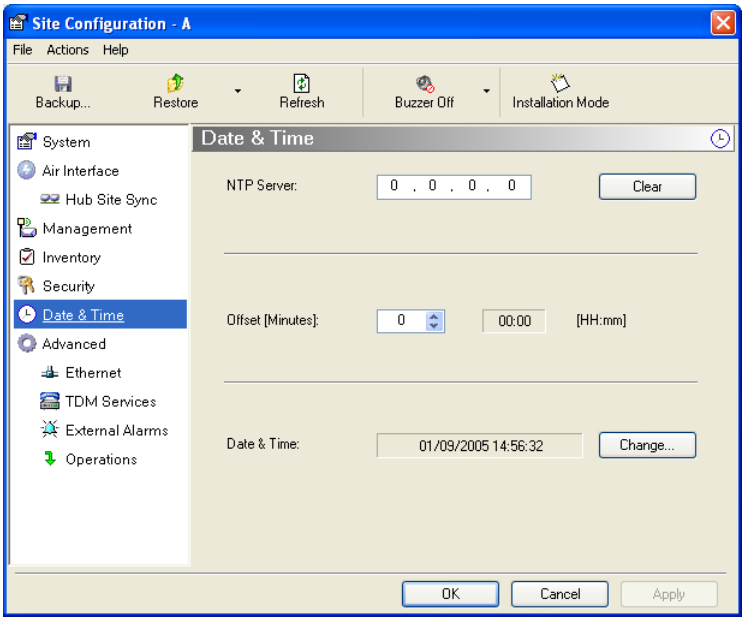


Figure 6-14: NTP Server Address - Site Configuration dialog box

4. If entering an address for the NTP Server, click Clear, and then enter the new address.
5. Set the Offset value.
6. To manually set the date and time, click Change and edit the new values.

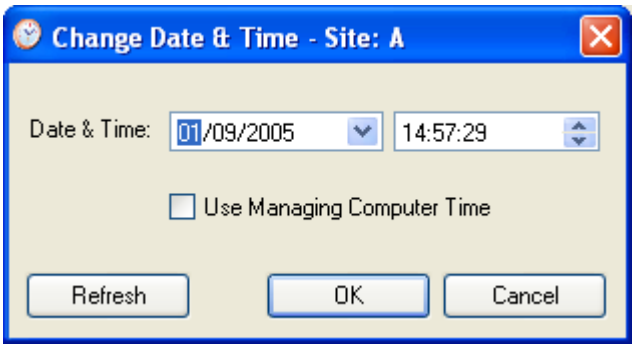


Figure 6-15: Change Date and Time - HQ dialog box

Configuring the Bridge

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:

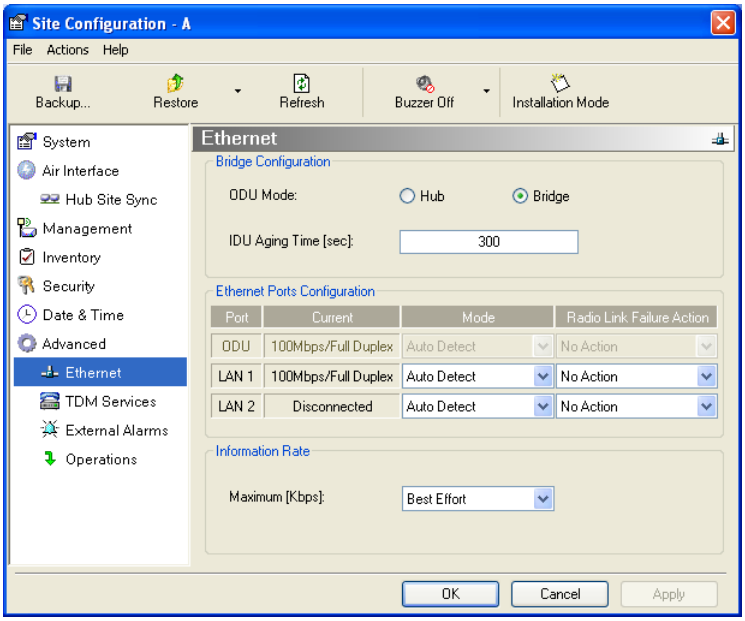


Figure 6-16: Bridge Configuration - Site Configuration dialog box

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, the aging time of the ODU is fixed at 300 seconds.

Note

Changing these modes requires system reset.

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.

Note

Any change to these parameters is effective immediately.

Each side of the link can be configured separately.

- The following list details common configurations; both sides are must be configured with the same parameter.
- Standard (Default) Configuration for Ethernet Applications
- Set IDU aging to 300 seconds, ODU set to Bridge mode
- 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.

Configuring Ethernet Mode

The Ethernet mode is configurable for line speed (10/100BaseT) and duplex mode (half or full duplex). This mode provides an Auto detect feature where the line speed and duplex mode are detected automatically using auto negotiation. Use the manual configuration when external equipment does not support auto negotiation. The default setting is Auto Detect.

The maximum Ethernet Information Rate can be limited via the pull down menu. The default setting is Best Effort.

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.

It is possible to close the Ethernet service by disconnecting the Ethernet port. 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-C)
- Power down the equipment and connect immediately after the power up (the fastest way is to enter install mode).

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.

To set the Ethernet information rate:

1. From the **Configuration** menu, select the site to reconfigure.
2. Click **Advanced > Ethernet**

The Configuration dialog box opens.

3. In the Information Rate pane, use the drop-down menu to select the maximum Information Rate.
4. Select **Other** to define the throughput with 8 Kbps resolution
5. Select **Best Effort** for the highest information rate possible for the link conditions and settings
6. Click **Apply** to save the changes.

ACCESS systems have a maximum rate of 2048 kbps.

Configuring the Jitter Buffer

By configuring the Jitter Buffer, 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 will overcome without TDM BER). You can also decrease the jitter buffer to decrease the system delay.

The jitter buffer can be configured between 2.1 and 16.0 milliseconds.

➢ **To configure the Jitter Buffer:**

1. In the Main menu click the Link Configuration button.
2. Run the Configuration wizard (See **Figure 6-1**).
3. On the Services screen, select the TDM Jitter Buffer tab:

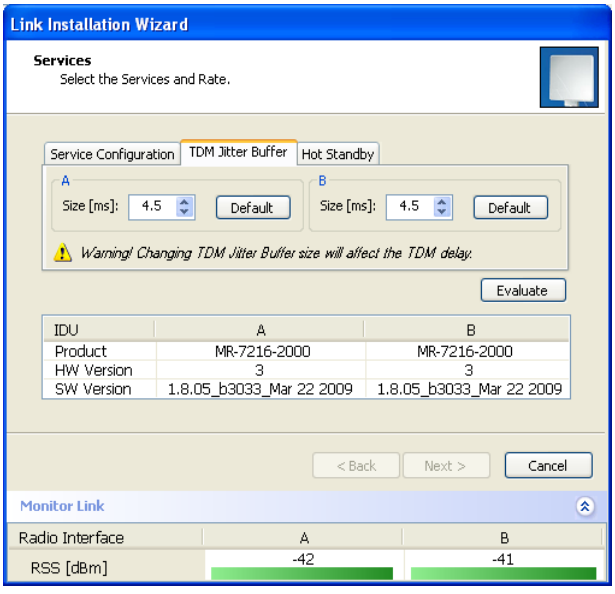


Figure 6-17: Jitter Buffer Configuration

4. Choose the desired values for HQ and Remote Site.

   After setting the new value, the user must evaluate the expected quality. During the evaluation the ETBE bar is displayed.

5. Click **Next >** to perform the change or **< Back** to cancel the change.

Extra caution should be use when decreasing the value, since the service quality might be affected in the case of interference. In cases of asymmetric interference, the jitter buffer can be set to different values per site. In such cases the latency will also be asymmetric.

MRL Manager Community Strings

If you wish to decrease the number of TDM services, you cannot simultaneously change the Jitter Buffer size, since the Evaluate function is blocked. Complete the wizard, and then re-enter it to change the Jitter Buffer.

Other variations in the order shown, do work. You may:

- Change the Jitter Buffer, Evaluate and then change TDM services.
- Add TDM services, Evaluate and then change the Jitter Buffer.

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. A new community value may be obtained from technical support for the purpose of setting new community; the serial number or the MAC address of the ODU must be supplied.

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, but can only be used one time on the first installation.

A new community string must be set when entering the system for the first time. 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 as the current community:

- For Read/Write community, use **netman**.
- For Read Only community, use **public**.
- For Trap community, use **public-bru1**.

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.

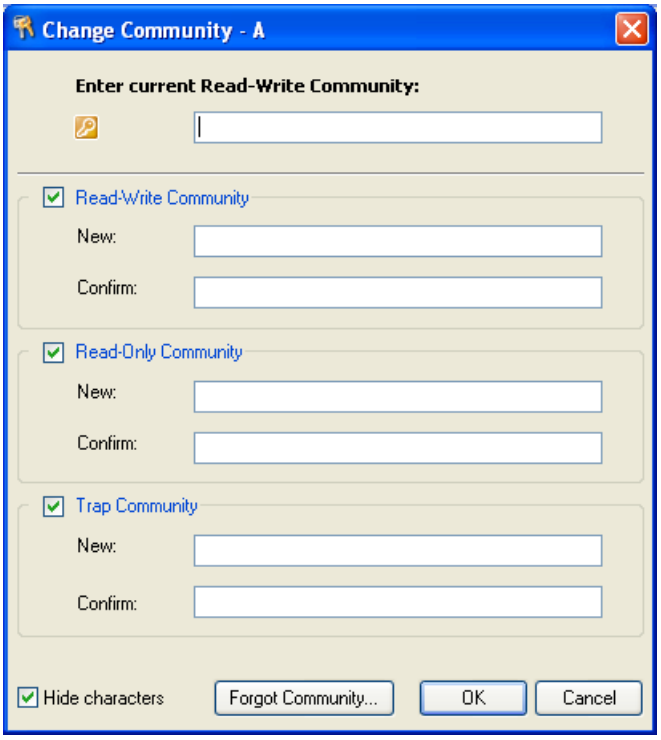


Figure 6-18: Changing the Community String

Forgotten 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 cus-

tomer support using the ODU serial number or MAC address. The serial number is located on the product, and 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 6-1). Then reconfigure the read-write community string

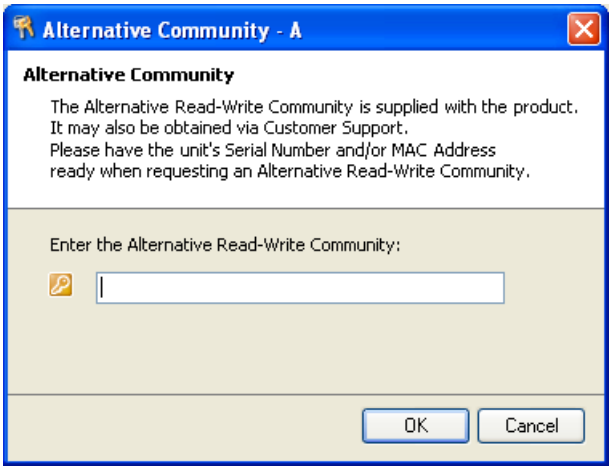


Figure 6-19: Alternative Community Dialog box

Muting the alignment tone

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 until the alignment procedure is to be performed.

➢ **To mute the alignment tone:**

1. Click on **Configuration** in the Menu bar and select the relevant site.
2. The Configuration dialog box opens.
3. In the Configuration dialog box, click the Buzzer button. The button toggles between on and off.

   The tone stops.

➢ **To restore the alignment tone:**

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. The tone starts.

Setting External Alarm Inputs

The IDU-C has two external alarm inputs in the form of dry-contact relays. The Alarm interface is located on the front panel of the IDU-C and is a 9-pin D-type female connector. see **IDU-C Alarm Connector** on page **L-3**, for wiring Specifications 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**.

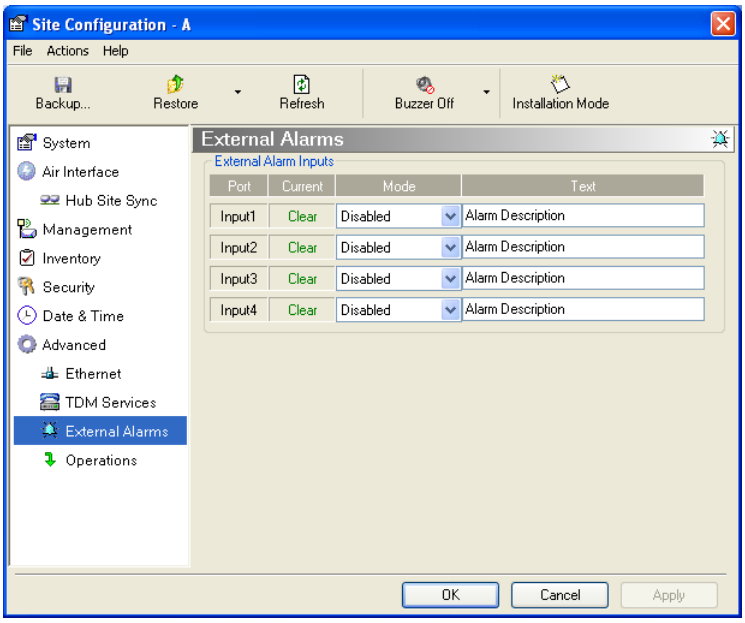


Figure 6-20: External Alarm Configuration

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

Managing Configuration Files

Saving Configuration in a File

The management software allows you to save configuration parameters of the local and remote units on the management station as a binary file. Each site is saved in a separate file and is site specific.

➢ **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

Configuration files can be uploaded from the management station.

➢ **To restore a configuration file:**

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

   The Configuration dialog box opens.
2. Click **Restore**.
3. From the Open dialog box select *.**ini** file to upload and click **OK**.

Resetting

Resetting the link causes service disconnection.

In order to maintain the link configuration, reset the remote site first.

➢ **To reset the unit:**

1. From Maintenance, reset the remote unit.
2. From Maintenance, reset the local unit.

➢ **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.
3. Click the Restore Defaults button.

   A message box asking if you want to restore factory default appears.
4. Click the check box if you want to keep the current IP settings.
5. Click Yes to continue.

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 6-21**).

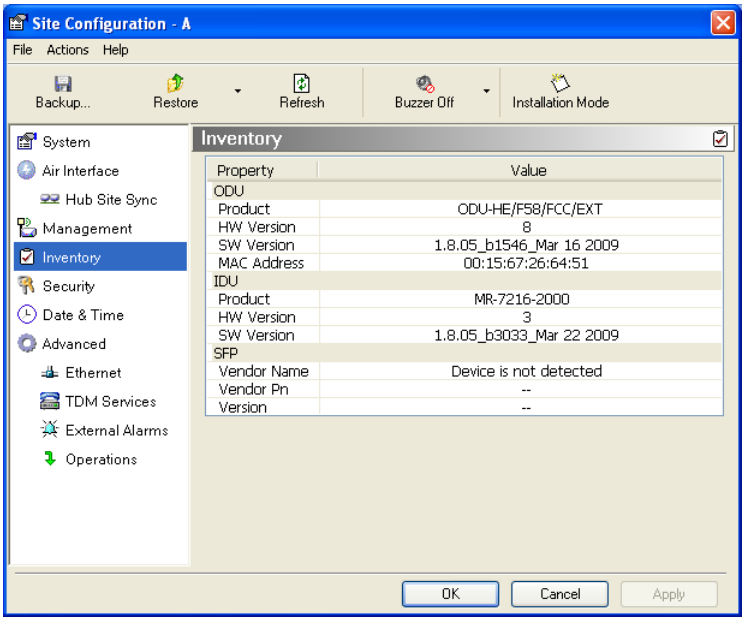


Figure 6-21: Inventory Screen

Configuration with Telnet

A Telnet terminal can be used to configure and monitor the ODU.

To start a Telnet session, use **telnet <ODU_IP>.**

For example, if you run Telnet as follows,

telnet 192.168.2.101

you will be asked for a user name and password.

The Telnet log on user name is the password that you used to enter the MRL Manager (for example, the default: ***admin***). The Telnet password is the corresponding Community string (default: ***netman***).

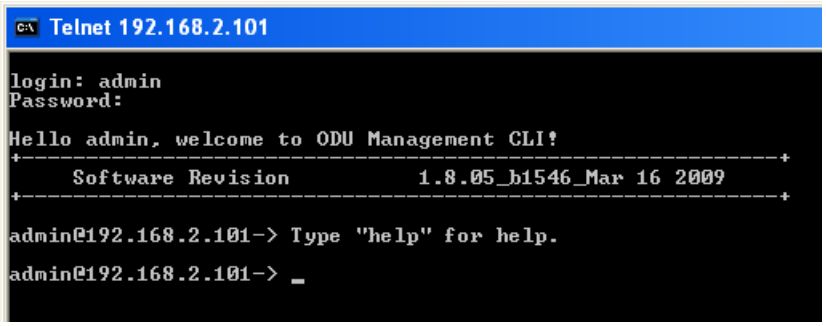


Figure 6-22: Telnet session log on

A Read-Only Community string allows display only whereas a Read-Write Community string allows display and set commands.

Supported Telnet commands are shown in table **6-1**. Note that some of the commands are model-specific. For example, TDM commands will not apply to Ethernet only and PoE based links.

Table 6-1: Telnet Commands

Command	Explanation
display inventory	Displays ODU product name, Name, Location, hardware and software revisions, uptime, MAC address, IDU product name, IDU software and hardware revisions
display management	Displays IP, Subnet, Gateway, Traps table
display link	Displays State, Link Name, Channel BW, RSS, TSL, Frequency/ACS, DFS, Rate/ARA, Distance
display Ethernet	Displays Bridge Mode, Aging time, Port table (State, Status and action)
display tdm	Displays Clock Mode, Master Clock Mode, Current Clock, Quality[1], TDM table (Line status, Error Blocks)
display ntp	Displays Time, Server and Offset
set ip <ipaddr> <subnetMask> <gateway>	Set the ODU IP address, subnet mask and gateway The user must reset the ODU after the command completion
display PM <interface:AIR,LAN1,LAN2,TDM1, TDM2,TDM3,TDM4> <interval:current,day,month>	Shows the performance monitor tables for each interface according to user defined monitoring intervals
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

Table 6-1: Telnet Commands (Continued)

Command	Explanation
Reboot	Reset both the IDU and the ODU. The user shall be prompt that the command will reset the card and that he has to reconnect the telnet session after TBD seconds.
Help	Displays the available commands

Figure 6-23, below, shows the available Telnet commands via the Help command.

```
login: admin
Password:

Hello admin, welcome to ODU Management CLI!
+------------------------------------------------------------+
    Software Revision         1.8.05_b1546_Mar 16 2009
+------------------------------------------------------------+

admin@192.168.2.101-> Type "help" for help.

admin@192.168.2.101-> help
   display inventory
   display management
   display link
   display ethernet
   display tdm
   display ntp
   display PM <interface:AIR,LAN1,LAN2,TDM1,TDM2,TDM3,TDM4>
              <interval:current,day,month>
   set ip <ipaddr> <subnetMask> <gateway>
   set trap <index:1-10> <ipaddr> <port:1-65535>
   set readpw <writePasswd> <newPasswd>
   set writepw <writePasswd> <newPasswd>
   set trappw <writePasswd> <newPasswd>
   set buzzer <mode:0=OFF,1=ON>
   set tpc <power:Value between minimal TX power, and maximal TX power>
   set bridge <mode:0=Bridging OFF,1=Bridging ON>
   set name <new name>
   set location <new location>
   set contact <new contact>
   set ethernet <port:MNG,LAN1,LAN2> <mode:AUTO,10H,10F,100H,100F,DISABLE>
   reboot
   help

Command "help" finished OK.

admin@192.168.2.101->
```

Figure 6-23: Telnet Management Screen

Link Lock Security Feature

The purpose of Link Lock

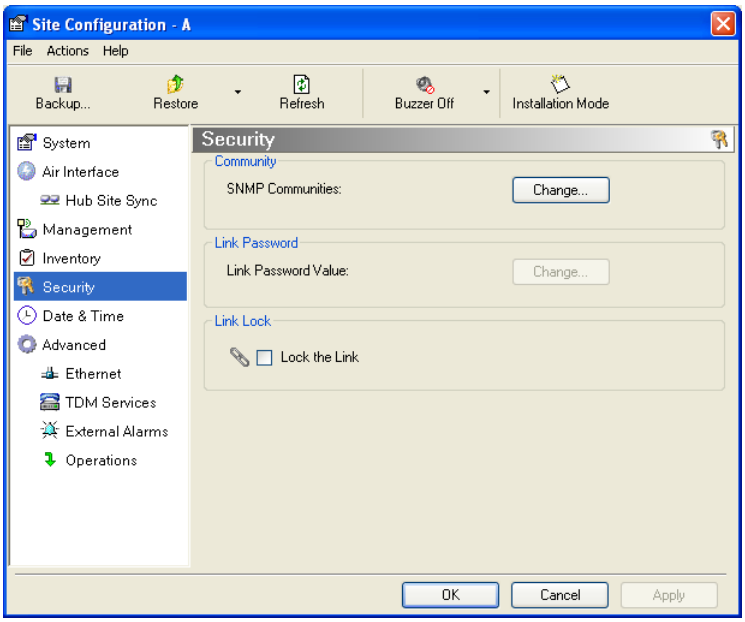
Link Lock is a part of the MRL security concept intended to meet a form of abuse encountered in the field. It is designed to prevent the situation where a remote ODU can be stolen and used as a "pirate" link to steal services or information. The Link Lock feature actually locks the local ODU to be synchronized 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.

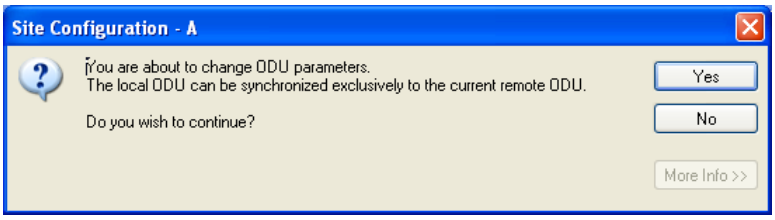
Link Lock can only be removed when the link is unsynchronized. In such a case, an alarm is raised by the MRL Manager.

To enable Link Lock:

1. Click **Site A** on the main tool bar.
2. Choose the Security tab. The following window is displayed:



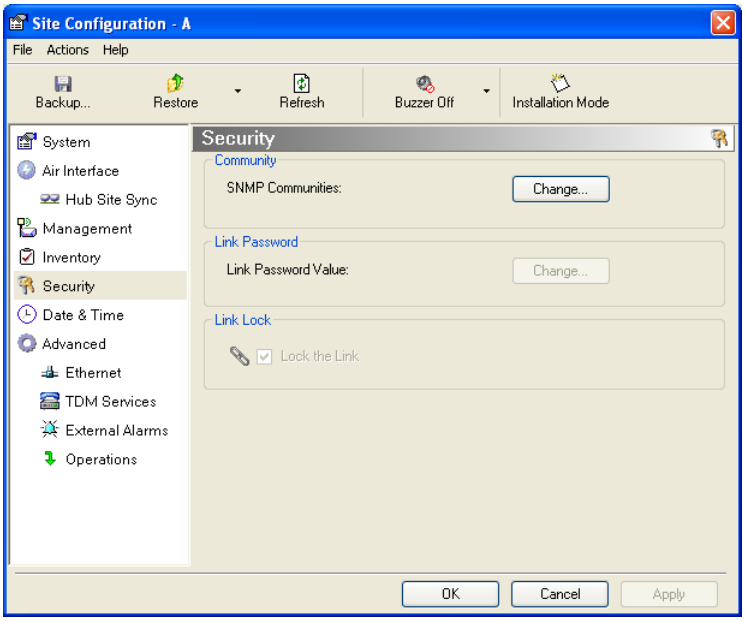
3. Click the Link Lock checkbox and then **OK**. You are asked to confirm the lock:



4. Click the **Yes** button and you are returned to the main window of the MRL Manager.

   Observe that a link icon is now displayed in the status bar on the bottom right of the MRL Manager window.

   The link to the remote unit is now locked. If you repeat steps 1 and 2 above, the Security screen will look like this:



   The Link Lock checkbox is now unavailable.

5. Repeat the procedure for Site B.

Note

To revert the Link Lock status to unlocked, power down each ODU in turn. Use the above procedure to uncheck the Link Lock status box for the live ODU.

A simple ODU reset at either end will restore the link to its previous locked or unlocked state.

Chapter 7

Monitoring and Testing the Link

The MRL Manager software enables you to monitor the link, as well as perform Loopback tests. It also provides a handy Link calculator utility for calculating the expected performance of the wireless link and the possible RF and antenna configurations for a specific link range.

Retrieving Link Information (Get Link Information)

The Get Link Information feature collects and writes all link and Manager information (from both sides) into a comprehensive file. The file can be used for diagnostics and should be sent to technical support to speed up assistance.

The following table lists link and system information that can be monitored.

Table 7-1: Get Link Information Data and Description

Data	Description
System Data	General information about the system
Link Information	Information about the link properties
Event Log	List of recent system events
Site Configuration	Data about the site parameters
Active Alarms	List of active alarms
Performance Monitor	Network performance data over defined time periods
Monitor	Detailed event data record

➢ To get link information

1. On the Help menu, choose Link Information.

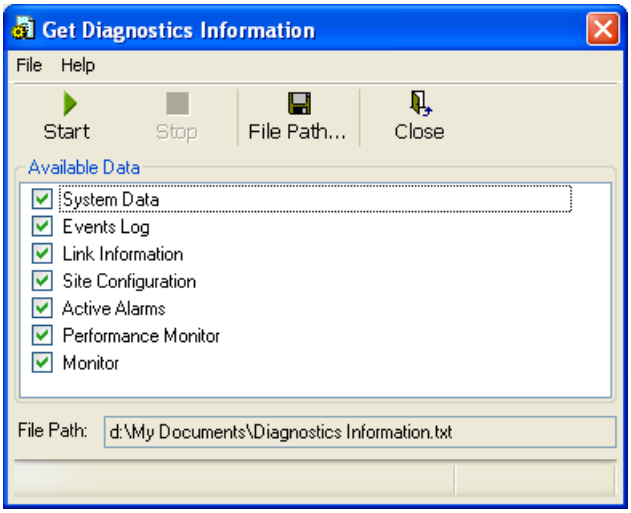


Figure 7-1: Get Link Information Dialog Box

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 specify the folder in which you want to save the file and then click Start to save the information.

   The file is saved in the specified folder as Link Information.txt

Link Compatibility

Link Compatibility 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 were detected that are fully compatible. Message indicates that upgrade is available.

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

softwareUpgradeRequired - different software versions were detected 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 were detected that are not compatible. User needs to perform local upgrades.

Table 7-2: Link Compatibility Trap Messages

Link State	Link	Link Status	Site Description	Site	Link Status

Table 7-2: Link Compatibility Trap Messages

	State text	Color		Desc. Color	Color
fullCompatibility	Active	Green	SW Upgrade Available	Yellow	Green
restrictedCompatibility	Active - SW Version mismatch	Magenta (Same as authenticati on 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

Testing the Connection

Testing the connection supports activation of the internal and external loop-backs on the local and remote units.

To activate a loopback:

1. From the Maintenance menu, choose Set Loopbacks.

   The Loopbacks dialog box appears:

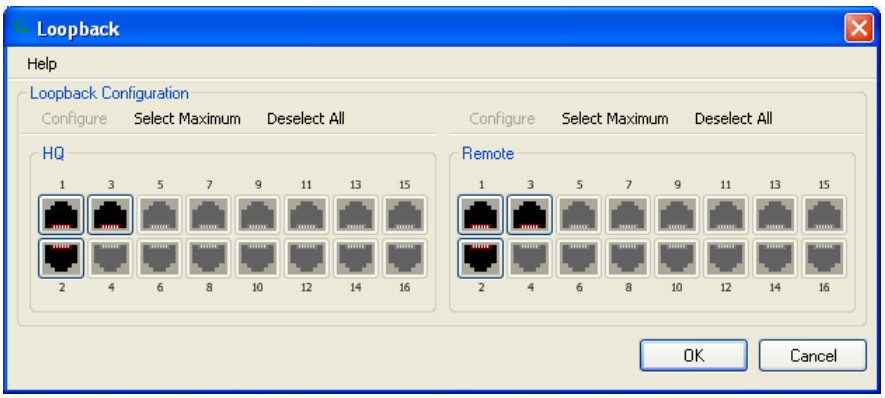


Figure 7-2: Loopback configuration box

   The selected port icons change color as in the following example:

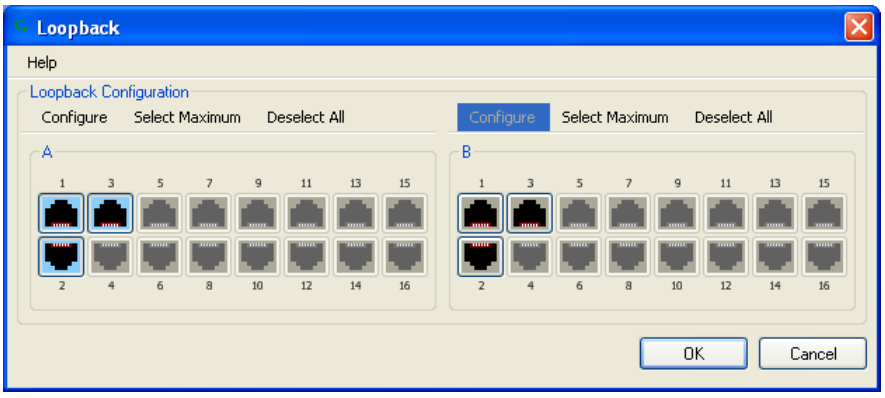


Figure 7-3: Loopback configuration box with three local port selected

Clicking any ony the colored ports or the Configure button will make avaialbe the same choices as appear in **Figure 4-21**.

2. Click **OK** to activate the loopbacks.

   This activates selected loopbacks. The corresponding service channel icons in the main menu changes color and appearance to indicate active loopbacks.

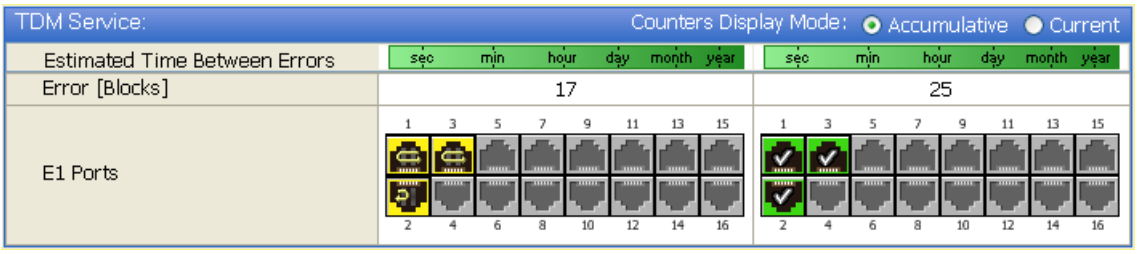


Figure 7-4: Three local ports set to loopback

To deactivate a loopback:

- From the From the Local or Remote Loopbacks dialog box (**Figure 7-3**), deactivate selected loopbacks by clicking them or all of them by selecting Deselect All and then click **OK**.

  When a loopback is deactivated, the corresponding icon in **Figure 7-4** reverts to its previous state (like the left side of the figure).

Local External Loopback

Local external loopback can be set to an external loopback to test the local E1/T1 port and its connection to the 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 management station connected to the local unit.

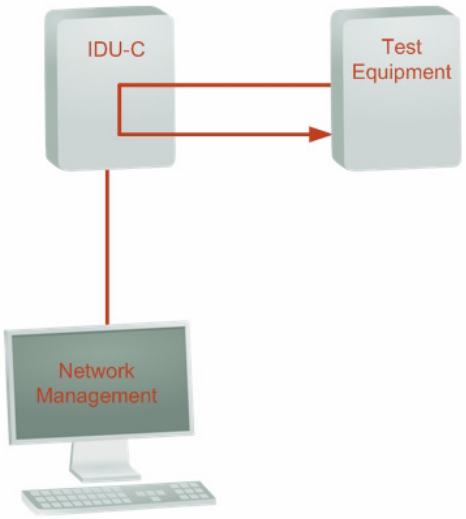


Figure 7-5: Local External Loopback

Remote Internal Loopback

Remote internal loopback can be set to an internal loopback to test connection between the local and remote units, the local E1/T1 port and its connection to the local side user equipment. In this mode, data coming from the local unit is looped back to it. This loopback is initiated in band from a management station connected to the local unit.

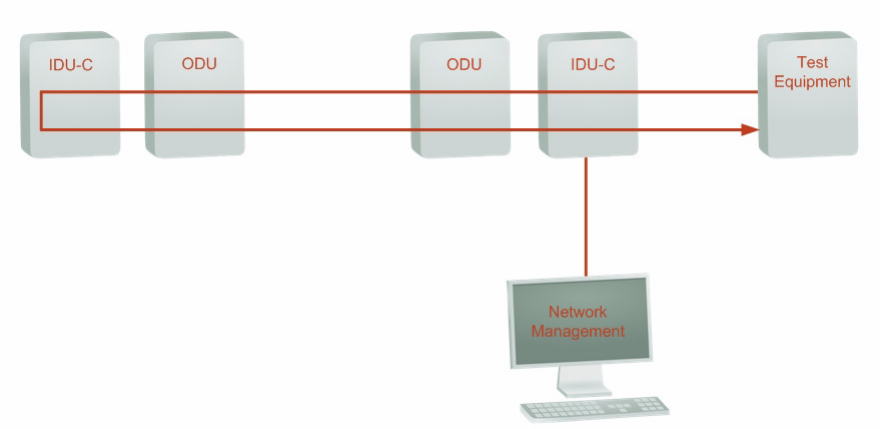


Figure 7-6: Remote Internal Loopback

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. This loopback is initiated by an in band command sent from a management station connected to the local unit.

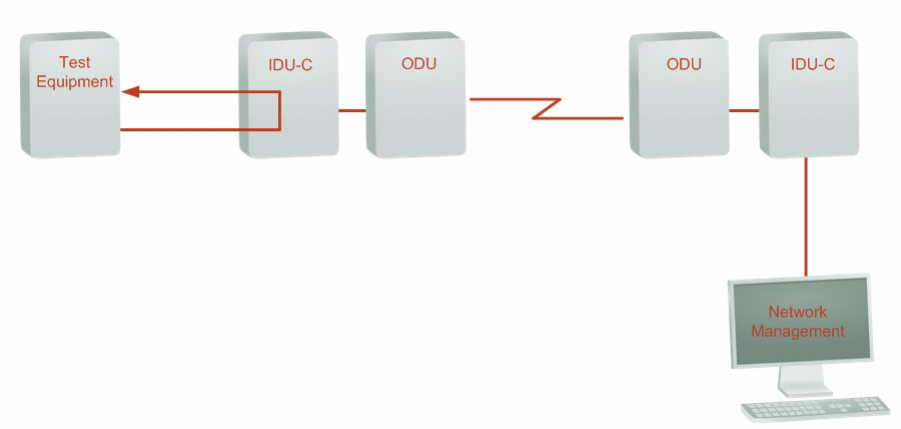


Figure 7-7: Remote External Loopback

Local Internal Loopback

The local unit can be set to close an internal loopback to test connection between the local and remote units, 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. This loopback is initiated by an

in band command sent from a management station connected to the local unit.

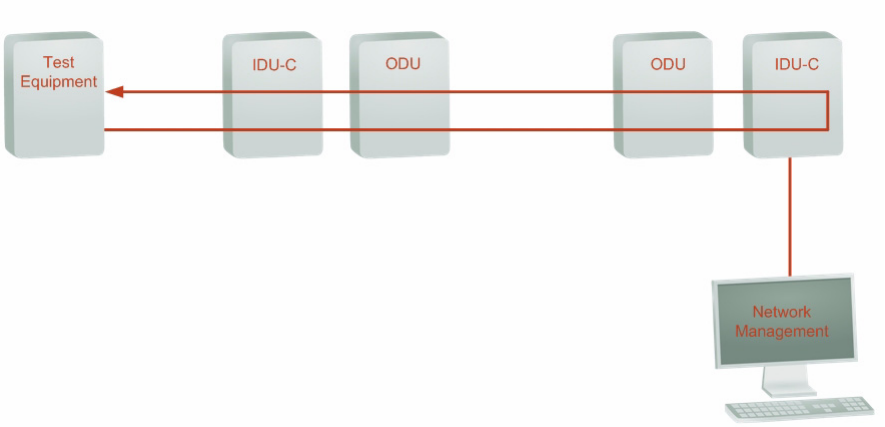


Figure 7-8: Local Internal Loopback

Reinstalling/Realigning the Link

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

Note

Activating Install Mode causes both sites to go into install mode, causing disruption in service for approximately fifteen seconds.

➢ **To reinstall the link:**

1. From the **Configuration menu**, choose a site.

   The Configuration dialog box opens.

2. In the Configuration dialog box, click the **Install Mode** button.

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

3. Click **Yes** to continue.

   The system enters Install mode and the alignment tone becomes audible.

4. Realign the ODUs and start the Installation wizard (see **Chapter 4**).

The Link Budget Calculator

The Link Budget Calculator is part of the MRL Manager software and is found in the Help menu. This useful utility enables you to calculate the expected performance of the wireless link and the possible configurations for a specific link range including antenna size, cable loss and climate conditions.

The Link Budget Calculator enables you to calculate the expected RSS of the link, and determine the stability of services and their effective throughput as a function of the link range and deployment conditions.

The Link Budget Calculator is found on the Installation CD and from tech support so it can be used prior to installation to define and verify link parameters such as expected RSS, maximum range, and number of E1s/T1s that a link is capable of providing. It enables verification of installation quality and provides calculations that consider "real world" factors such as climate.

The Link Budget Calculator screen appears in the following figure.

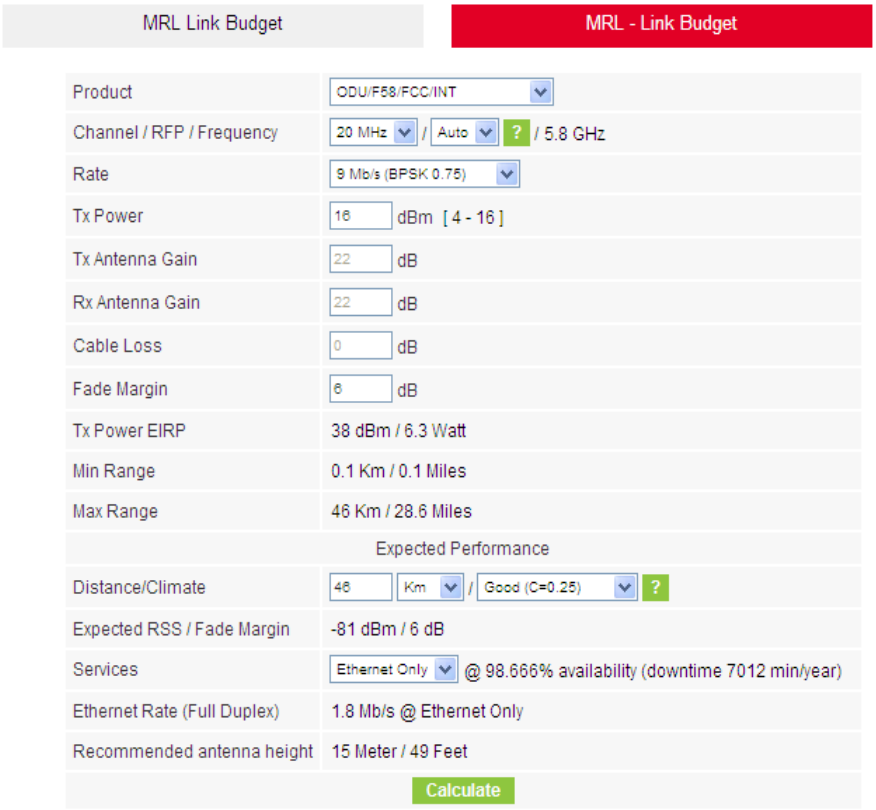


Figure 7-9: MRL - Link Budget Calculator

Performance Monitoring

Performance Monitoring 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).

MRL monitors the Air interface, ETH ports, and TDM trunks. It does so continuously, even when the MRL Manager is not connected.

Two types of logs are recorded:

- **Monitor log** that records statistics on traffic rate and radio signal strength.
- **Events log** that records when the rates fall above or below a predefined threshold.

Both the statistics (monitor) log and event log can be saved as TXT files.

The Monitor Log

The Monitor log records performance statistics for predefined intervals. You can save the monitor log to a text file, as well as display the information in an on-screen report.

Saving the Monitor Log

You can save the recorded Monitor log statistics to a text file.

➢ **To save the monitor log:**

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

   The Preferences dialog box appears:

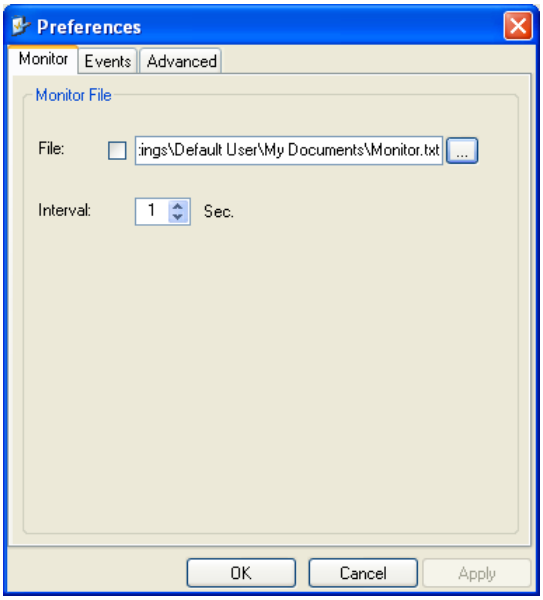


Figure 7-10: Preferences dialog box

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 monitor log file is to be saved.
6. Set the time interval for adding data to the file.
7. Click **OK** to save the file.

Viewing Performance Reports

The Performance Monitor Report displays performance views of each of the interfaces[1]:

1. Ethernet performance is not collected in PoE systems.

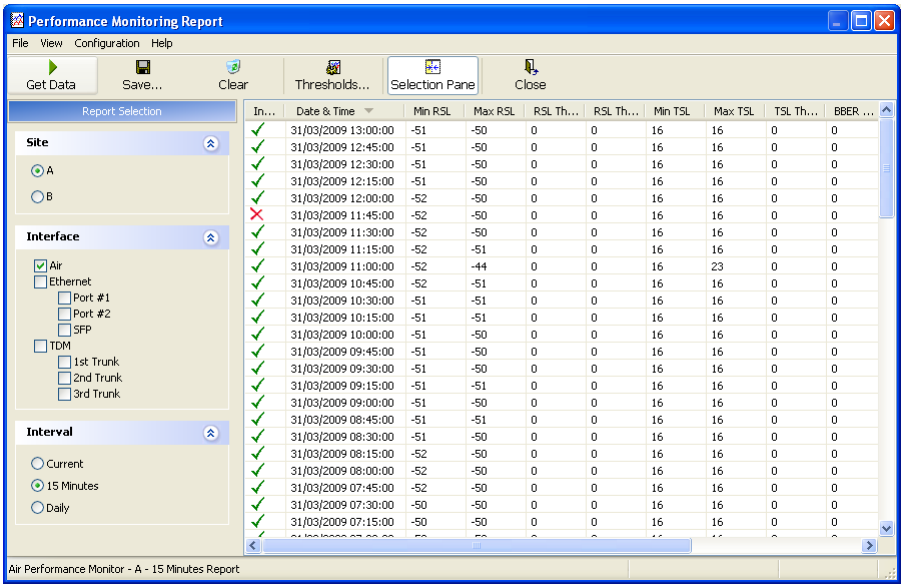


Figure 7-11: Performance Monitoring Report window

Several performance data occurrences 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 7-3** and **table 7-4**, in **Performance Monitoring Report Toolbar** below.

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 potential 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 E1/T1 service the recommended value is 1% (system default). Excellent TDM service is expected below the 1% threshold, meaning that for 1% threshold, the expected BBER value should be 0 if there are no problems during the 15 min interval. If the BBER threshold increases a degraded service might be noticed.

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 the system provides a loss less Ethernet service, there is throughput degradation in case of interference. The degradation is proportional to the BBER.

Radio RSS Threshold - Radio RSS Threshold can also be used to indicate problems in the radio channel. You can verify the RSS according to the link

budget calculator during the installation. A value of -5dB from the current RSS is recommended as a threshold.

Table 7-3: Explanation of performance data

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[a].
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)[b].
	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. Note, that the system is design for excellent quality of service with BBER of less then 1%. (at 1% BBER expected TDM BER is less than 1E-6.
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 transmitted in the specified port within the interval.

a. Possible reasons are: Clock changes within the interval and Power up reset

b. The transmit power is fixed. The value can be changed only by user configuration

Performance Monitoring Report Toolbar

You can use the toolbar to perform the actions described in the following table:

Table 7-4: Action of the toolbar buttons

Command Button	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.

Setting Air Interface Thresholds

You use the Thresholds button on the Monitoring Performance Report toolbar to set the Air Interface Thresholds:

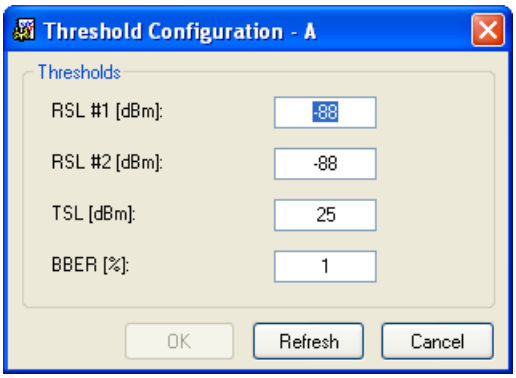


Figure 7-12: Threshold configuration dialog box

The Events Log

The Events log records system failures, loss of synchronization, loss of signal, and other events as described in the following table.

Table 7-5: Alarms and Information Messages

Message	Description
Radio Link – Sync	Radio link is synchronized
Radio Link – Out Of Sync	Radio link lost synchronization
Link Has Been Reset	ODU was reset due to internal problem
TDM Interface – Normal	TDM interface is operating properly
TDM Interface – LOS	Loss of Signal is reported by TDM interface
TDM Interface – AIS	Alarm Indication Signal is reported by TDM interface
TDM Interface – Loopback	A loopback is active on TDM interface
Link Resetting	Wireless link reset from the management station. This alarm is caused by automatic reset after link configuration.
Local ODU Resetting	The local ODU reset from the management station.

Table 7-5: Alarms and Information Messages

Message	Description
Monitor was stopped since no connection to the link	No ODU-to-IDU traffic was detected during the last 20 minutes.
TDM Service – Normal	TDM service is operating properly
TDM Service – Alarm	Error has been detected on a TDM line
Configuration problem detected	The link needs to be reinstalled
Channel Scanning in progress	The ODU is scanning the channels for the remote ODU
Transmitting on <frequency> GHz	The ODU is transmitting on the frequency channel listed
Radar activity was detected in <site>, on channel <frequency> GHz	For DFS versions only. Radar is detected; the channel is prohibited for 30 minutes.
Monitoring fo Radar activity on channel <frequency> GHz	For DFS versions only. ODU is looking for Radar activity.
Bit Failed indication	Indicates ODU hardware problem. Send error code to Technical Support.
Link Status	Indicates incorrect connection or incompatibility between versions. Available in 1.620 versions and above.
Site Status	Indicates incorrect connection or operation at the site. Available in 1.620 versions and above.

The events are displayed in the Events log in the lower part of the MRL Manager Main menu:

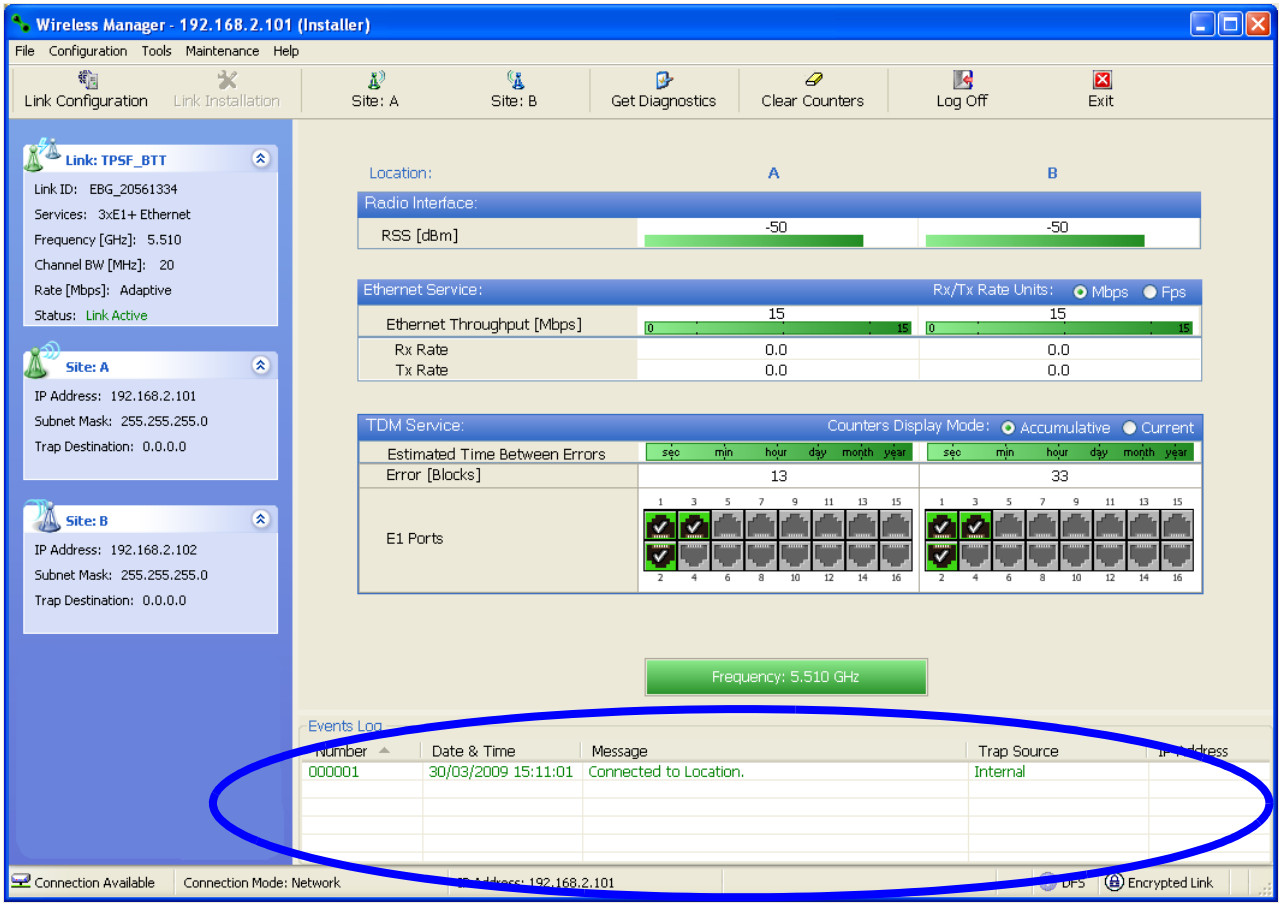


Figure 7-13: Events Log Display

Setting the Events Preferences

You can define a color for the traps to be displayed in the Active Alarms screen, according to the 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:

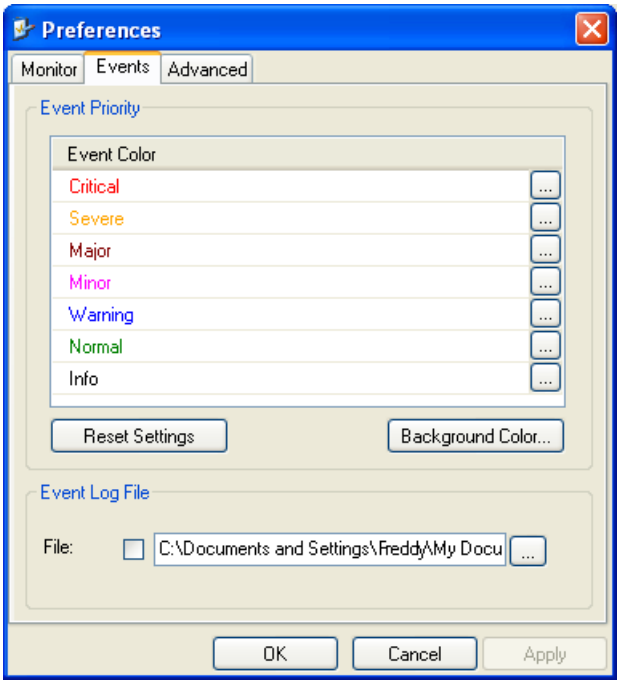


Figure 7-14: Preferences dialog box

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

You can save recorded events in an Events log text file. New alarms are automatically added to the text file, as they enter the event log.

To save the event log:

1. From the Tools menu, choose Preferences.

The Preferences dialog box appears

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.

Error Detection and Alarms

MRL™ Error detection and Alarms detect compatibility problems, fault conditions of the radio or user links, and subsequently 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 **Defining the Management Addresses** on page **6-14** 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.

To view summary of saved alarms:

- From the Tools menu, choose Active Alarm Summary.

  The Active Alarms Summary window opens:

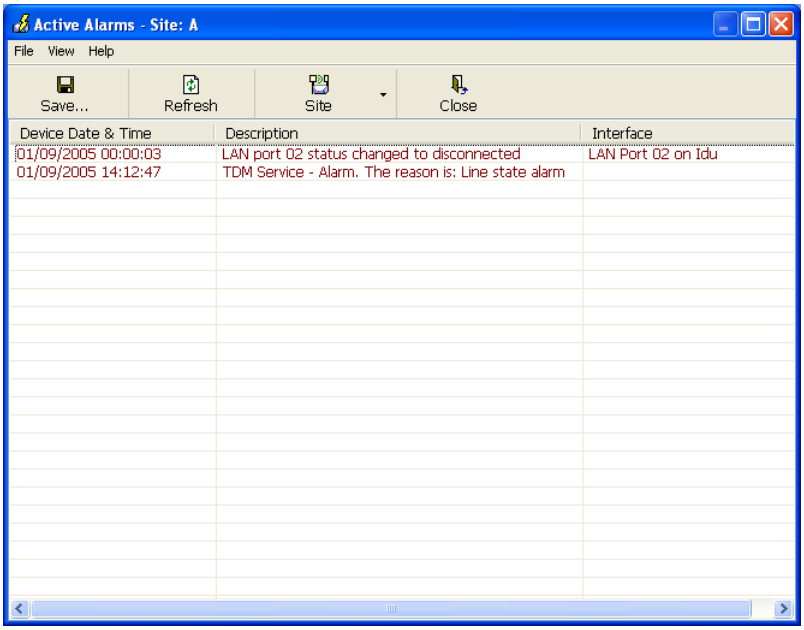


Figure 7-15: Active Alarms Summary

The following table provides an explanation of the command buttons

Table 7-6: Active Alarms command buttons

	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.

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 number 4 indicates link loss due to power failure at the remote end.

Chapter 8

Security

MRL Security

MRL's integrated advanced encryption support provides enhanced air interface security for carriers and private networks by ensuring 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.

Initial encryption and authentication is based on a user-defined master key (Link Password). While standard Wireless LAN encrypts only the Ethernet Payload, the AES encrypts both the source and destination MAC addresses.

Entering and Changing Passwords

There are two passwords necessary to use the MRL system:

- Management Password required for running the Management software
- Link Password used for encryption purposes. This link password is entered when installing or configuring the link.

Changing the Management Password

➢ **To change the management 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.

Changing the Link Password

The Radio Link is encrypted using the Advanced Encryption System (AES) using a 128 bit dynamic key. During the installation process, you must enter a Link Password. An Initial encryption key is then generated. Each time a link is established, the system validates the Encryption key. If the validation fails, the link is established but no service or configuration is allowed. In this state, you can change the link password for each of the sites.

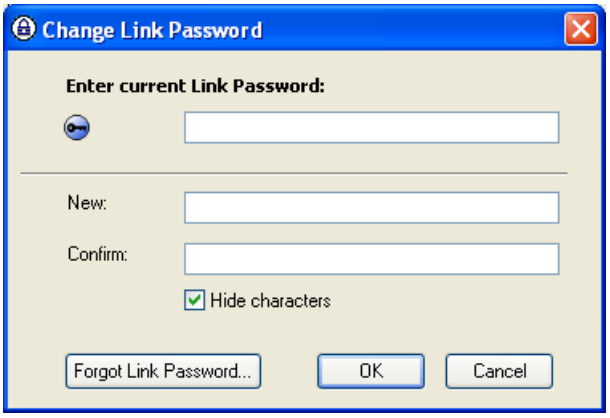
Note

Returning to factory defaults returns the Link Password to the default password **wireless-bridge**.

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.

Forgotten Link Password

In case of a forgotten link password, you may enter the key password supplied with the product. The key password may be obtained from customer support after validation of the device serial number or MAC address. You 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.
3. The Change Link Password dialog box appears.
4. Click the Forgot Link Password button.

The Key Link Password dialog box appears.

5. Type the key link password.
6. A new link password may now be set.

Chapter 9

Diagnostics and Troubleshooting

Diagnostic Tables

Use the following tables to diagnose any faults in the system.

Table 9-1: 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 ODU alignment. Check that the radio configuration of both site A and site B units are the same (channel and Link Name).
Weak signal	Verify the ODU alignment, reconfigure the link.
	Verify the alignment tone sounds the Best Signal sequence.

The LEDs show faults in the system or the link.

LED	Status	Remedy
PWR	Off	Check that AC adapter is connected to the IDU-E and the AC power outlet.
IDU	Orange	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 management software.
	Red	Check the ODU Antenna alignment. Check that the radio configuration of both site A and site B units are the same (channel and Link Name).

	Off	Check the TDM service configuration in the NMS.
SERVICE	Orange	Check that the system is not in loopback mode. Check the site B IDU ports and cables and site B external equipment.
	Red	Check the site A IDU ports, cables and external equipment.

Replacing an ODU

Prior to any action verify that both ODUs have the same software version (Configuration > Configure site xxxxxx>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 in 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 Link Name, channels, link password, IP addresses, and names.

Restore Factory Setup

The Restore Factory Setup feature is available from version 1.6xx forward. To use this feature, we recommend performing the following sequence:

1. Set the remaining ODUs back to the factory setup by using the Configuration>Configure site>Advance option.
2. Activate the second ODU and reconfigure the link from scratch.

Frequently Asked Questions

Q: What performance issues will arise due to environmental conditions?

The system 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. This can be accomplished by using higher gain antennas.

Q: When using the MRL, what is the potential for interference between our system and other cellular or wireless Networks devices?

The MRL is a robust system. However since it operates in unlicensed ban, interference can occur. Nevertheless, the fact that we can manually set the frequency to one of 5 (6) non-overlapping channels gives you the flexibility to find a clean channel. In addition, each MRL link incorporates Forward Error Correction and adaptive modulation to mitigate interference.

Q: What protocol does the MRL use,e.g. 802.11?

MRL uses a proprietary protocol; this protocol contains improved options that more efficiently support the clock reconstruction from the TDM services.

Q: What type of security is offered on MRL?

MRL has three levels of security:

1. AES hardware mechanism
2. Each unit uses a unique Link Name 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?

Installing two MRL systems in the same band with cross polarization provides 20-25 dB separations. However, spatial separation is a superior method and 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?

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 mange MRL using RNMS instead of the supplied management software that comes with the units?

Yes. The MRL is SNMP-based. The MRL can be managed when using other SNMP software after implementing MRL MIB's.

Q: Can I use the MRL with any vendor's external antenna?

MRL supplies the MRL external ODU with an N-type typical connector. Any vendor's external antenna that is of the same type and of equal or less directional gain as an antenna that MRL authorized with its specific external ODU product, can be used. This is provided that it can be cascaded to our external unit. Please note that db losses in the cascading table between the external ODU and the antenna should be taken into consideration. (In the supplied cascading cable of one meter we have 1 dB loss).

Q: Do we need to add external arrestors on MRL cables?

Although the MRL™ ODU includes arrestors and lightening protection, it is suggested to implement external lightning/grounding suppression. see **Appendix C**, **Lightning Protection and Grounding Guidelines**.

Q: What is the actual Ethernet data rate and maximum throughput?

The maximum net throughput of the MRL is full duplex 18 Mbps.

The MRL is a symmetrical system meaning that 18Mbps is provided in both directions.

Q: What is the sensitivity for each rate of the MRL?

The rate sensitivities for a 20MHz channel are:

Rate [Mbps]	**Sensitivity** [dB]
12	-84
18	-81
36	-74
48	-68

Q: Does MRL withhold any MAC Addresses?

The MRL is a layer 2 Bridge (VLAN transparent). The built-in switch contains a MAC Address table up to 2047.

Q: Can I use any category 5e cable in order to connect the IDU and ODU?

The cable should be suitable for outdoor use, and shielded Category 5e.

Q: What are the BER values expected in the MRL link?

10-11 (according to BER sensitivity threshold)

Q: Does MRL use DSSS technique?

No, MRL uses the advanced OFDM technique.

Q: What are the advantages of the MRL solution over other possible alternatives (e.g., wireline, wireless, etc.)?

Advantages include the following:

- Easy and intuitive installation using audio indication.
- Easy configuration using the management software of overall link site-to-site, there is no need to travel between the two sites in order to change the configuration.
- Easy migration between transmission channels.
- Backup option - backup and restore using .ini files.
- Very light ODU (1.5 kg). Low wind-loading
- No RF loss between IDU and ODU. Smaller antennas can be used
- Robust Air Interface Layer 2 ARQ insures "error-free" Ethernet service even in harsh conditions. Retransmit mechanism for TDM ensures low BER.

- Integrated E1/T1 and Ethernet radio over one single product.
- Supports simultaneous Voice and Data applications with a single radio - no need for external mediation device.
- Smooth migration to VoIP applications.
- Carrier class compliant with ITU standards for E1 and T1.
- Low and constant TDM latency (8 msec).
- Extremely accurate recovered clock low cost replacement to PDH radios.

Online Help

Online help can be accessed from the Help menu on the main screen of the MRL Manager.

Figure 9-1:

Technical Support

Technical support for this product can be obtained from the local VAR, Integrator or distributor from whom it was purchased.

MRL

Part 2: Advanced Installation

Broadband Wireless Transmission

User Manual

Version 1.8

UM 2000-22/03.09

Appendix A

Mast and Wall Installation

The ODU or O-PoE can be mounted on a mast or a 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.)**

ODU or O-PoE Mounting Kit Contents

The ODU or O-PoE mounting kit includes the following items:

- One Large Clamp (see **Figure A-1**)
- One Small Clamp (see **Figure A-2**)
- One Arm (see **Figure A-3**)
- Four Screw hex head M8x40
- Two Screw hex head M8x70
- Four Washer flat M8
- Three Washer spring M8
- Two M8 Nuts

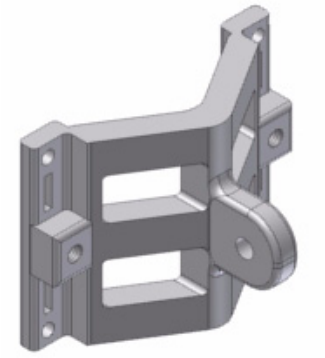


Figure A-1: Large Clamp

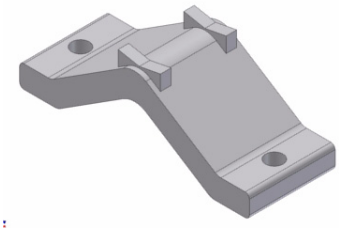


Figure A-2: Small Clamp

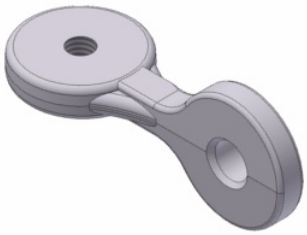


Figure A-3: Arm

Mounting MRL on a Mast

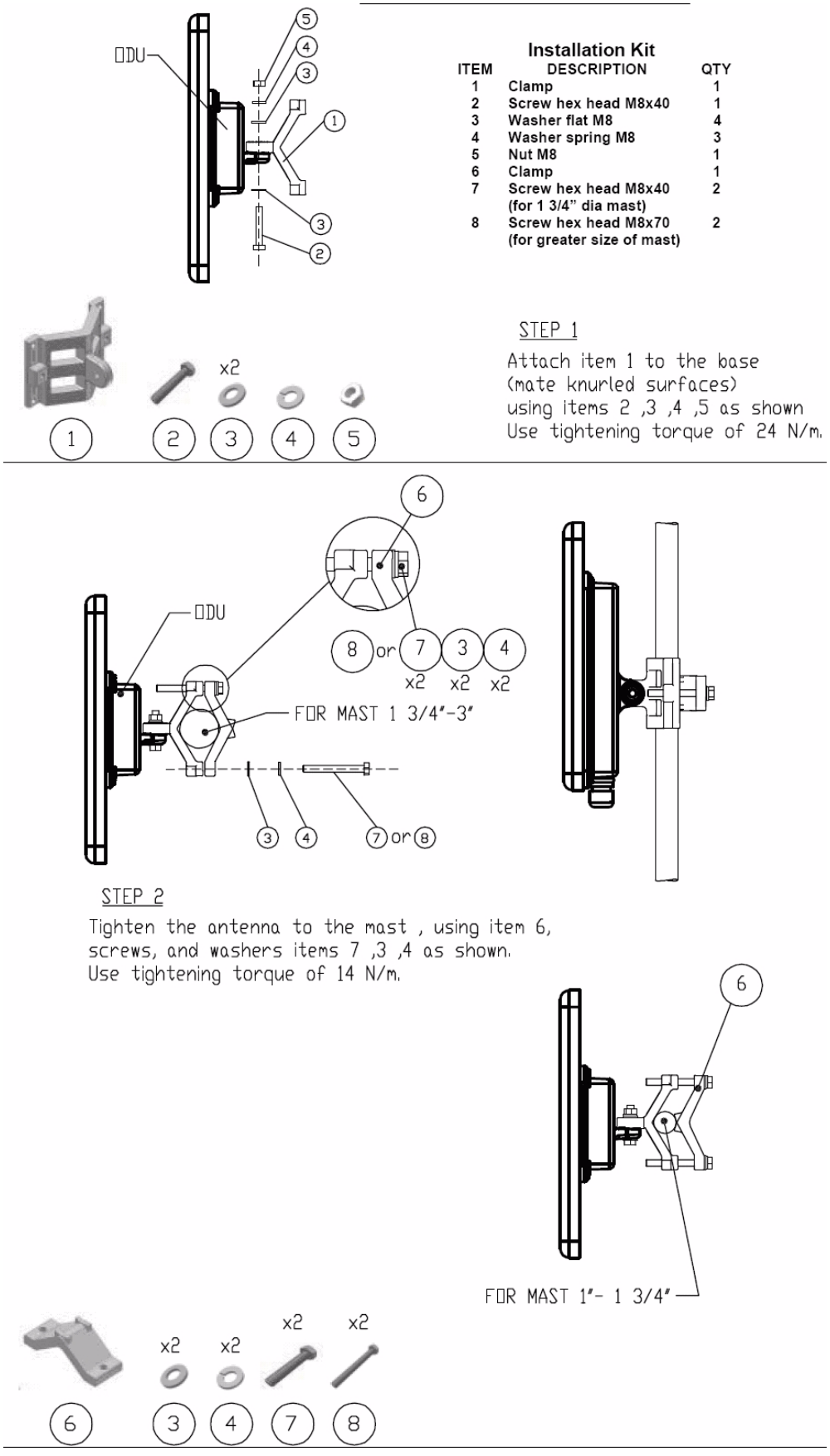


Figure A-4: Mounting on a Mast

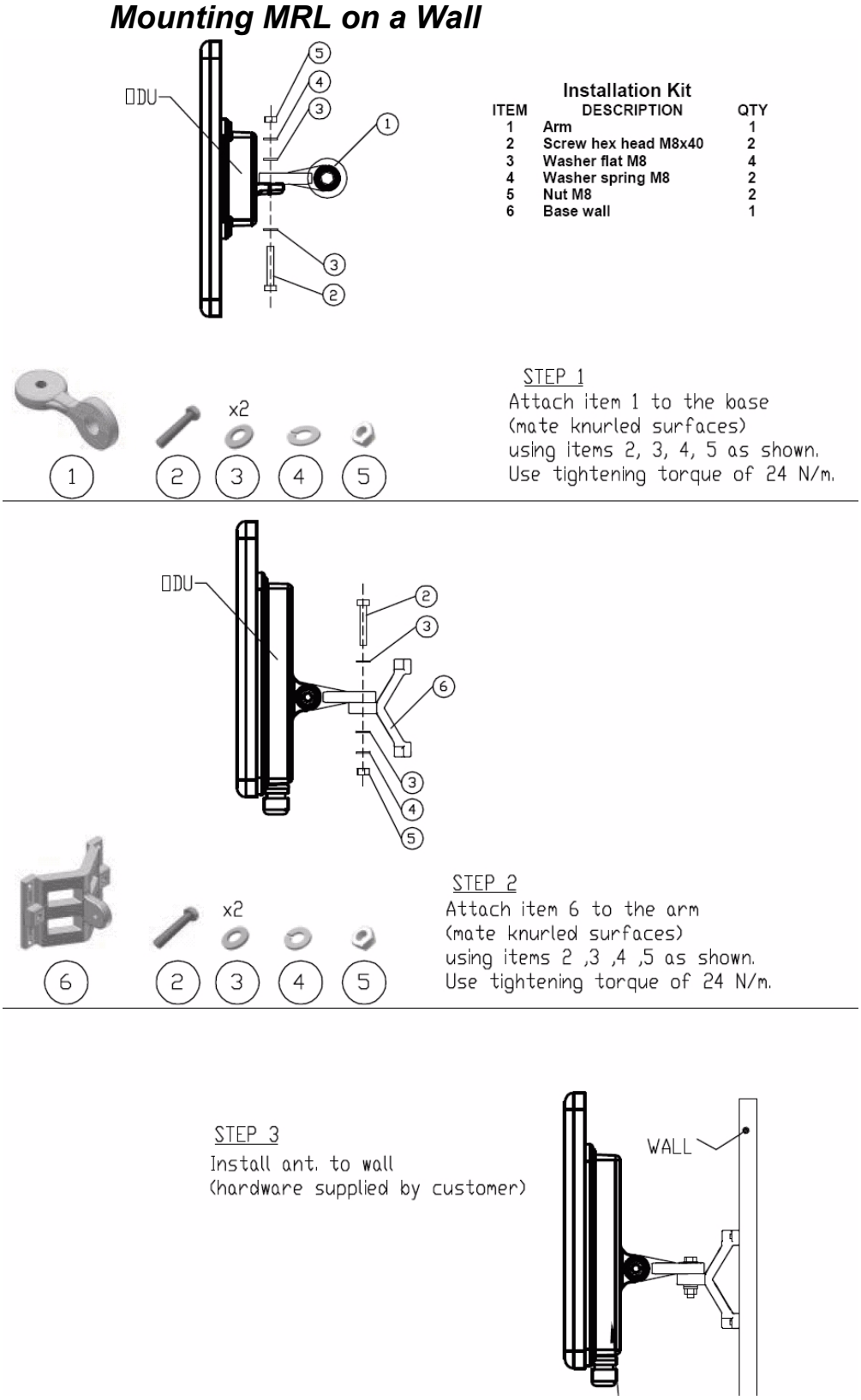


Figure A-5: Mounting on a Wall

Mounting an External Antenna

The optional external antenna can be mounted on a mast.

External Antenna Mounting Kit Contents

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.

Appendix B

Link Budget Calculator

Overview

The Link Budget Calculator is a utility for calculating the expected performance of the MRL 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.

User Input

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.

- Band, which determines frequency and regulation
- Channel Bandwidth (fixed to 20 MHz for MRL)
- 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
- Required Range

Link Budget Calculator Internal Data

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 and configured TDM trunks 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. Using the notation of figure **B-13** below, splitting *ExpectedRange* into $d_1 + d_2$, the ***Fresnel zone height*** at distance d_1 from the left hand antenna, is given by

$$0.6 \times \sqrt{\frac{\frac{300}{frequency_{GHz}} \times d_1 \times d_2}{d_1 + d_2}}$$

For the most conservative setting, we take the mid-point between the antennas, setting $d_1 = d_2 = \frac{ExpectedRange}{2}$

which gives $0.6 \times \sqrt{\frac{\frac{300}{frequency_{GHz}} \times \left[\frac{ExpectedRange}{2}\right]^2}{\frac{ExpectedRange}{2} + \frac{ExpectedRange}{2}}}$

simplifying to $0.52 \times \sqrt{\frac{ExpectedRange}{frequency_{GHz}}}$.

The ***boresight clearance height*** is calculated as:

$$\sqrt{R^2_{Maean} + \left[\frac{ExpectedRange}{2}\right]^2} - R_{Maean}$$

where $R_{Mean} = 6367.4425Km$.

Running the Link Budget Calculator

The Link Budget Calculator is supplied on the MRL Manager CD. It may be run stand-alone from the CD or from the MRL Manager application.

➢ **To run the Link Budget Calculator from the CD:**

1. Insert the MRL Manager CD into the drive on the managing computer. In the window which opens, click the Link Budget Calculator option.
2. If the CD autorun application does not start by itself, then point your browser to

   Z:\MRL\Setup\DATA\Link Budget Calculator.htm

   where Z should be replaced with your own CD drive name.

To run the Link Budget Calculator from the MRL Manager:

- Choose **Help | Link Budget Calculator** from the main menu of the MRL Manager as in the following figure:

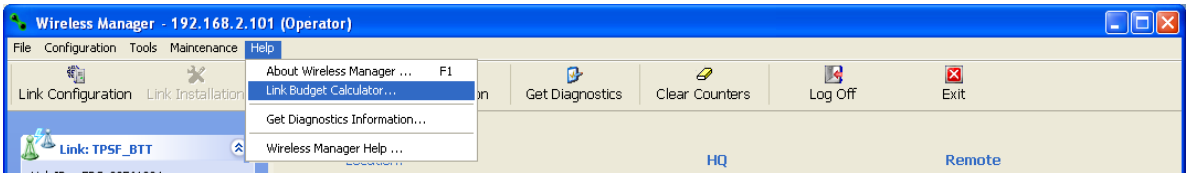


Figure B-1: Accessing the Link Budget Calculator

However invoked, your browser displays the following page:

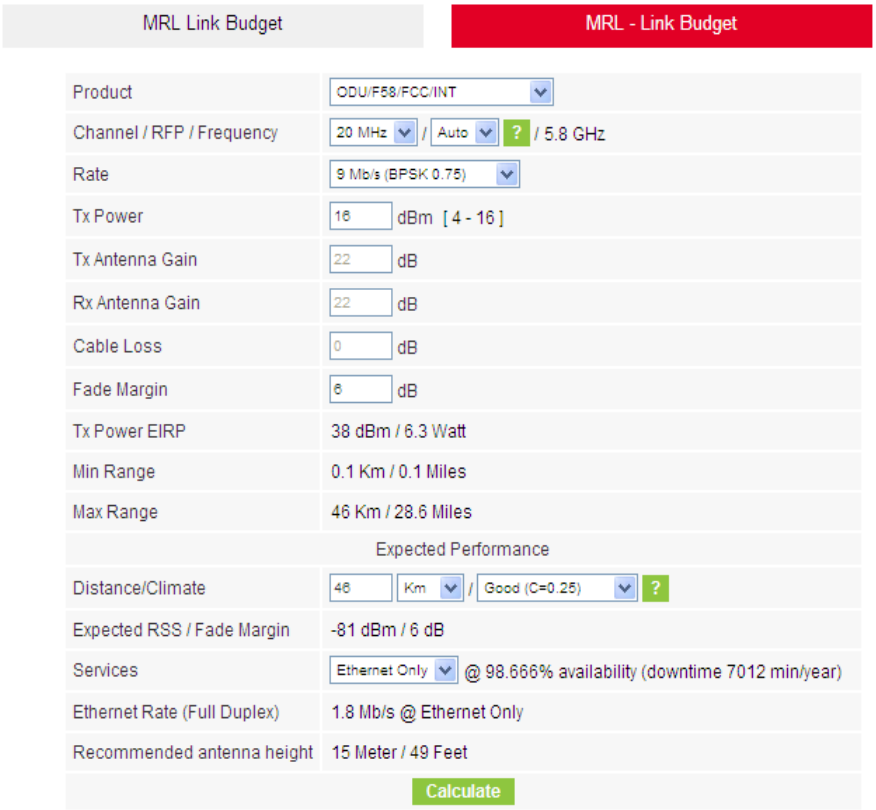
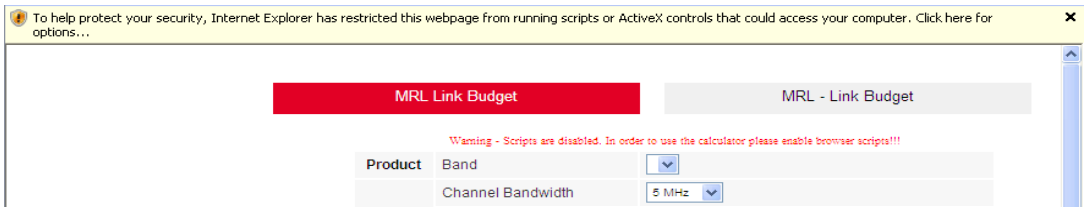


Figure B-2: Link Budget window

- Microsoft Internet Explorer users may see a warning message like this:



Note

Click the yellow bar and follow the instructions to allow blocked content. Click the left hand tab to display the MRL calculator.

- Mozilla FireFox and Google Chrome users may see a warning message like this:

You may ignore it and continue by clicking the left hand tab to display the MRL calculator.

To use the Link Budget Calculator for MRL:

1. Choose a band from the drop-down list.

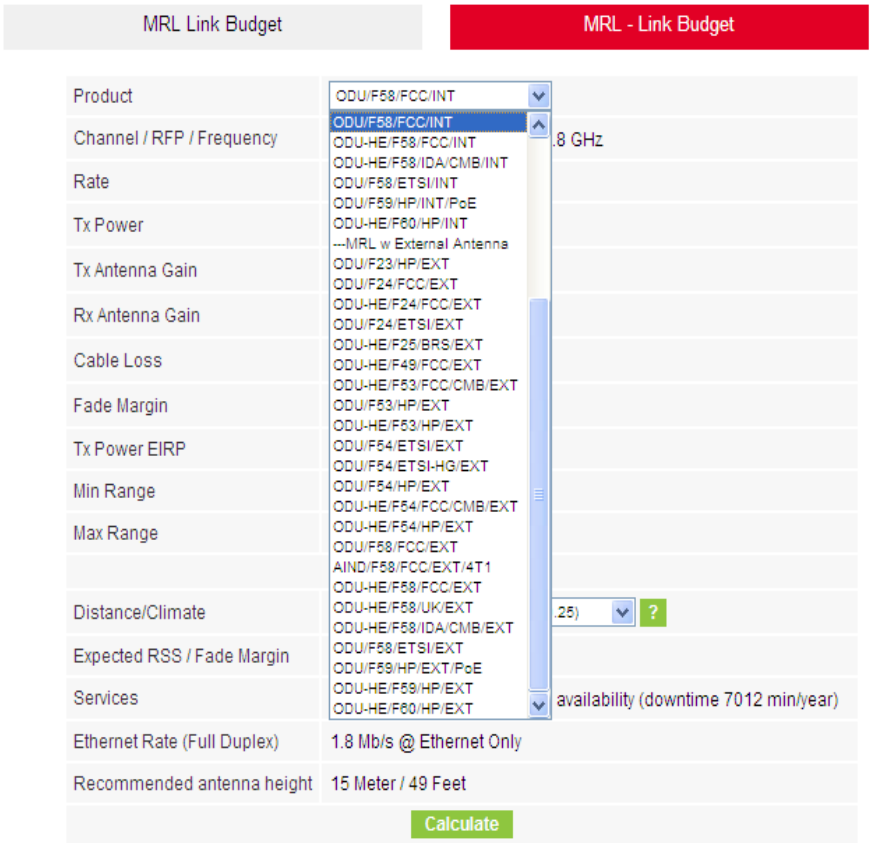


Figure B-3: Product selector

2. Enter the radio details. Note that Channel, RFP, Frequency and Rateare chosen from a drop-down lists:

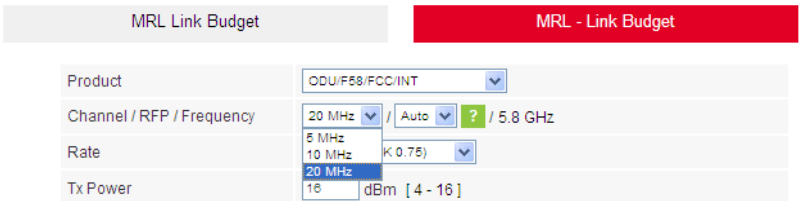


Figure B-4: Channel selector

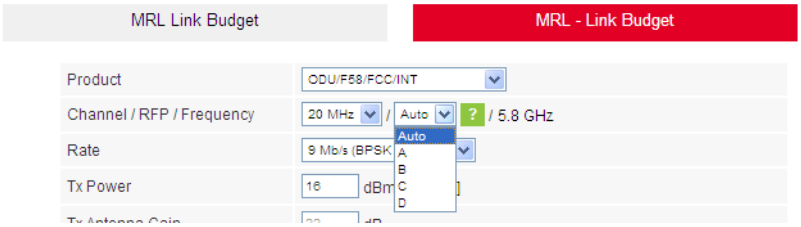


Figure B-5: RFP selector

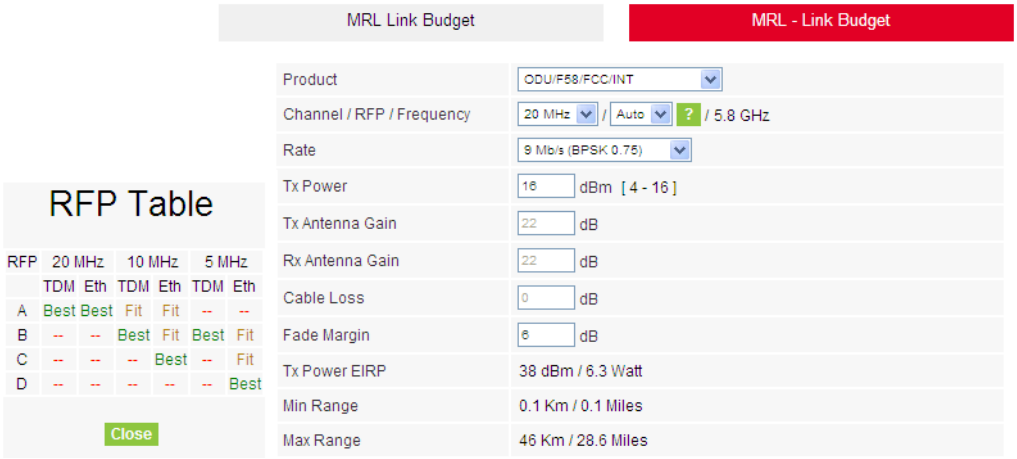


Figure B-6: RFP selection help table

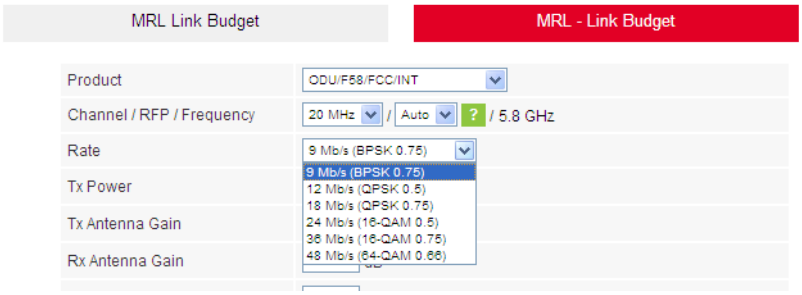


Figure B-7: Rate selector

3. Complete parameter entry using further selctors as shown:

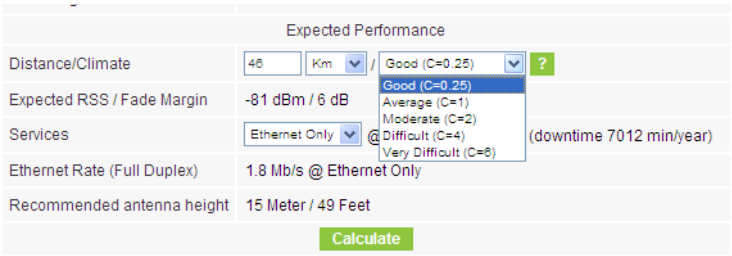


Figure B-8: Climate/terrain factor delector

Figure B-9: Climate/Terrain factor help

In **Figure B-10** we display a map of the world showing C Factor contours:

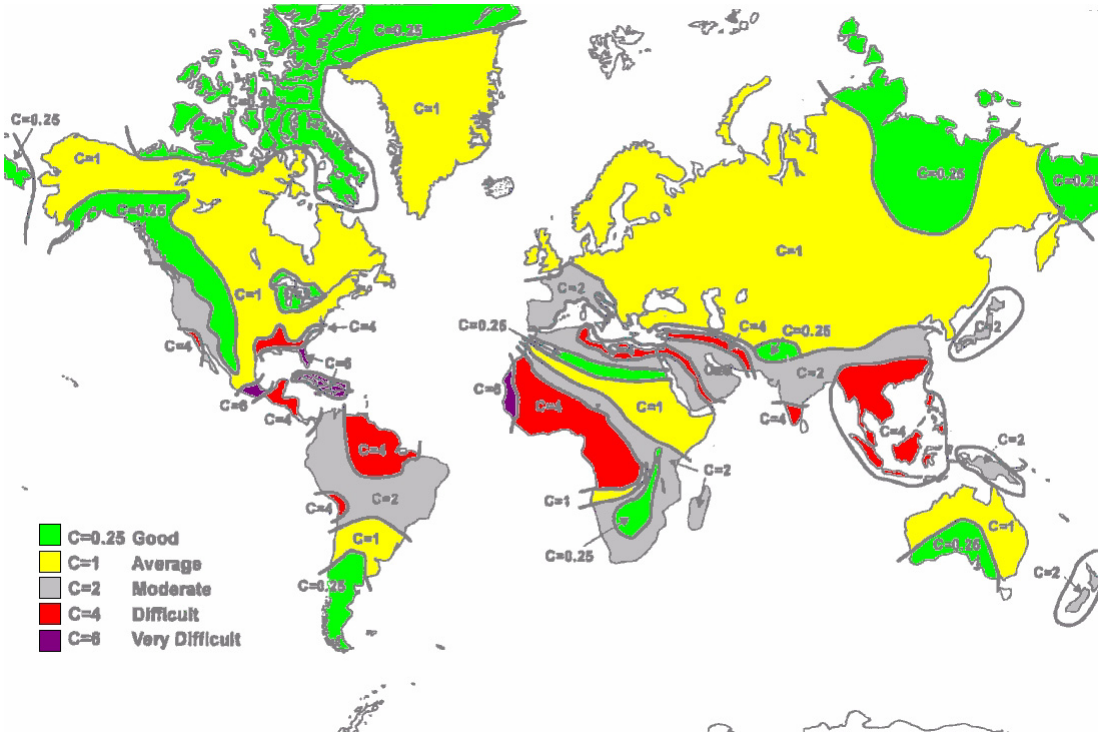


Figure B-10: World map showing C Factor contours

Figure B-11: Distance units selector

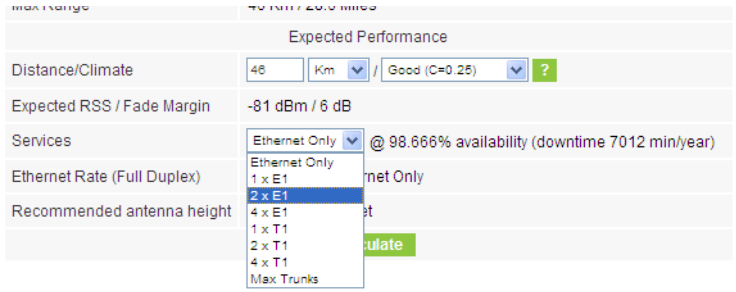


Figure B-12: Services selector

The **Rate** shown, defines the air-interface rate in Mbps. The system operates in TDD mode and has the overhead of the air-interface protoco.l Thus, the Ethernet actual throughput is provided by the **Ethernet Rate**.

Note

For a given air-rate, Ethernet throughput will decrease 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.

4. Click **Calculate** to obtain the required performance estimate.

Note

Placing the cursor in any other calculated field will also update the calculated results.

The Expected Performance parameters are calculated and displayed:

- **Expected RSS** - the expected RSS that the MRL Manager shows when the MRL 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.

About the Fresnel Zone

The Fresnel zone (pronounced "frA-nel", with a silent “s”) 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.

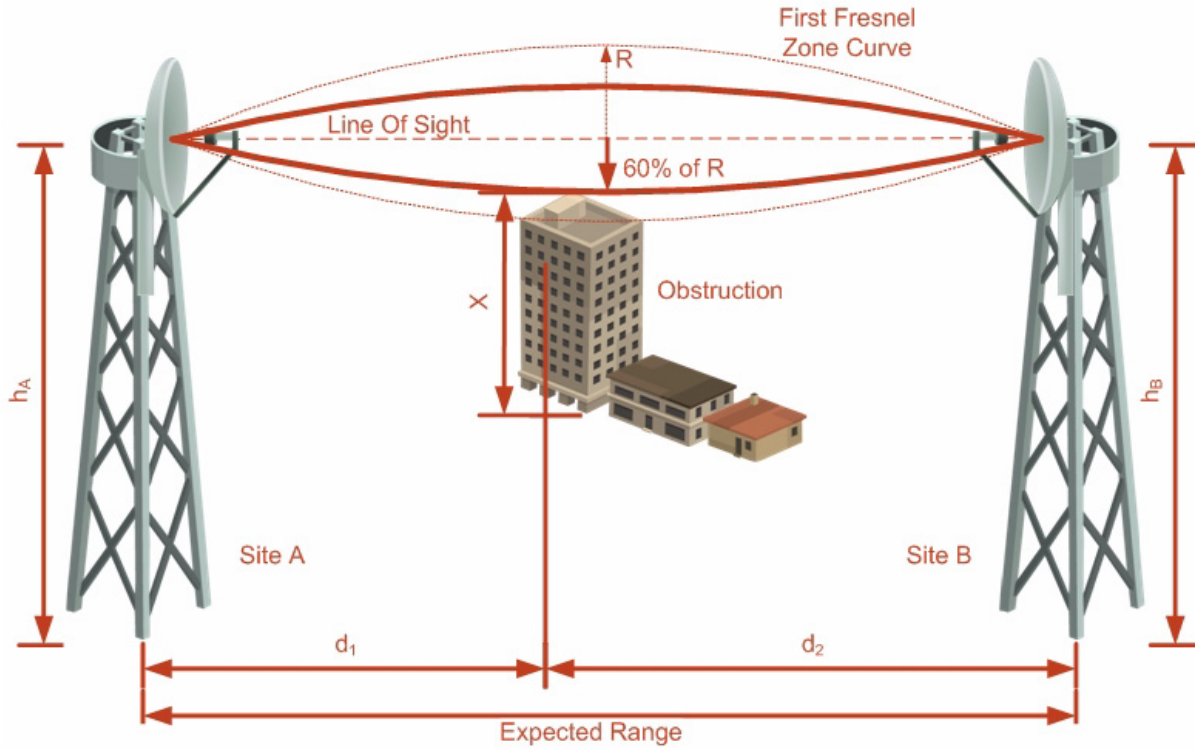


Figure B-13: Fresnel zone

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 B-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.

For more about Fresnel zone, see **http://en.wikipedia.org/wiki/Fresnel_zone**.

Appendix C

Lightning Protection and Grounding Guidelines

About this appendix

This appendix is -

- Generic, applying to all MRL radio products.
- At best a guide. The actual degree of lightning protection required depends on local conditions and regulations.

Otherwise, meticulous implementation of the guidelines in this appendix will provide best protection against electric shock and lightning.

100% protection is neither implied nor possible.

MRL™ Lightning Protection Components

The MRL™ 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

Grounding for Antenna Cable

A Grounding Kit must be connected to the coax antenna cable and reliably grounded as shown in Figure X. The grounding kit is an Andrew Type 223158-2 (**www.andrew.com**). See figure **C-1** below.

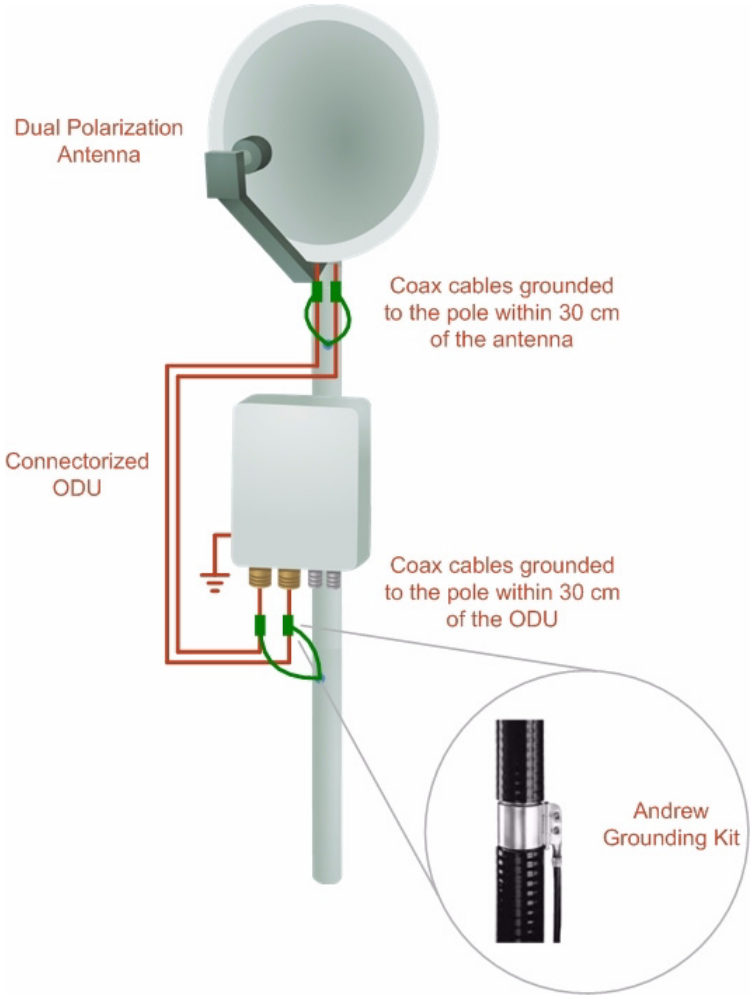


Figure C-1: Grounding antenna cables

Grounding for Indoor/Outdoor Units

ODU Grounding

MRL™ 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 can not 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 should 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 should be permanently connected to ground.

External Lightning Surge Suppressors and Grounding

A Grounding Kit and Surge Arrestor Unit must be located near the ODU and properly grounded as illustrated in figures **C-2** and **C-3** below:

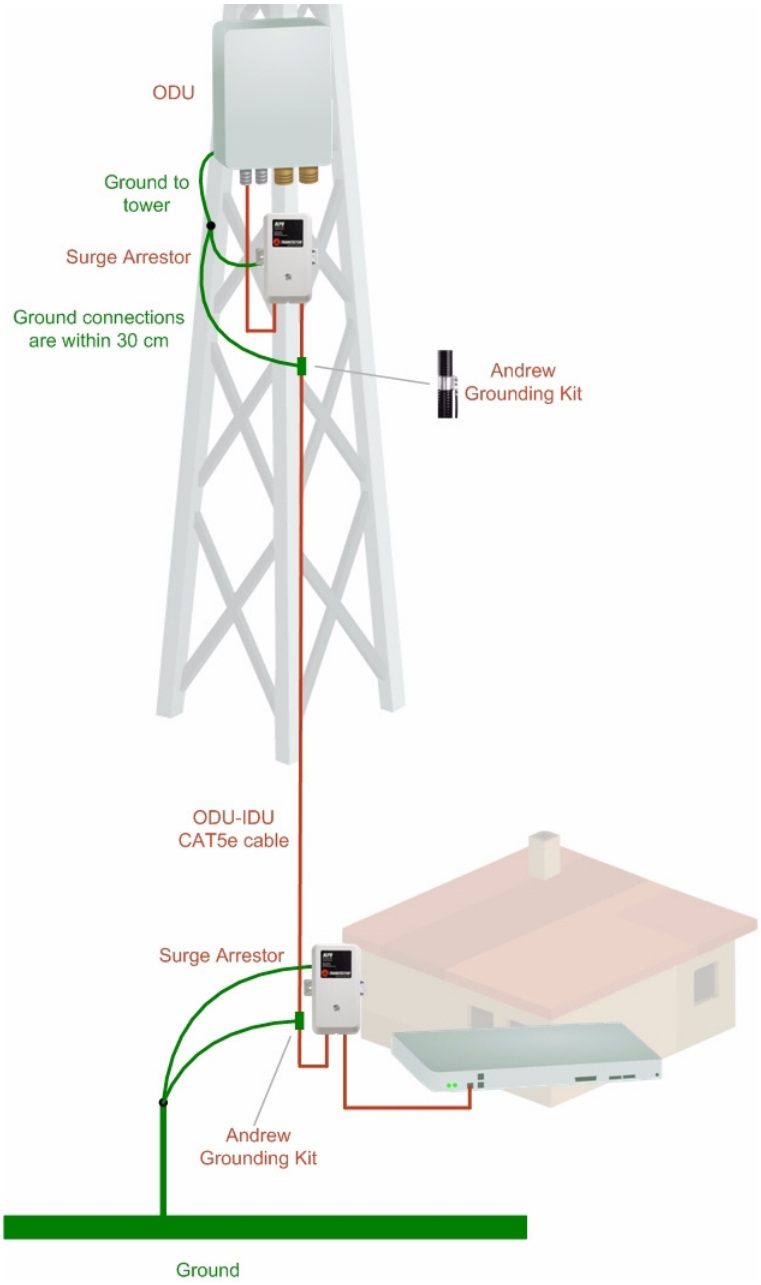


Figure C-2: Grounding a typical pole installation

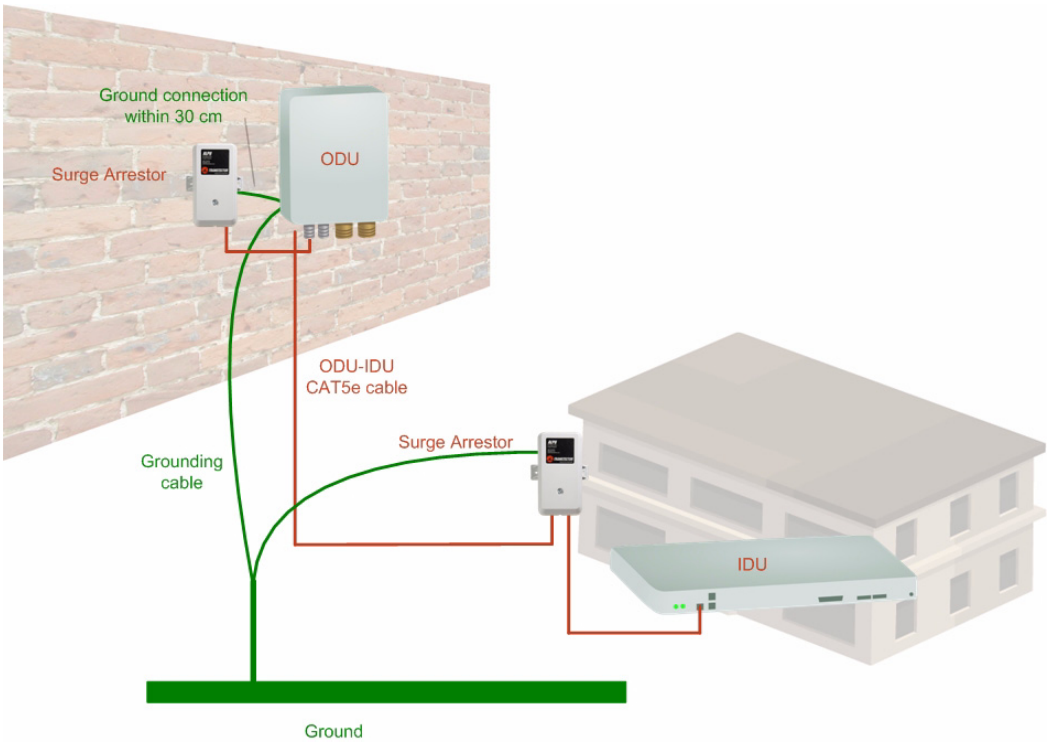


Figure C-3: Grounding a typical wall installation

The next figure shows a close-up of the rear of grounded ODU:

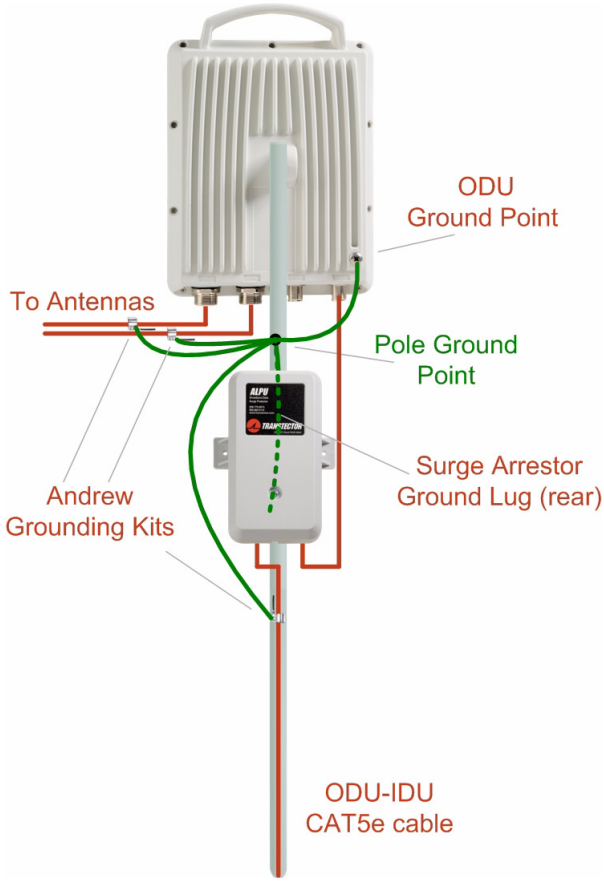


Figure C-4: ODU Surge Suppressor and grounding

The Transtector protection circuits shown in figure C-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 & 3,6) and DC power (pins 4,5 & 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 C-5: Transtector's 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'), between the stud and the site grounding point.

7. Replace the cover.

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 **C-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

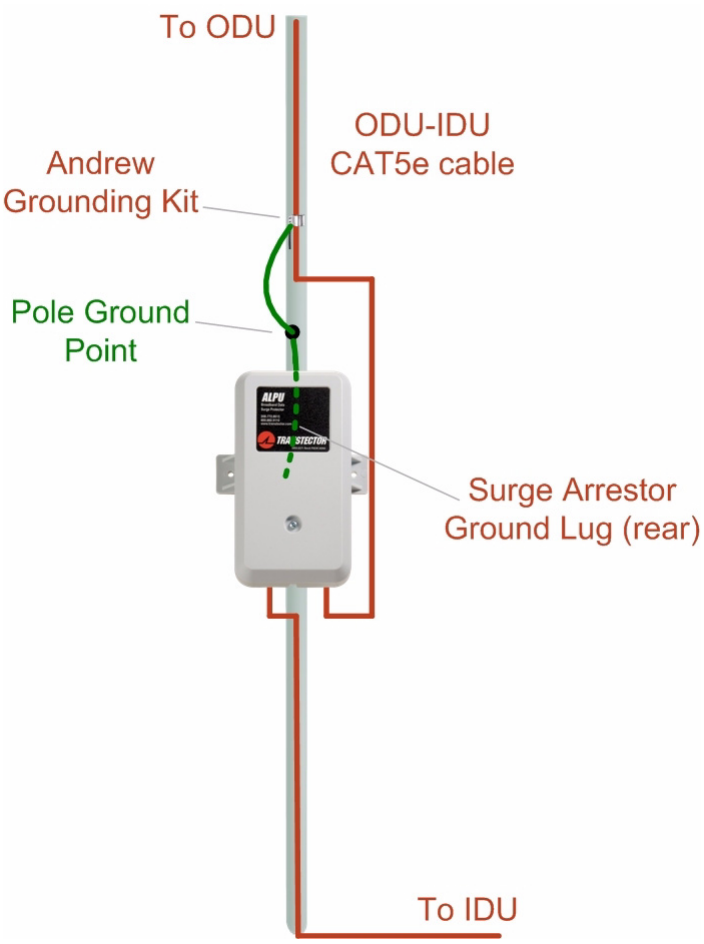


Figure C-6: Surge Suppressor and grounding at building entry point

Internal ESD Protection circuits

MRL™ is designed to meet the ETSI/FCC/Aus/NZ/CSA EMC and Safety requirements. To fulfill these requirements, the system's Telecom lines at the ODU/IDU are Transformer-isolated and include internal ESD (Electro-Static-Discharge) Protection circuits.

Appendix D

Preloading an ODU with an IP Address

Why this is Needed?

All ODUs supplied by MRL 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 set out in chapter **5**.

This appendix explains how do achieve the same thing in the field.

Required Equipment

The minimal equipment required to pre-load an ODU with an IP address is:

- Laptop computer (managing computer) satisfying the requirements of table **4-1**
- An installed copy of the MRL Manager
- A PoE device
- A crossed Ethernet LAN cable
- An IDU-ODU cable
- If you have connectorized ODUs, two N-type RF terminators

The procedure

To Preolad 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.
3. Connect the Poe device to AC power.

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 other people.

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 MRL Manager.
6. At the log on window, choose Local Connection.

Figure D-1: Log on Window for Local Connection

7. Enter the default password, ***admin***. After a few moments, the MRL Manager main window appears:

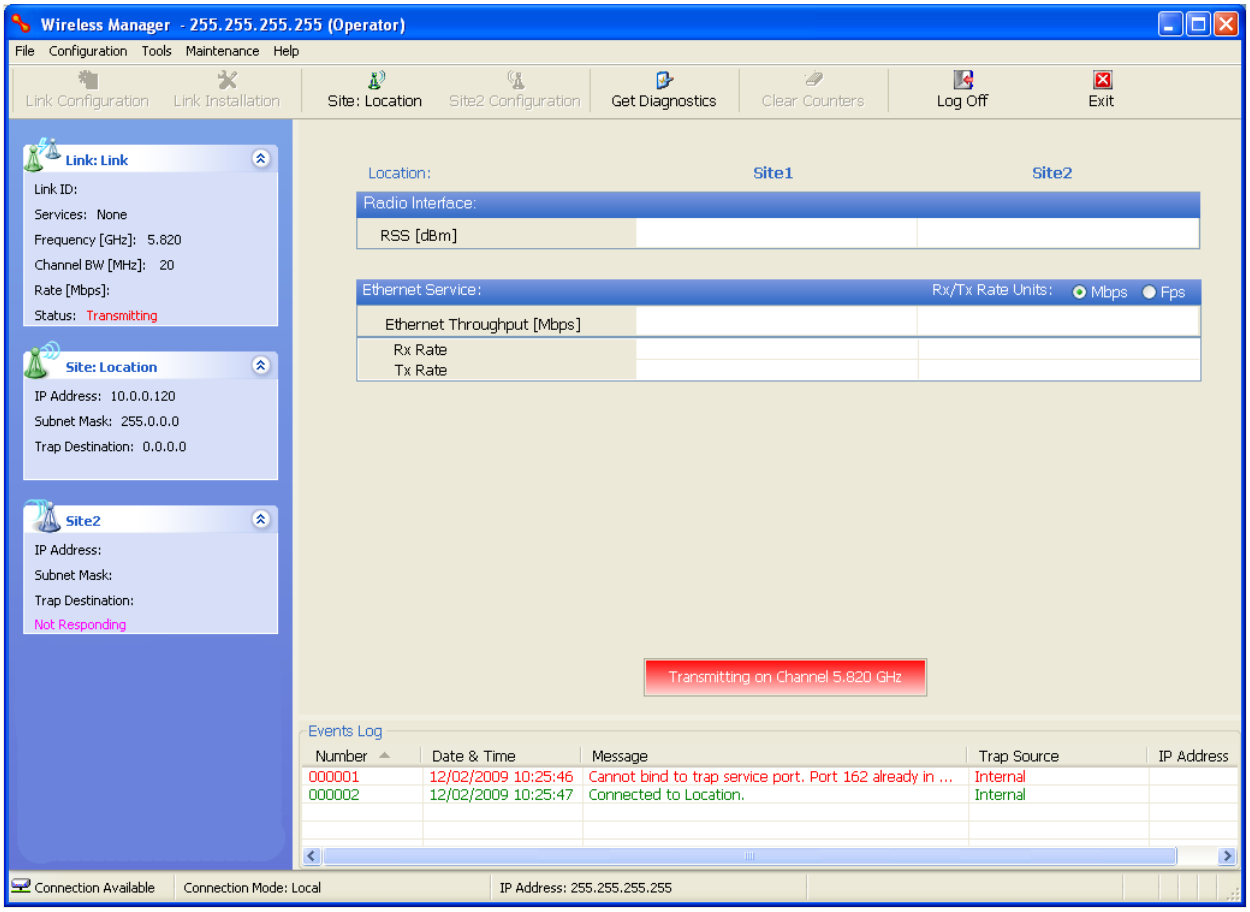


Figure D-2: Opening MRL Manager window prior to installation

8. Click the un-grayed **Site:Location** button. The following dialog window appears:

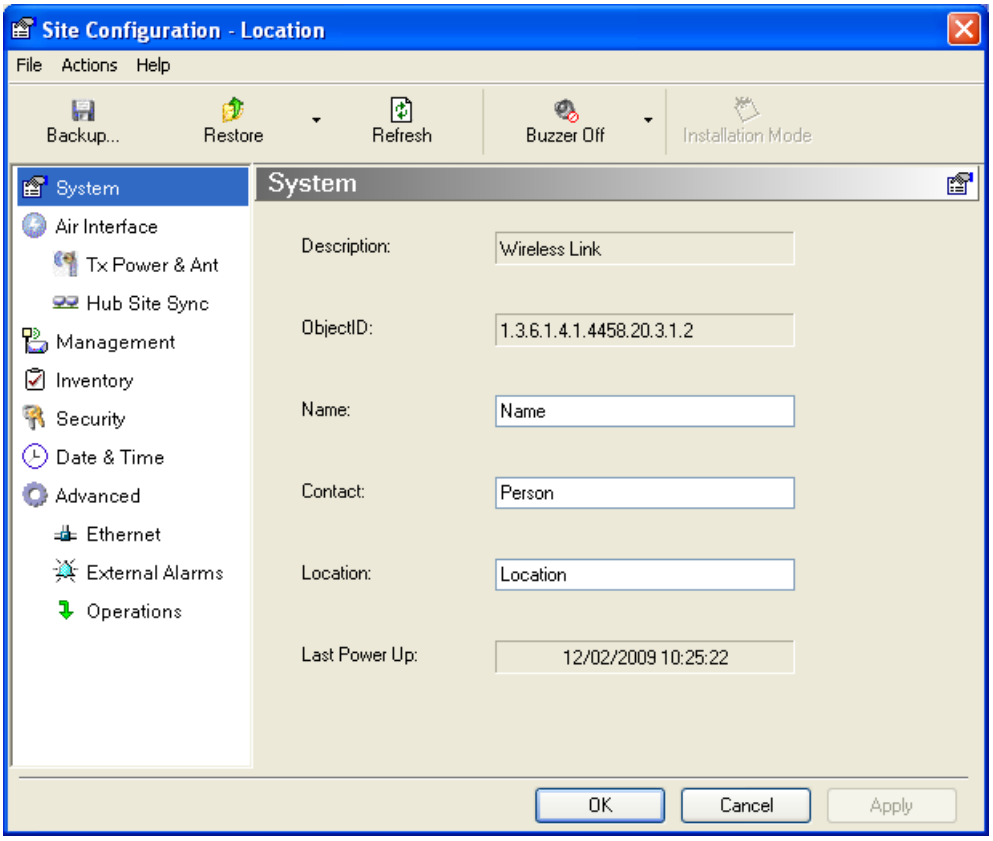


Figure D-3: Configuration Dialog Box

9. Click the **Management** item in the left hand panel. The following window is presented:

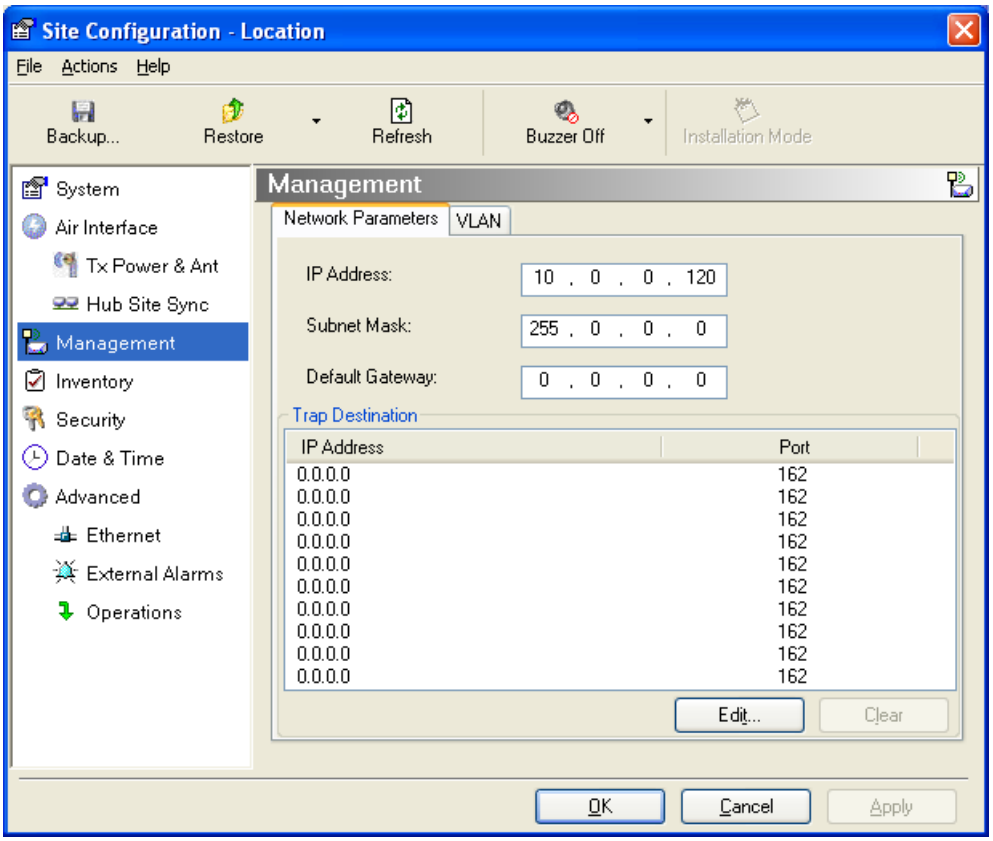


Figure D-4: Management Addresses - Site Configuration dialog box

10. Enter the IP Address, Subnet Mask and Default Gateway as requested. For example, the ODU used here is to be configured as follows:

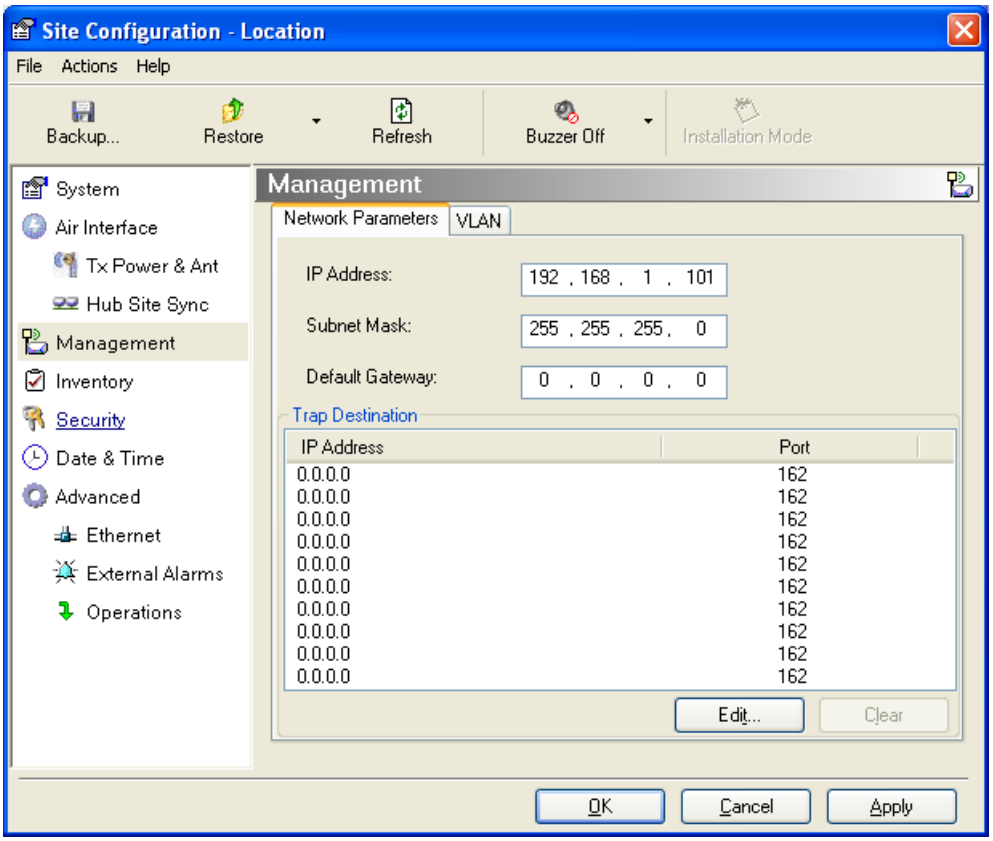


Figure D-5: ODU with IP Addressing configured

11. Click **OK.** You are asked to confirm the change:

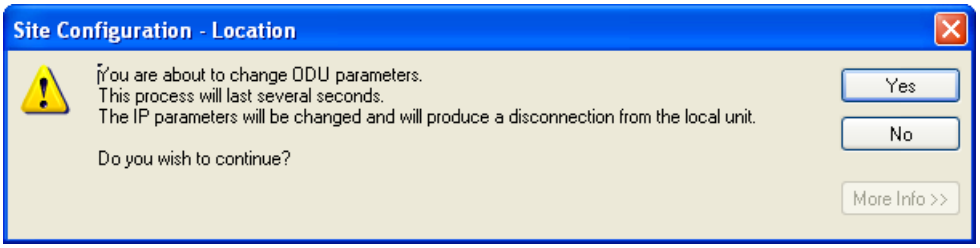


Figure D-6: Confirmation of IP Address change

12. Click **Yes** to accept the change. After about half a minute the changes will be registered in the ODU. On the left hand panel of the main window, you will see the new IP configuration for the ODU.

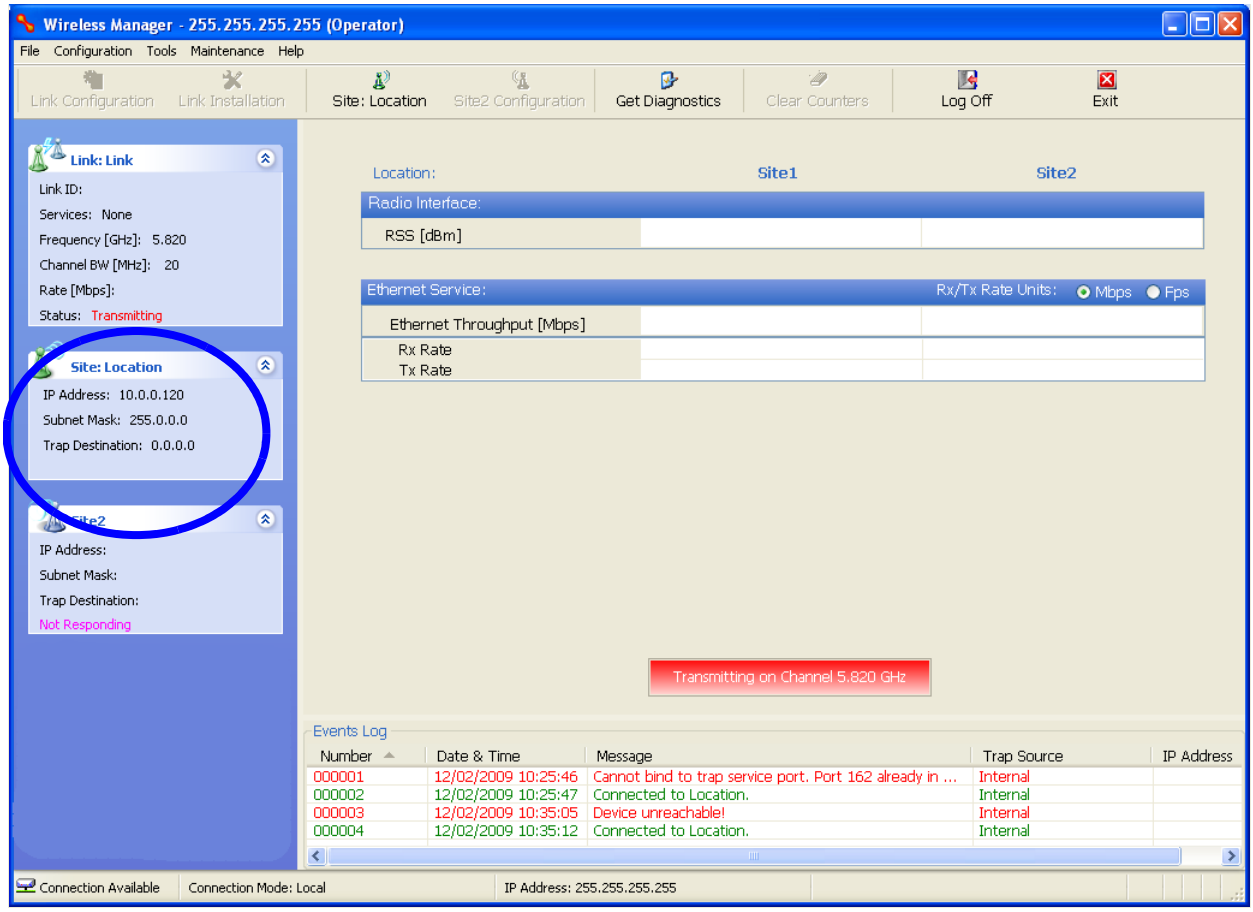


Figure D-7: Main Window after IP Address change

13. Click **Cancel** to leave the open Management dialog. You may now exit the MRL Manager, or connect to another ODU. If you choose to connect to another ODU, after about a minute, the main window of the MRL Manager will revert to that shown in figure **D-2** above. In any event, power down the changed ODU; the IP address change will take effect when you power it up again.

Note

Don't forget to remove the RF terminators from a connectorized ODU after powering it down.

Appendix E

Changing the FactoryDefault Band

Why this is Needed?

All ODUs supplied by MRL come pre-configured with a factory set up product (part number) dependent band. It may be changed using the procedure in this appendix.

- The ODUs as supplied by MRL are typically set up with a factory default band for your product.
- If for some reason the default band needs to be changed, it should be done before link Installation.
- Use of an incorrect band may be in violation of local regulations.

Required Equipment

The minimal equipment required to change an ODU default band is:

- Laptop computer (managing computer) satisfying the requirements of table **4-1**.
- An installed copy of the MRL Manager
- A PoE device
- A crossed Ethernet LAN cable
- An IDU-ODU cable

The procedure

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 will commence beeping at about once per second, indicating correct operation.
4. Launch the MRL Manager.
5. Log on as Installer.

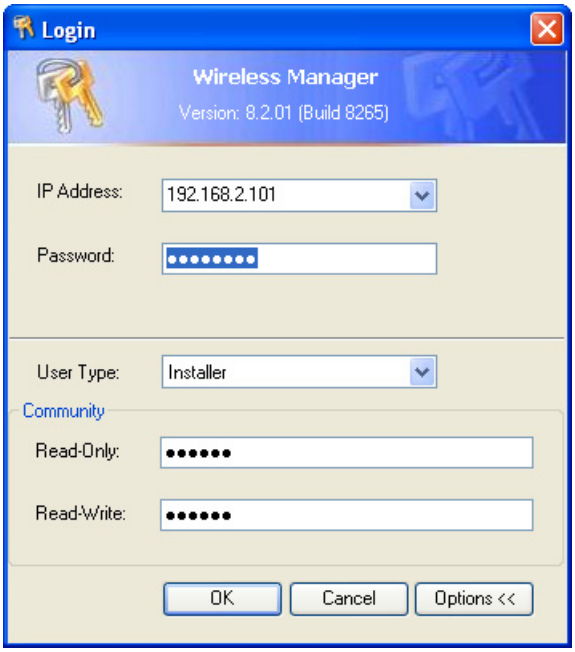


Figure E-1: Becoming Installer

6. Enter the default password, ***wireless***. After a few moments, the MRL Manager main window appears:

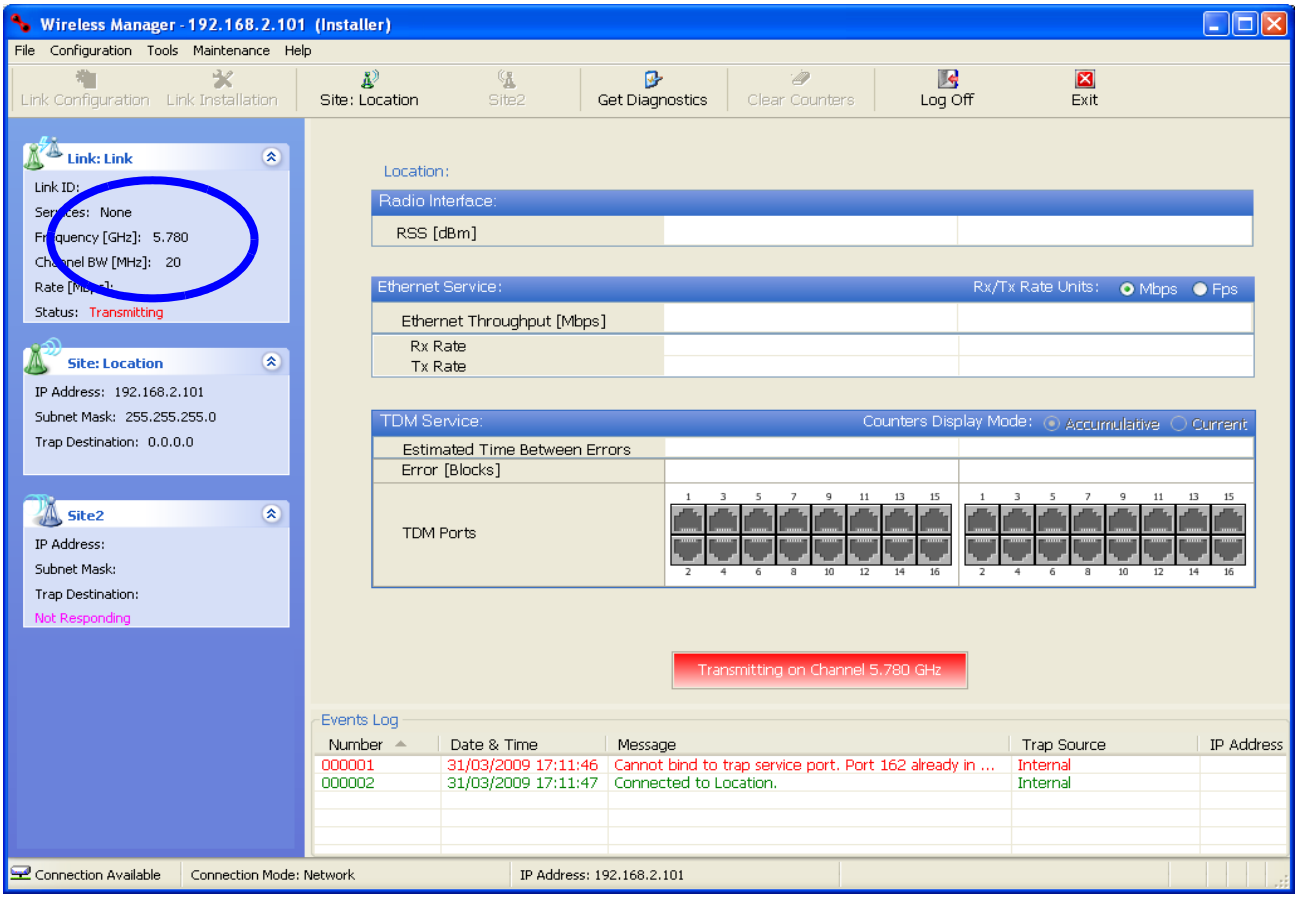


Figure E-2: Opening MRL Manager window prior to band change

7. Click **Tools | Change Band**. The following window appears:

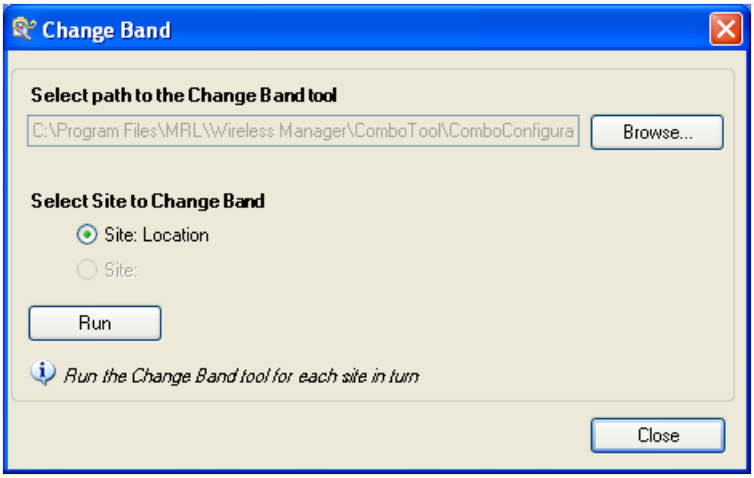


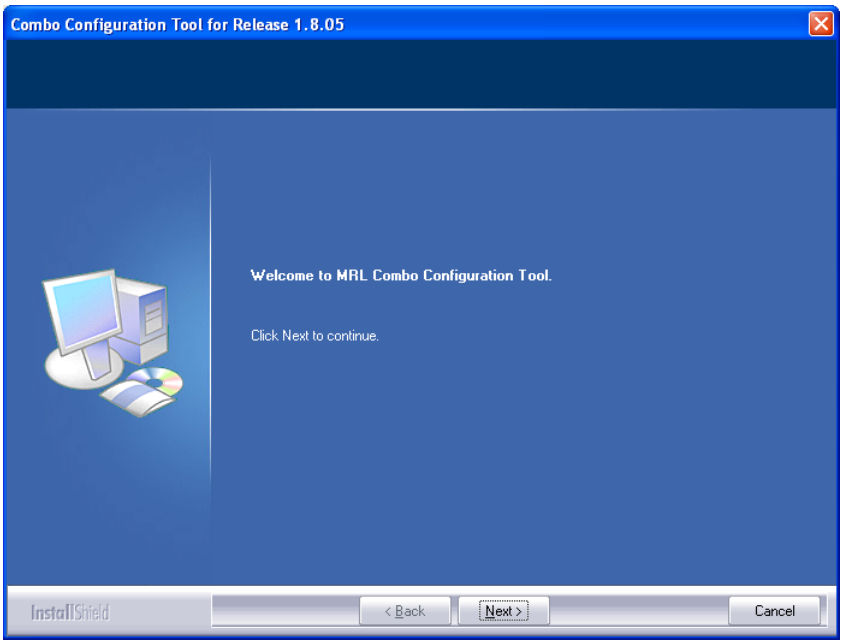
Figure E-3: Change Band dialog

8. This release uses an external task, located by default as shown. The Site radio button indicates the currently connect ODU.

Note

For a link with two sites ready for installtion, either site would be available; you would change the "over the air" site first and then the directly connected site.

9. If these parameters are correct, click **Run**. The Combo Configuration tool starts up. A Welcome window appears:



What is the Combo Configuration Tool?

MRL is supplied preconfigured to a default frequency band and regulation. Combo products (identified by **/CMB** in their model number) may be reconfigured to use any one of the supported frequency bands as set out in **table E-1** below:

Table E-1: Available Bands by Product and Regulation (GHz)

Product Name	Supported Bands	Comment
WL1000-ODU-HE/F58/FCC/CMB	**5.8/FCC**	**Factory Default**
	5.3/HP	
	5.4/HP	
	5.8/IDA	
	5.9/HP	
WL1000-ODU-HE/F54/FCC/CMB	**5.4/FCC**	**Factory Default**
	5.3/FCC	
	5.4/HP	Without DFS
	5.3/HP	Without DFS
WL1000-ODU-HE/F54/IC/CMB	**5.4/IC**	**Factory Default**
	5.3/FCC	
	5.4/HP	Without DFS
	5.3/HP	Without DFS

The Combo Configuration Tool is a software utility supplied by MRL to change the link frequency band. It runs as a familiar Windows Wizard.

This appendix will walk you through the Wizard. It also provides help for common problems encountered during the configuration.

Who may use the Combo Configuration Tool?

As pointed out above, it is vailable from the MRL Manager for a user logged on as Installer. Since it may be run stand alone, you should note the following caveats:

Caveat to the use of the Combo Configuration Tool

- The tool is intended for the use of MRL accredited personnel at the user's site or MRL Customer Support Engineers.
- It is the user's responsibility to operate the system according to local regulations and to acquire the relevant permits or licenses for the frequency band selected, if applicable.

Operating the Combo Configuration Tool

The Combo Configuration Tool is a Wizard, which guides you through the process of changing the frequency band.

Before using the Combo Configuration Tool

Before starting:»

- » Obtain»» the IP address of both the local ODU and remote ODUs of the link
- » Make a note of the correct required frequency band
- » If the link uses external antennas, ensure that they support your required frequency band

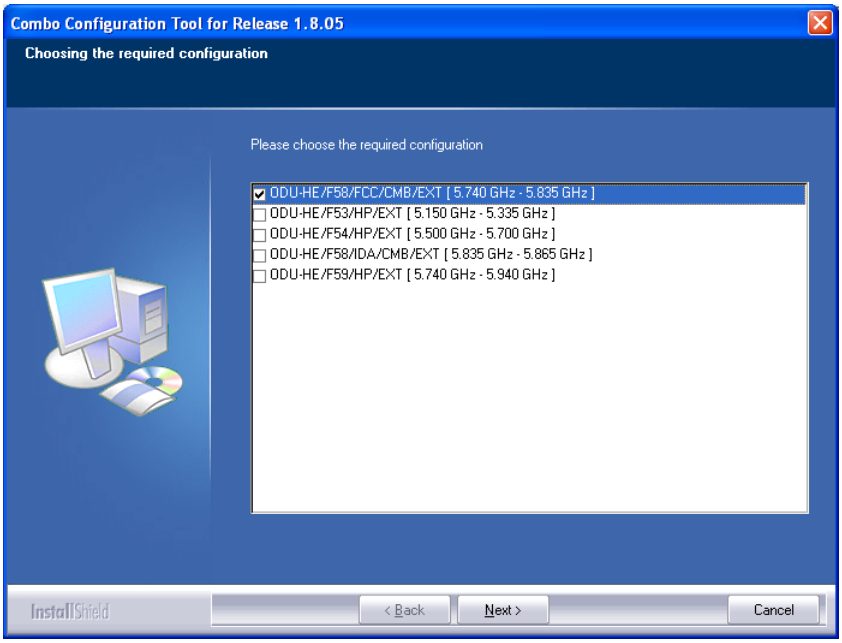
Also, note that

1. The procedure below must be carried out for both ODUs in the link.
2. Changing the frequency band may affect the available Link Budget and system performance.

Using the Combo Configuration Tool

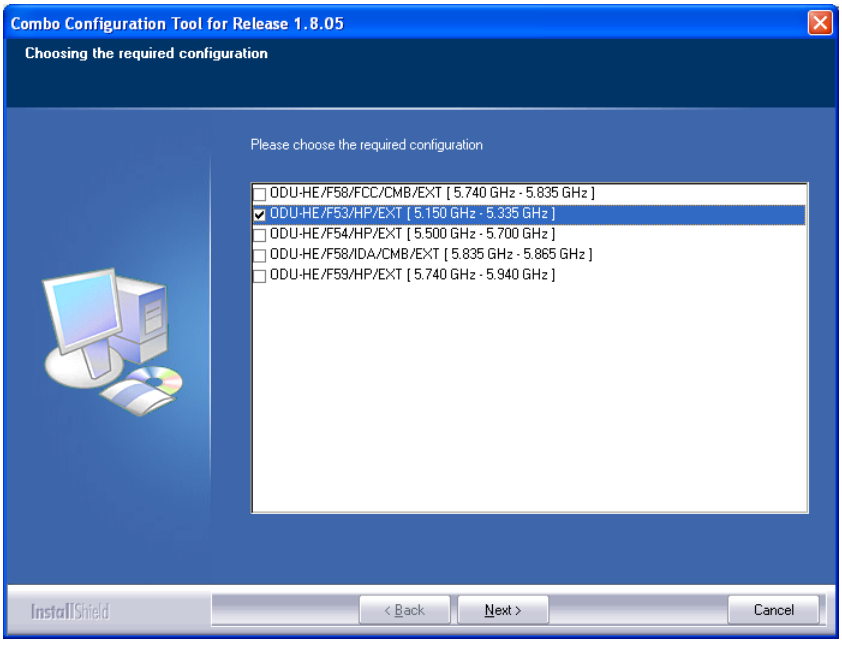
➢ **To change the factory default band (Continued):**

10. On the Welcome window, click **Next**. After about a minute of computation, the following window is displayed:
11. Enter the ODU IP address.
12. Click **Next**. The following progress panel is displayed:



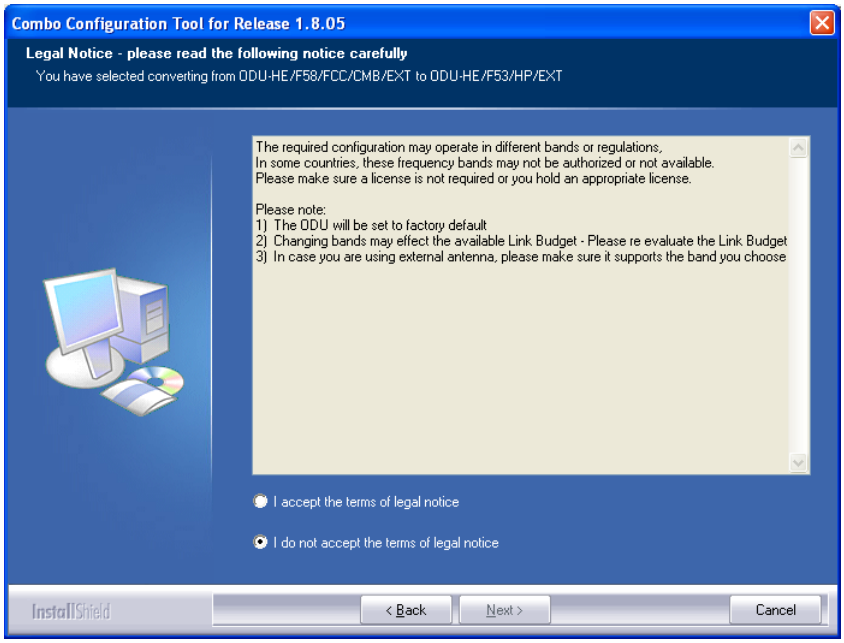
The checked item is the currently configured frequency band.

13. Check the box with the required frequency band, (as shown for example, in the window below). If you do not see the required frequency band in the previous window, click **Cancel** and consult MRL Customer Support.

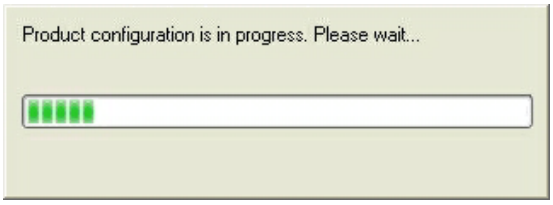


14. Otherwise, click **Next**. The following window is displayed:

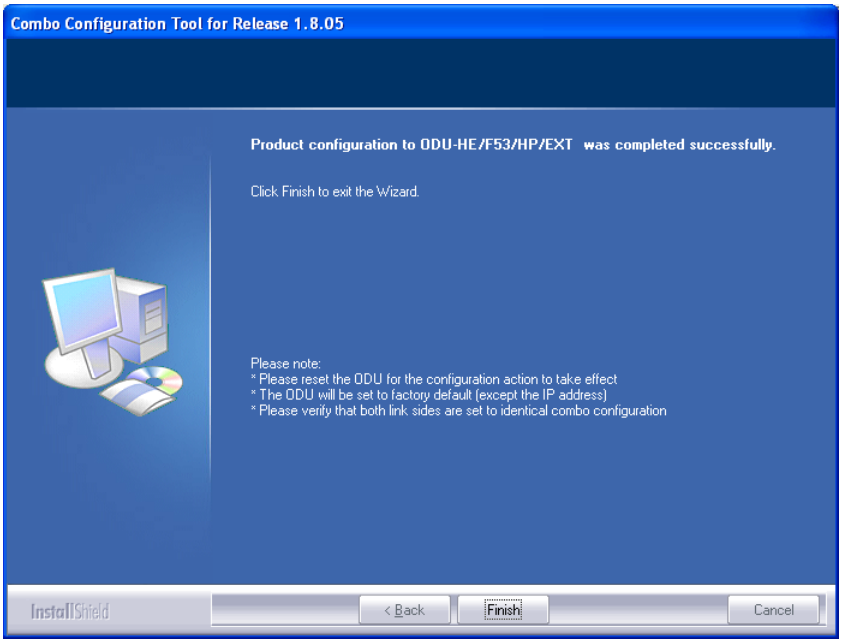
:



15. If the legal notice is acceptable, click the "I accept" radio button, and then click **Next**. The following progress panel is displayed:



Upon successful completion of the configuration process, a termination window is displayed:

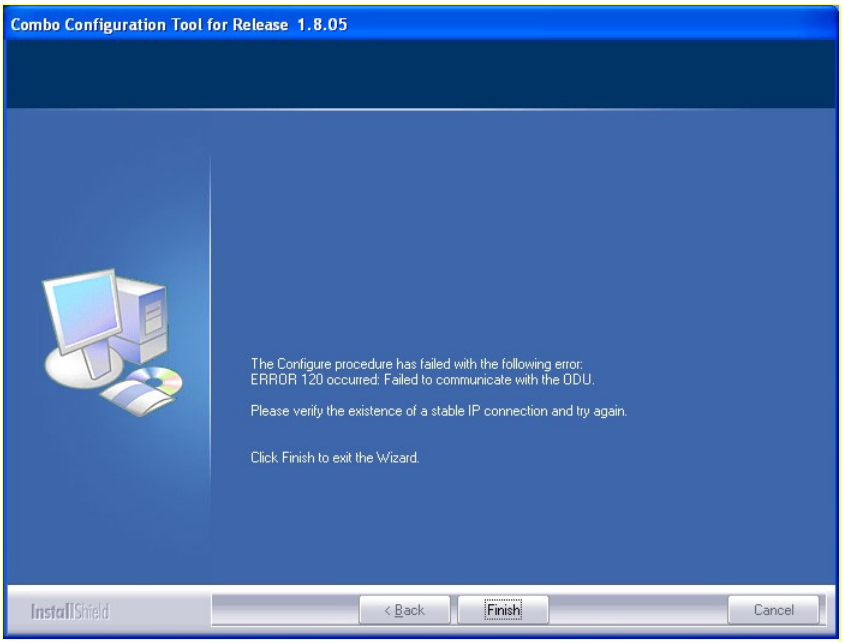


16. Click **Finish** to exit the Wizard as shown. The change will take effect after you reset the ODU.

17.Repeat the whole process for the second ODU in the link.

If you receive an error message

The last stage above may terminate unsuccessfully due to an error. Error messages are posted to a window like this:



The following table sets out possible errors:

Error Number (nn)	Error Text Message
Common message preamble:	The Configure procedure has failed with the following error: ERROR nn occurred:
120	Failed to communicate with the ODU. Please verify the existence of a stable IP connection and try again.
940	Product is not identified.
1040	The ODU is not a Combo product.
1020	A configuration problem detected. Aborting.

The only items requiring explanation are errors 940 and 1020.

Error 940 may arise as a results of an ODU firmware problem. Error 1020 will appear for any reason not caught by the other entries in the table. In all such cases, you should consult with MRL Customer Support.

Special Products or Features: Entering a License Key

If you go to the Operations window as Installer (figure **E-4**), you will see a provision for entering a license key. Should you ever require such a key, the procedure is as follows:

To enter a License key:

1. Log on as Installer (as for the previous procedure).
2. Click the **Site:Location** tool bar button. From the main tool bar.

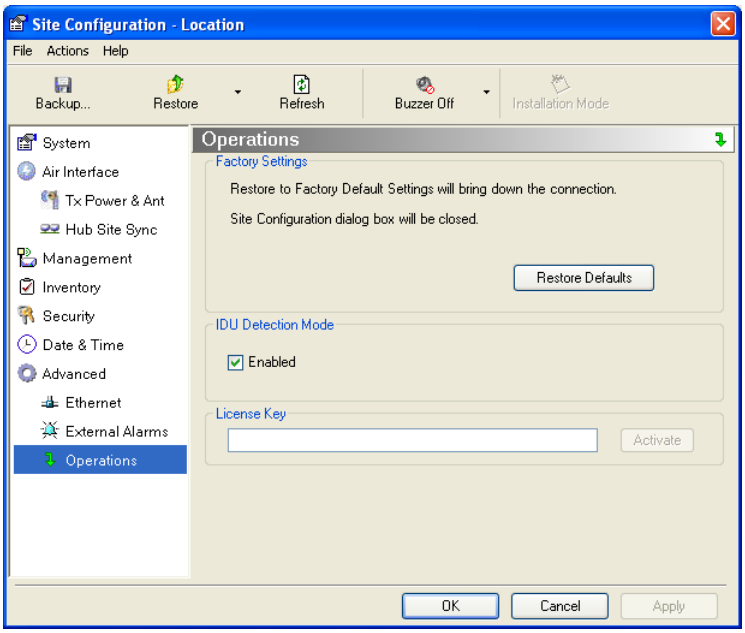


Figure E-4: Using the Operations window to enter a license key

3. Enter your license key and click **Activate**.
4. When it is accepted, click **Cancel**.

Note

License keys, where appropriate, are obtainable from MRL Customer Support.

Appendix F

Software Upgrade

What is the Software Upgrade Utility?

The MRL 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.

Upgrading an Installed Link

➢ **To upgrade software for a link:**

1. In the MRL Manager main menu, click **Tools | Software Upgrade ...** The following detached window appears

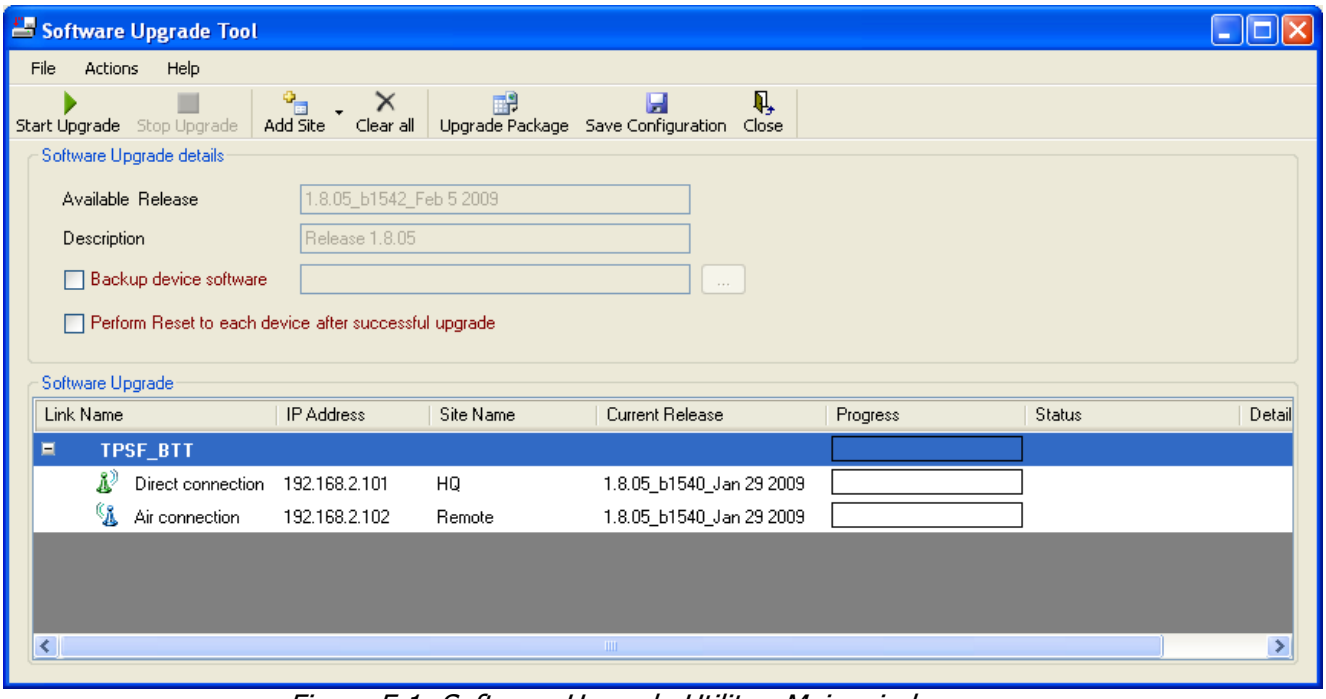


Figure F-1: Software Upgrade Utility - Main window

The default sites shown in the Software Upgrade list panel belong to the currently link. The list may be empty if you are running the MRL Manager "offline".

2. Click **Add Site** to add additional sites for upgrade.

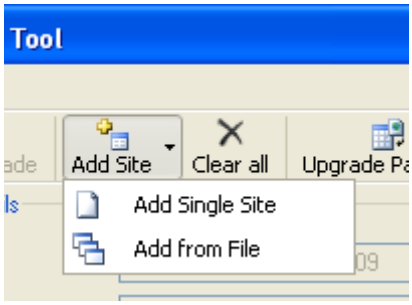


Figure F-2: Add site options

Click **Add Single Site** for one site only:

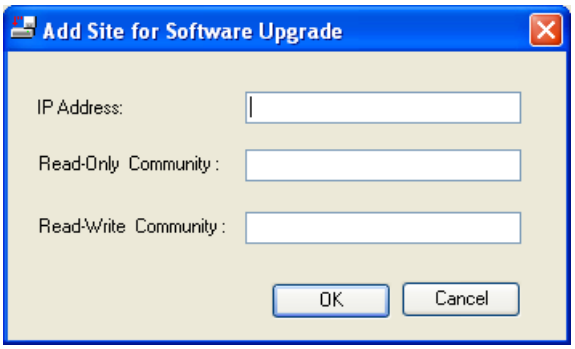


Figure F-3: Adding a single site for upgrade

Enter the IP address of the site, the Community strings (Default: ***public*** and ***netman***, respectively) and then click OK. The site will appear in the Software Upgrade list box. For example if we add the site at IP address 192.168.2.101, the SWU main window of figure **F-1** looks like this:

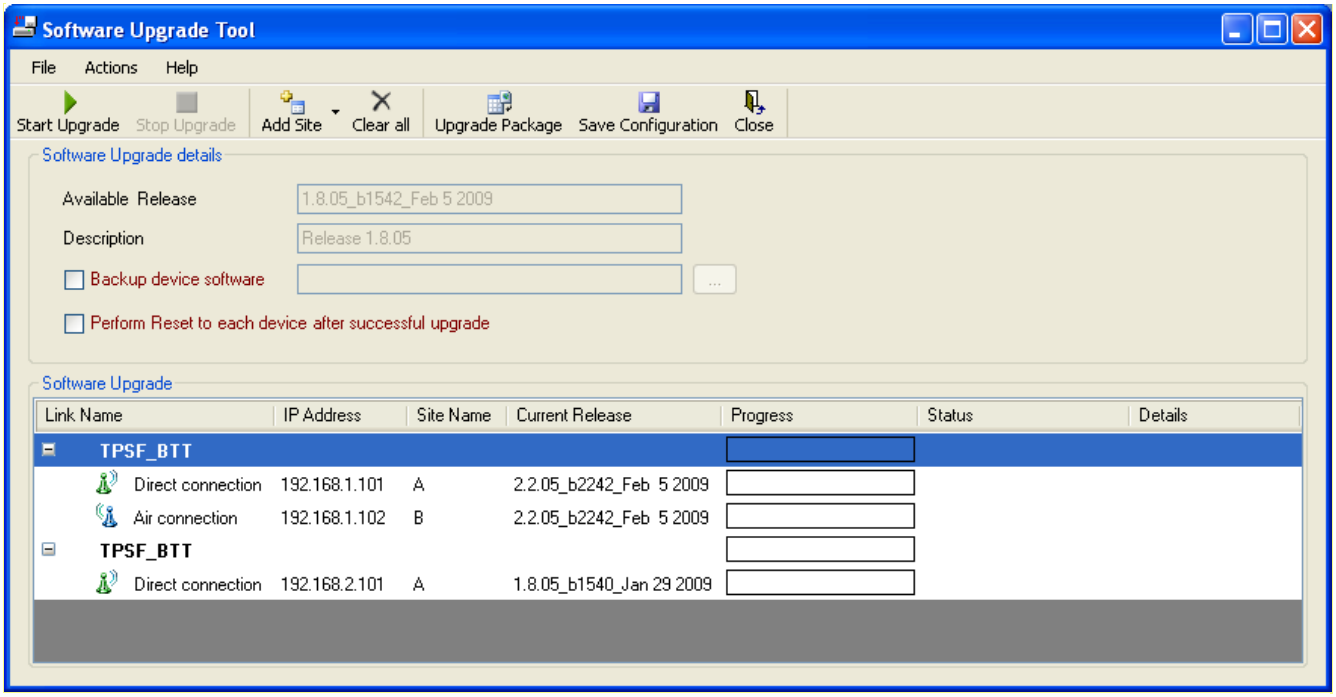


Figure F-4: Single site added for upgrade

The list can be cleared using the **Clear All** button.

As an alternative to adding sites one at a time, you can add sites from a prepared list using the **Add from File** option in figure **F-2**. The list has the following format:

<IP address>,<Read-Only community>,<Read-Write community>

Here is an 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

3. Having created an update list, click **Upgrade Package** to chose the relevant files. The default files are located in the **SWU** subdirectory in the MRL 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.
4. 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 here is the same as that in **page 6-24**, and serves the same purpose. It provides a fallback if the upgrade proves problematic.

5. The next check box determines whether or not the sites should be reset immediately after the upgrade. Bear in mind that on the one hand, a

reset involves a service interruption, but on the other hand, the software upgrade will not become effective until after the reset is carried out.

6. Click **Start Upgrade** to commence the process.

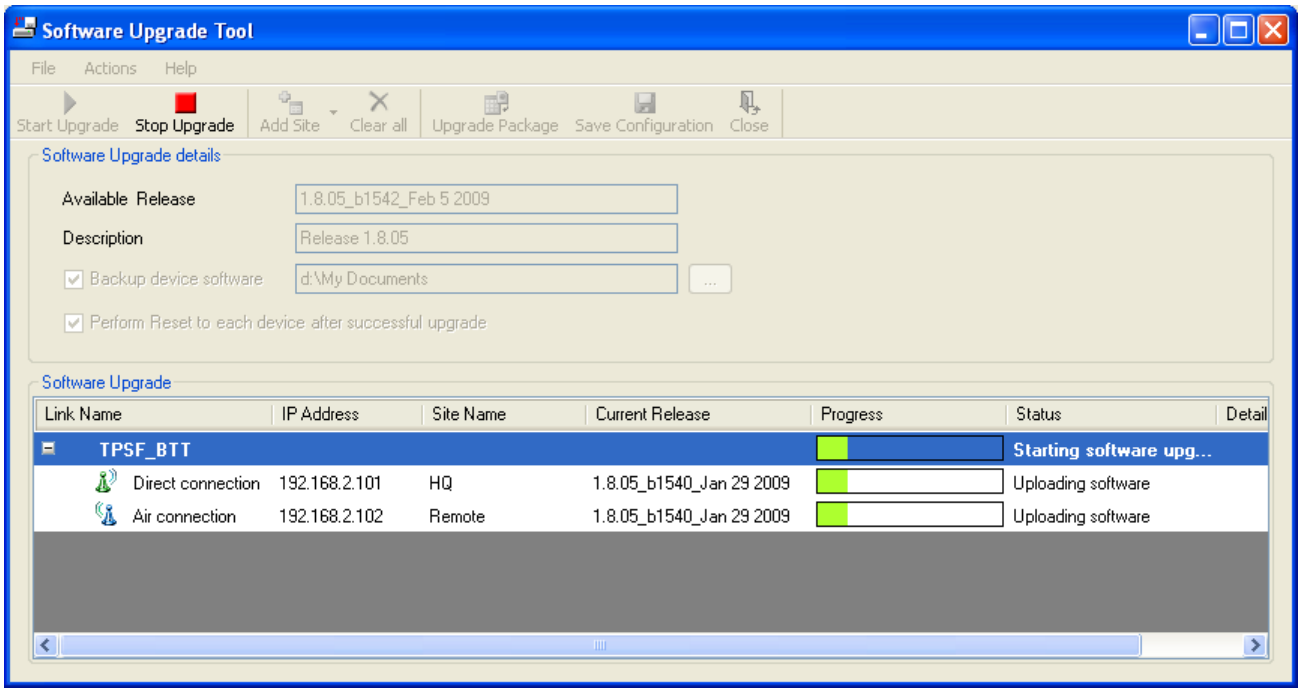


Figure F-5: Software upgrade in progress - Note the stop button

7. Click **Close** to exit.

If one or both sites fail to update, a warning notice will be displayed.

Caution

If one site of a link updates but the other fails, you should 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 could experience a link software mismatch which may affect service.

Appendix G

AIND Alignment

Use this procedure when using the all indoor system MRL-ANID or manually aligning two MRL units.

To achieve the best benefit and link budget from the MRL installation, the link antennas must be aligned; the two antennas should exactly face each other.

In order to achieve the best performance, the line of sight must be as clear as possible with no obstructions between the two sites.

Prior to attempting alignment, install the hardware and software in accordance with the MRL Installation and Operation Manual. The figure below shows the link setup. At least two people are needed to perform the alignment procedures.

Once the alignment is complete, you are able to evaluate the quality of the link

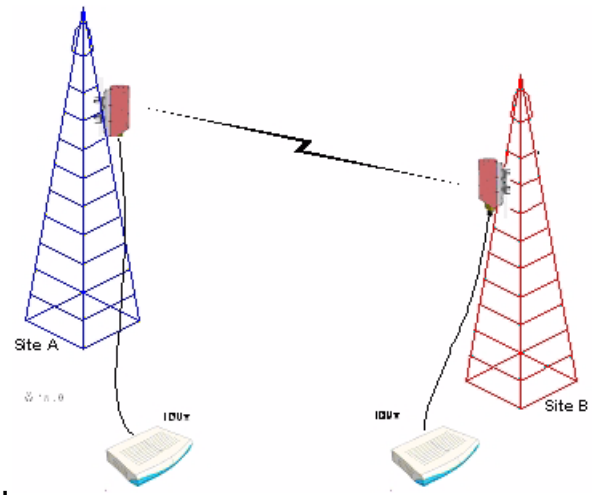


Figure G-1: MRL Link Setup

Expected Signal Level for AIND radios

Use the Link Budget Calculator utility supplied on the MRL Manager Software CD-ROM to calculate the expected performance of the MRL™ wireless link. The utility allows you to determine the RSS of the link and number of

E1/T1 services available at a specified distance. In all-indoor type installations, a long transmission line (RF cable) between the radio and antenna will be used; oftentimes over 100'. In this case the attenuation (RF loss) of the cable must be determined (for both sides) and entered as a dB loss in the Link Budget calculator. In many cases, a larger antenna is necessary to compensate for this transmission line loss.

Andrew LDF and AVA cables are good for minimizing loss.

Performing MRL AIND Alignment

The supervisor of the antenna alignment is situated at the receive site with the Spectrum Analyzer.

Equipment Setup

➢ **To set up the antenna alignment equipment:**

1. Coarsely align the two antennas. Use the compass readings taken during the Site Survey to point the antennas in the correct direction.
2. Connect the equipment as shown in **Figure G-1** but connect a spectrum analyzer in place of the remote MRL-AIND.
3. Turn on the CW transmit signal from site A (from the MRL NMS).
4. At site B, tune the SA to the frequency transmitted.
5. Increase the SA sensitivity according to the expected receive signal.

Aligning the antennas

When one antenna is moved, the opposite site is passive. Move the antennas very slowly.

➢ **To align the antennas:**

1. Slowly move the site B antenna azimuth axis (the elevation axis should be locked) until you see the best signal on the SA Lock the azimuth axis.
2. Slowly move the site A antenna azimuth axis (the elevation axis should be locked) until you see the best signal on the SA.
3. Lock the azimuth axis.
4. Slowly move the site B antenna elevation axis (the azimuth axis should be locked) until you see the best signal on the SA.

   Lock the elevation axis.
5. Slowly move the site A antenna elevation axis (the azimuth axis should be locked) until you see the best signal on the SA.

   Lock the elevation axis.

6. Repeat steps 1 to 4 until the reading on the SA is equal or as close as possible to the calculated receive signal (for Rx Power Level. (see **Expected Signal Level for AIND radios** on page **G-1**.)
7. When the SA reads the expected receive signal, the antennas are aligned and there is an indication of a good link between the sites.
8. Tighten the antenna azimuth axis and elevation axis.
9. Stop the CW function. The NMS will restart the system.
10. Connect MRL-AIND unit to the external antenna. The operational link is shown in **Figure 3-1**.
11. Configure MRL™ NMS at both sites to operate at the pure channel frequency found in the RF survey. MRL™ is now ready for operation.

Configuring the Link

1. Run the Installation Wizard in the MRL Managerr Software to set the configuration of the link. Configure the link in accordance with the parameters calculated in the Link Budget Calculator.
2. MRL™ has a unique identification number, the Link Name. Each side of the link looks for its partner with the same Link Name. Therefore both sides of the link must be configured with the same Link Name.
3. The MRL™ link is now ready for operation.

Evaluating the Link

With the link operating at a pure channel as determined by the RF survey procedure, the recommended performance threshold of an MRL™ link is the following:

RSS: -84 dBm minimum

There are cases when there is no line of sight, but still the link is of an acceptable quality.

If the link is not within the acceptable limit, see the next section, **Troubleshooting**.

Troubleshooting

If the link is not within the acceptable limit as defined in the previous section, **Evaluating the Link**, check the following:

- Verify that both antennas have the same polarization (horizontal/vertical).
- Check all the MRL-AIND cable connectors for faulty connections.
- Verify that there are no obstacles in the Fresnel zone of the antenna path such as large buildings, trees, etc.
- Use a spectrum analyzer with suitable sensitivity to measure the signal at the distance between the sites.
- If nothing improves the receive power level, check the overall link.
- Reduce the distance of the link-move the equipment from one site closer to the other site-where it is possible to actually see the antennas with the naked eye.

- If you now get the expected receive signal level, you can assume that the equipment is operational, and the problem arises from interference between the sites.

Appendix H

Hub Site Synchronization

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

Using a method called Hub Site Synchronization (HSS) an external cable is connected from the master to all collocated ODUs; this cable carries pulses sent to each ODU, which synchronize their transmission with each other. The pulse synchronization ensures that the transmission of packets occurs at the same time for all collocated units. This also results in all of the hub 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 H-1 shows interference caused by non-synchronized collocated units.

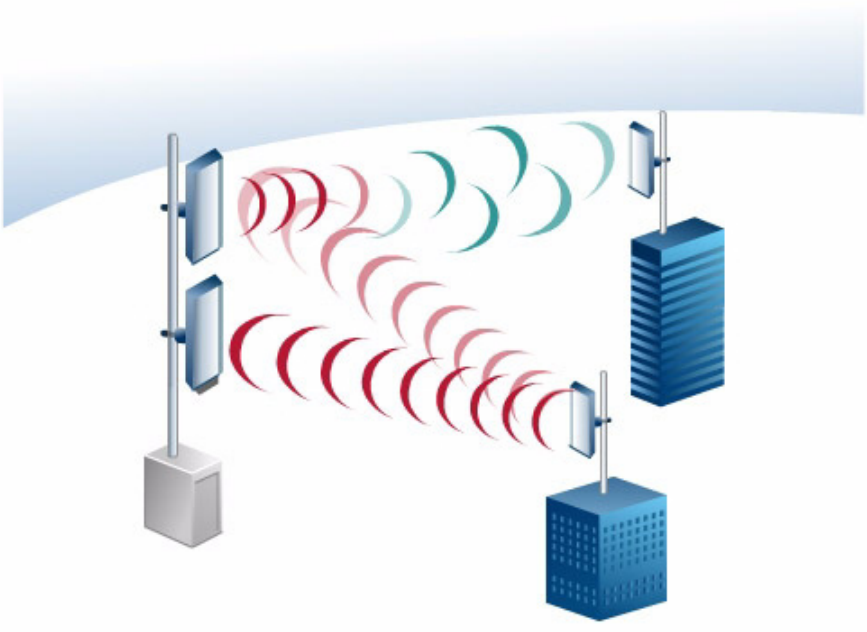


Figure H-1: Interference caused by collocated units

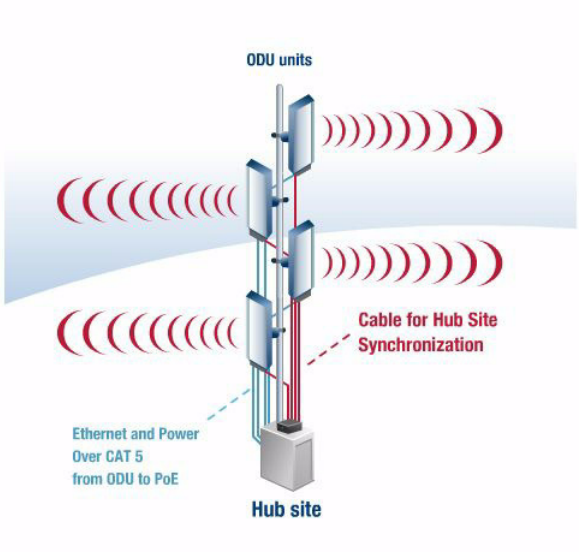


Figure H-2: Collocated units using Hub Site Synchronization

Collocation Planning

MRL provides a collocation planning tool and calculator for planning the placement of multiple units at the same site. It provides physical guidelines for each specific installation scenario. The tool can be used prior to installation to define and verify the distance between the collocated units and their direction, polarization and TPC adjustment.

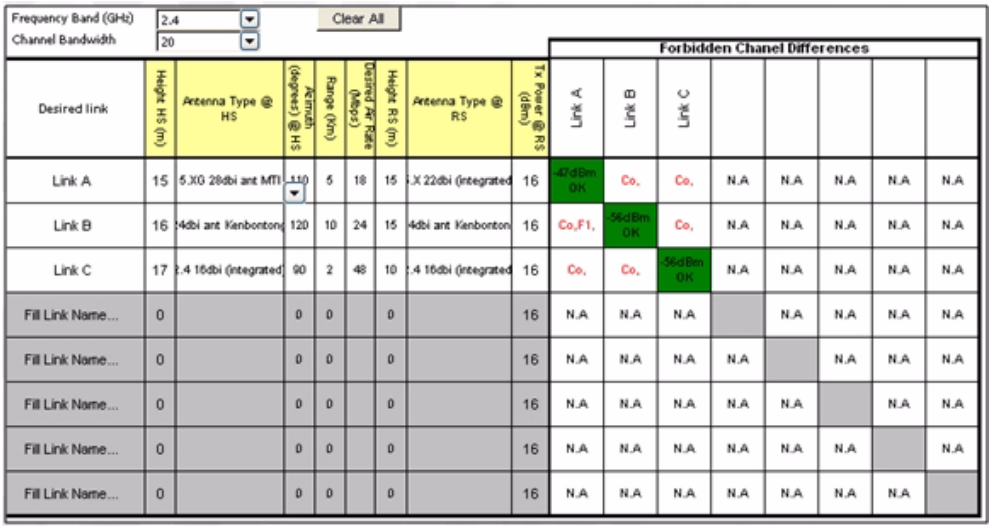


Figure H-3: Collocation Site Calculator

Hardware Installation

HSS supports installation of up to sixteen collocated units. 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 via CAT 5e cable. Prepared lengths are available for purchase.

The HSS is supplied with ten protective covers; any port not in use must be closed with a protective cover.

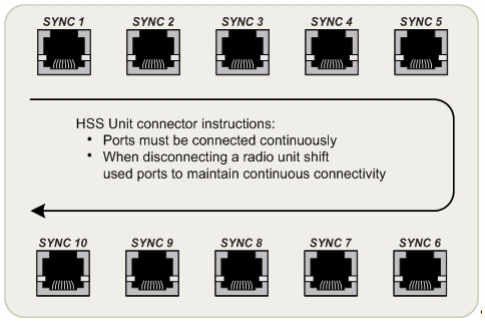


Figure H-4: HSS Interconnection Unit

Note

Ensure that the collocated units are connected in sequence from SYNC 1. If an ODU is removed form the hub site, then all remaining ODUs must be reconnected to maintain the connectivity.

To connect an ODU to the HSS:

1. Unscrew the protective cover from the port marked SYNC 1.
2. Connect the RJ-45 connector from one end of the prepared CAT 5e cable to SYNC 1.
3. Connect the other end of the CAT 5e cable to the ODU connector labeled SYNC.
4. Tighten the protective seal that is on the prepared cable over the RJ-45 connector.
5. 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.

ODU/HSS Connection Pinout

Table H-1: ODU/HSS Connection Pinout

ODU RJ-45		Color	HSS HUB RJ-45	Notes
1	twisted	White/Green	1	
2	pair	Green	2	Not Applicable
3	twisted	White/Orange	3	
6	pair	Orange	6	
4	twisted	Blue	4	
5	pair	White/Blue	5	
7	twisted	White/Brown	7	
8	pair	Brown	8	

Architecture

One of the collocated ODUs at the hub site acts as the Hub Sync Master (HSM); all the other collocated units are Hub Sync Clients. The Hub Sync Master generates the pulses that synchronize the timing of the Hub Sync Clients.

A Hub Sync Client can be configured to be two different types:

Hub Sync Client-Continue Transmission (HSC-CT): In the event that the unit loses synchronization with the Hub Sync Master, the link remains active. However, without synchronization pulses, it is possible that this unit will cause interference.

Hub Sync Client-Disable Transmission (HSC-DT): In the event that the unit loses synchronization with the Hub Sync 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.

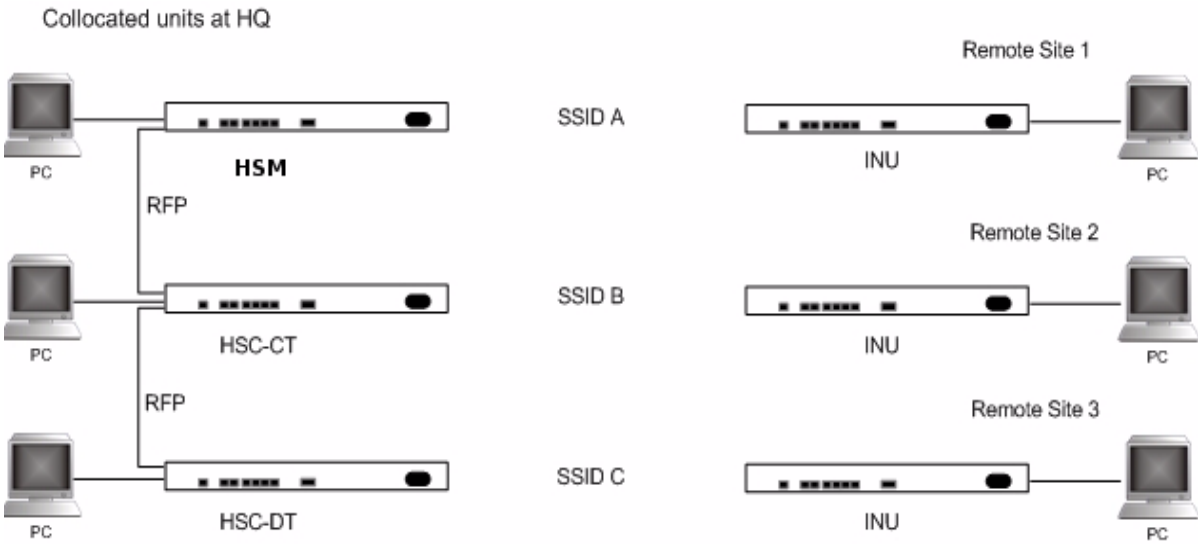


Figure H-5: HSS Typical Application

Radio Frame Pattern Table

The synchronization pulse is termed Radio Frame Pattern (RFP). Four RFP pulses are available. The RFP is selected depending on the type of services that the complete system is to provide - see the table below. Select the RFP that gives you the Best Fit for the system services and select the Channel Bandwidth accordingly.

Note

The RFP must be the same for each link within the collocated system.

Table H-2: Radio Frame Pattern Table

	Channel Bandwidth				
	20 MHz	**10 MHz**		**5 MHz**	
RFP	TDM & Ethernet	TDM	Ethernet	TDM	Ethernet
A	Best	Fit		--	
B	--	Best	Fit	Best	Fit
C	--	--	Best	--	Fit
D	--	--		--	Best

HSS Link Configuration

For HSS-enabled units, the Hub Site Synchronization Settings dialog box appears in the Link Configuration Wizard.

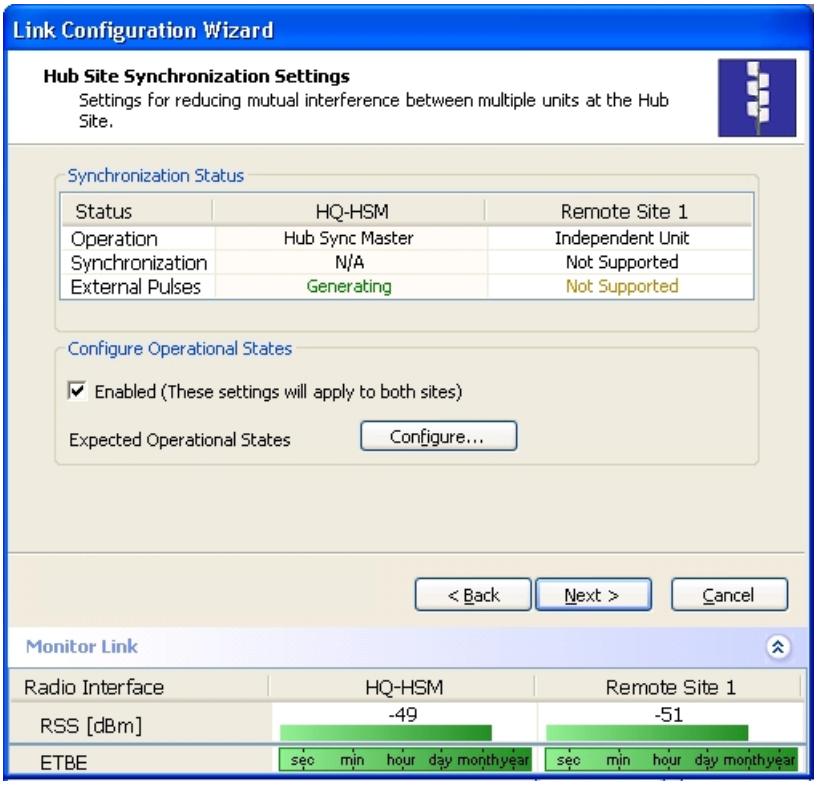


Figure H-6: Hub Site Synchronization Settings dialog box

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. Possible states are described in the following table:

Table H-3: External Pulse Status

Status	Description	Text Color
Not Detected	Sync pulses not detected	Green
Generating	Unit is HSM and is generating RFP pulses	Green

Table H-3: External Pulse Status (Continued)

Status	Description	Text Color
Generating and Detected	Unit is HSM and generating RFP pulses and is also receiving pulses from another unit. Incorrect configuration.	Red
Generating and Improper Detected	Unit is HSM and generating RFP pulses and is also receiving incorrect pulses from another unit. Incorrect configuration.	Red
Detected	HSC detecting pulses	Green
Improper Detected	Incorrect RFP and BW configuration	Red
Multiple Sources Detected	More than one HSM generating pulses. Incorrect configuration.	Red

To configure the Operational States of the hub site unit

1. 1.Click the Enabled check box
2. 2.Click the Configure button

   The Hub Site Configuration dialog box with the current status of the ODUs is displayed.
3. 3.Select the type of unit configuration from the drop-down list. Because only the relevant options are displayed according to the hardware configuration of each unit, usually the remote site will have only the Independent Unit option available.
4. 4.Select the appropriate RFP radio button. Some RFP options may be disabled depending on the BW previously selected.

Take care to avoid incorrect configuration of bandwidth, RFP or to set multiple Hub Sync Masters, as system interference can occur. MRL gives error messages and tool tips if the system is configured with mismatches.

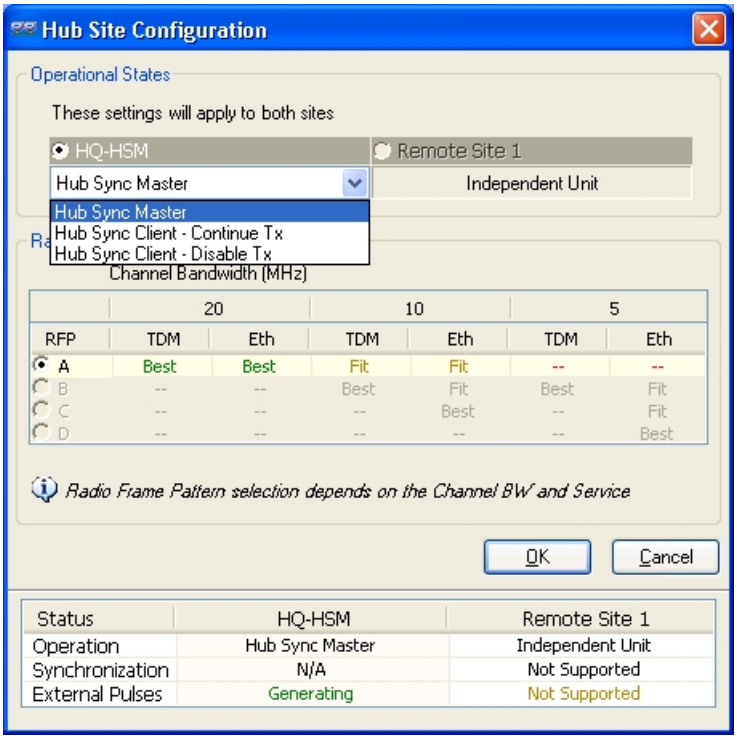


Figure H-7: Hub Site Configuration dialog box

Site Configuration

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.

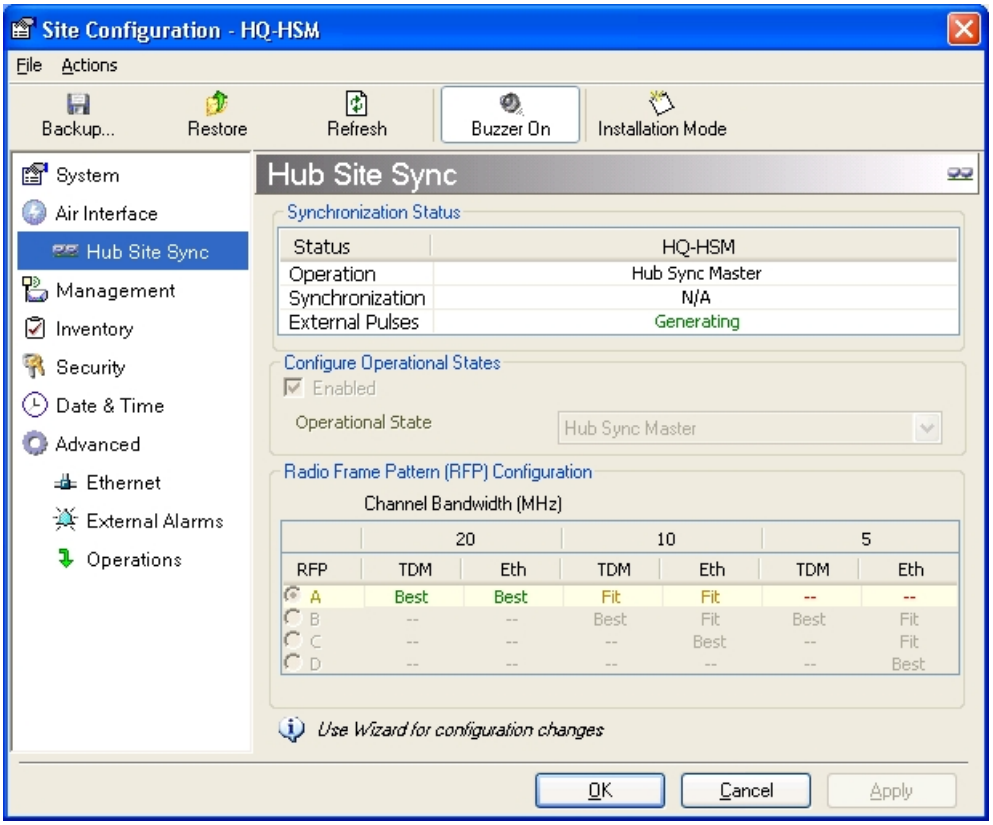


Figure H-8: Site Configuration - Hub Site Sync dialog box

The following figure is displayed when the hardware does not support HSS. These units may be used as independent remote units.

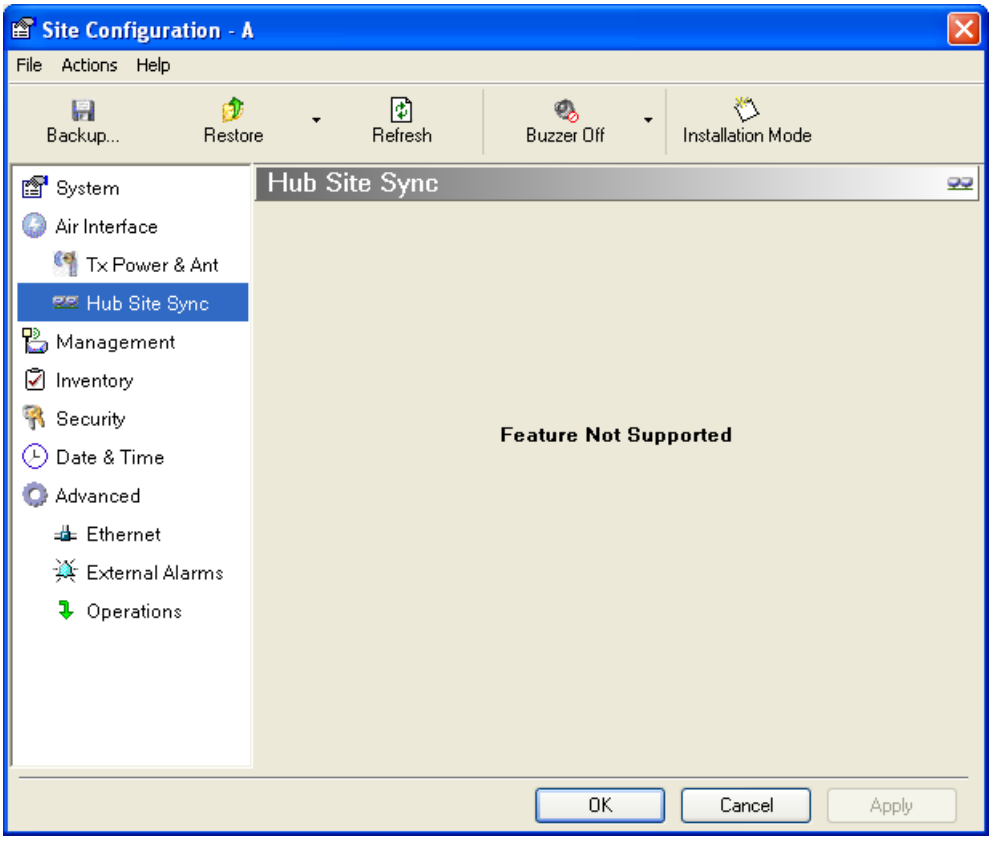


Figure H-9: HSS Not Supported

Appendix I

BRS Installation Procedure

BRS Link Activation

In accordance with 2.5 GHz standard, MRL-BRS systems links must be activated before use. This is done at both ODUs independently before installation on site. Both ODUs must be configured the same.

➢ **To Activate a BRS Link:**

1. Install MRL Manager software as usual.
2. When the Manager Main Screen is displayed it appears with the Link Status label red and showing Inactive. The Link Configuration and Link installation buttons are disabled.

Figure I-1: Inactive Manager Screen

3. Click **Configuration>Configure Location**

   The Air Interface dialog box opens:

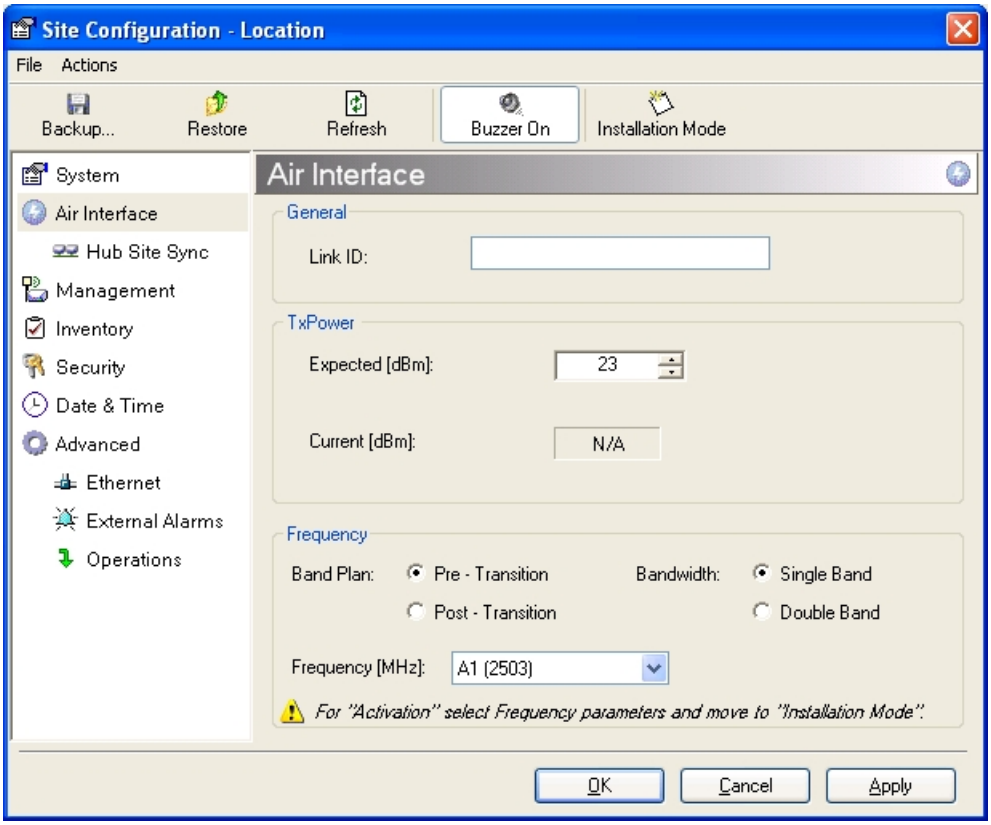


Figure I-2: BRS Air Interface dialog box

4. Set the appropriate Frequency Band Plan and Bandwidth.
5. Select the required frequency band, and click **Apply**.
6. Click **Installation Mode**
7. Repeat for the remote ODU.

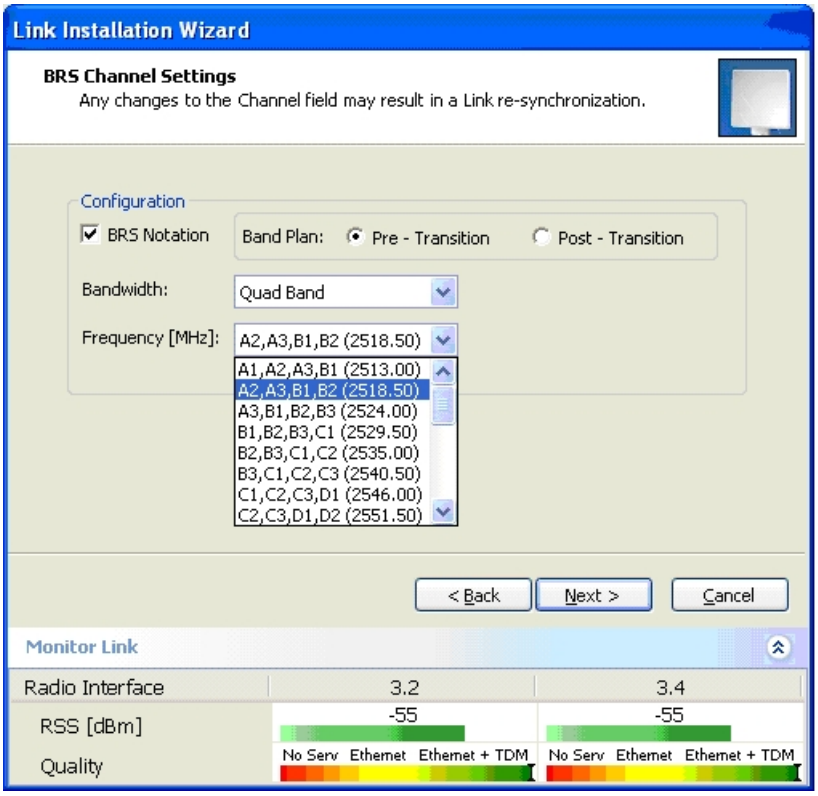


Figure I-3: BRS Channel Settings Pre-Transition

8. Perform the remainder of the Installation procedure as defined in the Installation section.

BRS Link Configuration

The BRS link is reconfigured during the Link Installation or the Link Configuration wizards, or from the Air Interface screen.

Both sites in a BRS Link must be configured identically.

Note

Any changes to the frequency settings cause the link to re-synchronize. A short loss of service will occur during re-synchronization.

To Configure BRS Channel Settings:

1. Set the Band Plan.
2. Select the Bandwidth required,
   - Single Band
   - Double Band
3. Select the Frequency from the pull-down menu.
4. Click Next. The system is re-synchronized to the changes.

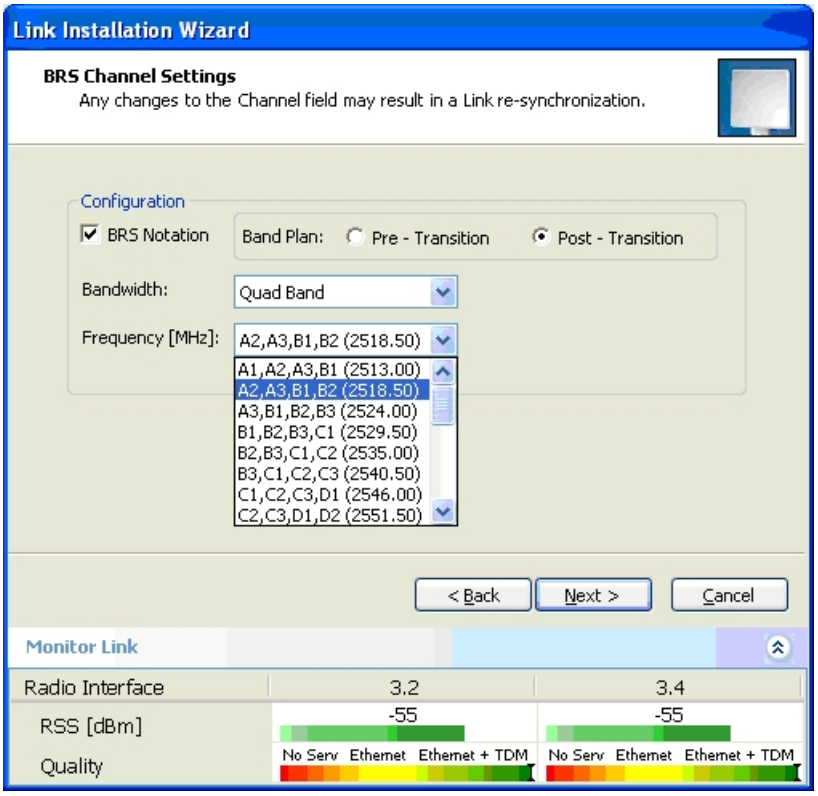


Figure I-4: BRS Channel Settings Post-Transition

Appendix J

5.4 FCC/IC Installation Procedure

5.4 FCC/IC Links: Background

The 5.4 FCC/IC standard 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.

MRL products have the DFS feature available as well as ACS.

An immediate consequence of the 5.4 FCC/IC standard 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 4**, a **link activation** method is used.

The ODUs are either supplied from the factory ready for use with 5.4 FCC/IC or alternatively, they can be set up for it using the Combo Tool (**Appendix E**). In either case, the ODUs may be activated prior to field deployment.

5.4 FCC/IC Link Activation

To Activate a 5.4 FCC/IC Link:

1. Install MRL Manager software as usual.
2. Connect the PC to the IDU-ODU pair to be used as the local site.
3. Run the MRL Manager and log in as Installer. You will see the following window:

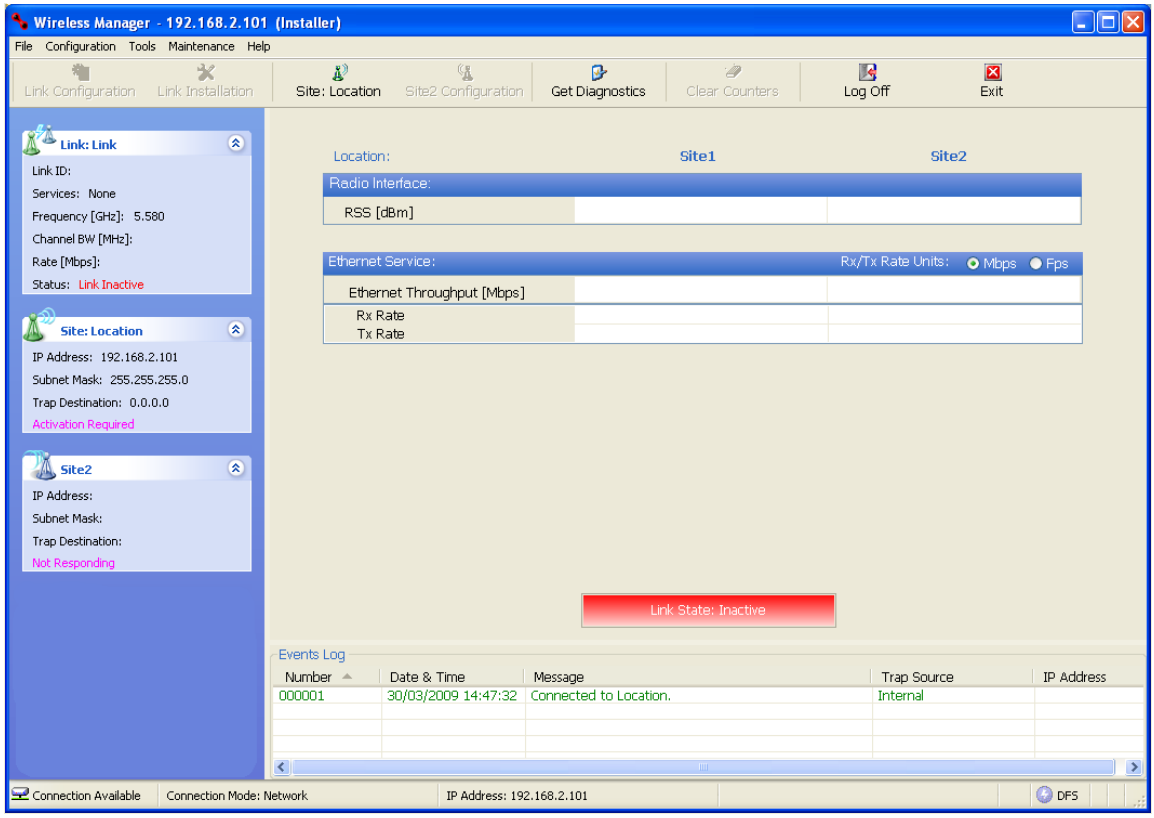


Figure J-1: Activating an ODU - Inactive Manager window

When the Manager Main Screen is displayed it appears with the Link Status label red and showing Inactive.

4. Click **Site:Location | Air Interface** for the logged in site..
5. The Air Interface dialog box opens:

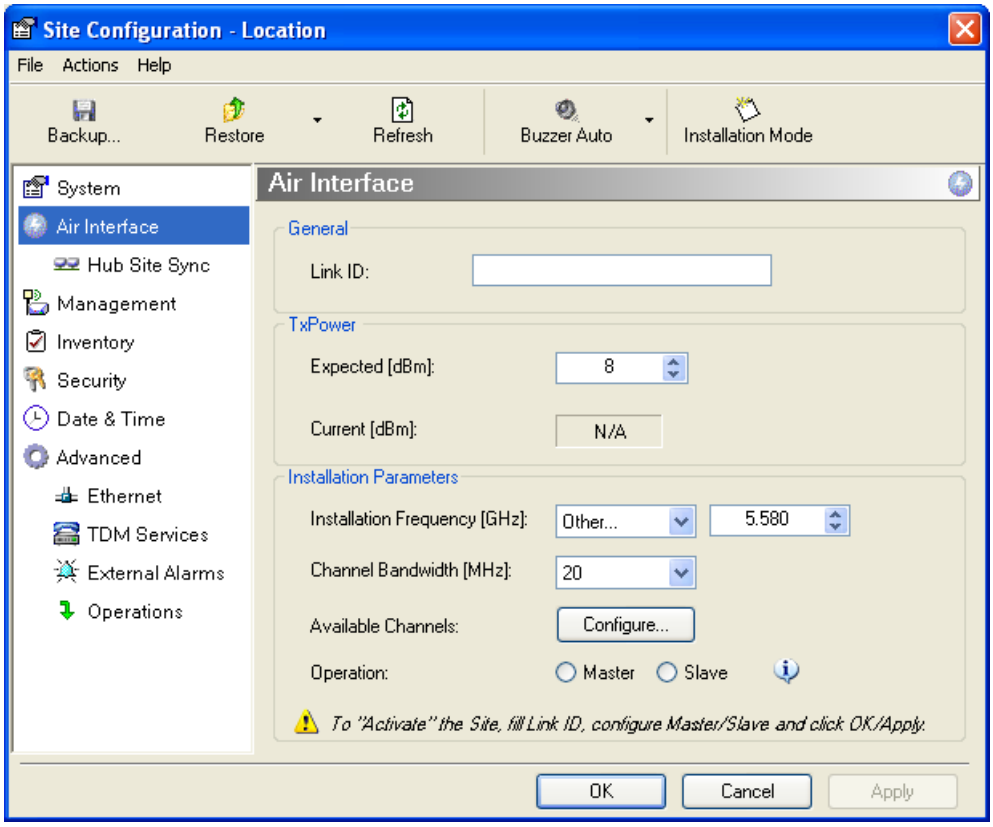


Figure J-2: Air Interface dialog box

6. Enter the link SSID and note it for use with the second site of the link.
7. Check the **Master** radio button.
8. Click **OK.** The following window appears:

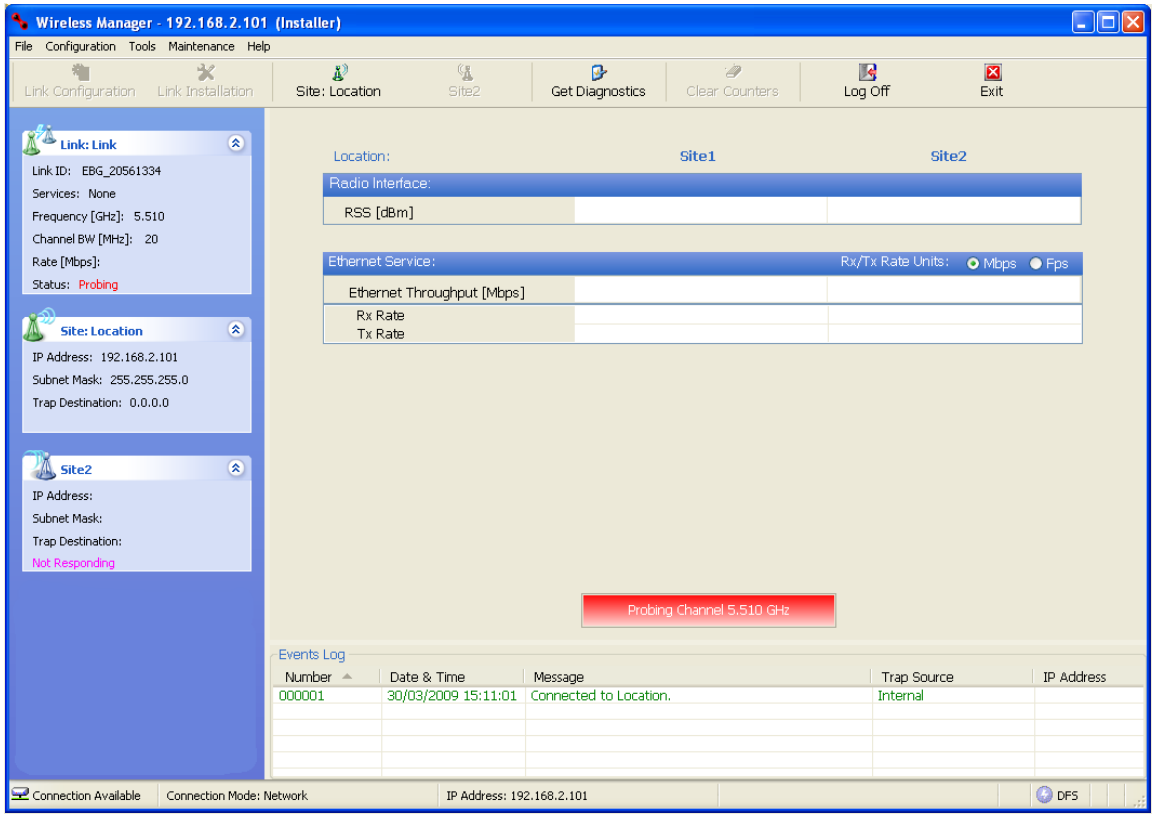


Figure J-3: The local ODU after activation - Active Manager Window

Notice that the SSID is shown in the Link name pane.

9. Repeat the above procedure for the remote ODU, ensuring that in the Air Interface window, that you enter exactly the same SSID, 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 J-3** will look like this:

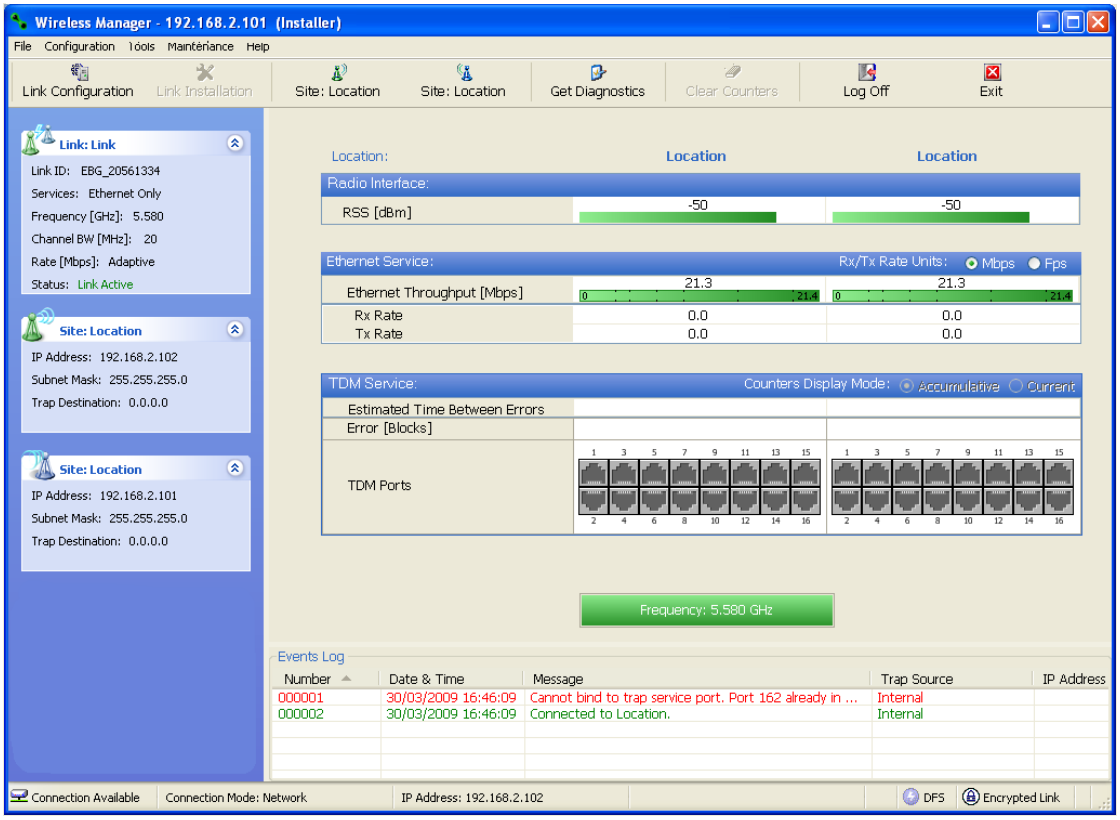


Figure J-4: Both sites activated and awaiting configuration

5.4 FCC/IC Link Configuration

The Configuration procedure may be carried out from either site using the Configuration wizard as shown in **Chapter 6**.

Note

Both sites in a 5.4 FCC/IC Link must be configured identically.

The only difference is in the Channel Settings window:

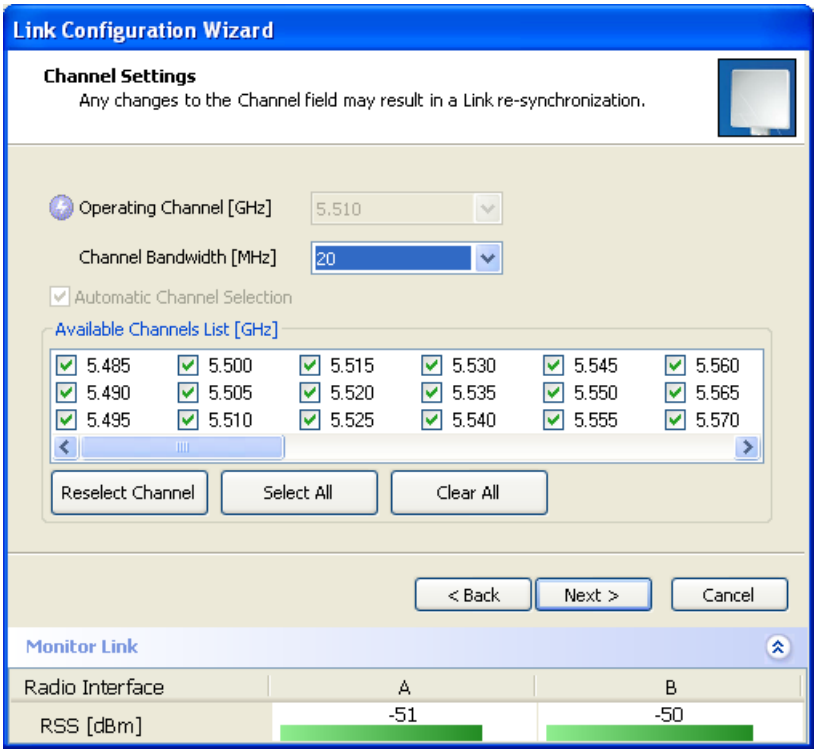


Figure J-5: Channel Select dialog box - ACS permanently enabled

Note

ACS cannot be disabled.

Upon completion of the wizard, the Site configuration dialogs can be used in the usual way. Once operational, the MRL Manager window is the same as for other MRL models.

Here is the MRL Manager main window upon completion of the wizard:

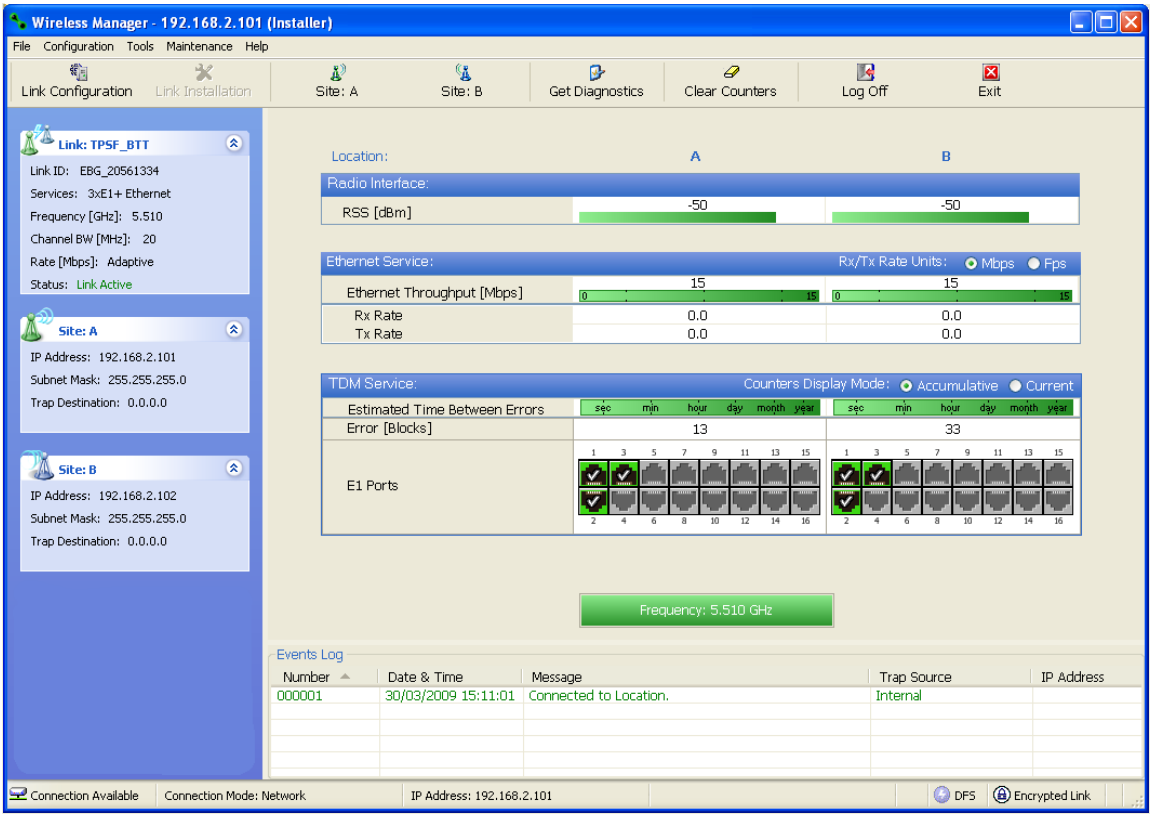


Figure J-6: 5.4 FCC/IC operational

Appendix K

Hot Standby Installation Procedure

What is a MRL Hot Standby Link

The MRL 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 **K-1** below.

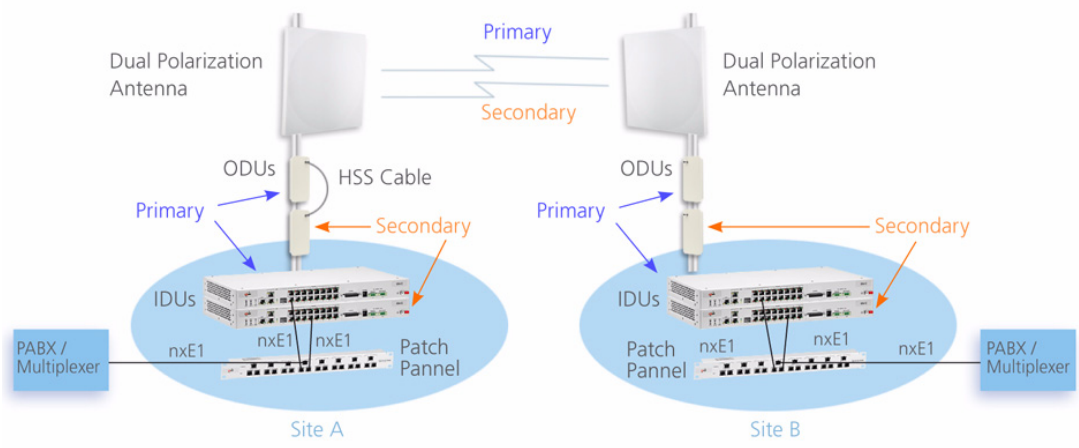


Figure K-1: MRL Hot Standby Link

The MRL Hot Standby Link is designed to provide high reliability high-capacity Point-to-Point Links. The MRL Hot Standby Link 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

The main features of the MRL Hot Standby Link are –

- Cut-over from the primary to the secondary link completely automatic
- Cut-over time no more than 50 ms

- Automatic restore to primary link as soon as it becomes available
- Supports up to four TDM channels

Purpose of this Appendix

This appendix is an installation and maintenance guide for MRL Hot Standby Link. It applies to all MRL radio products able to support the Hot Standby operational mode.

Who Should Read this

This appendix is intended for persons responsible for the installation and maintenance of MRL Hot Standby Links. To use it you need to know how to all MRL radio products

- Install a MRL radio link
- Use the MRL Manager software

MRL Hot Standby Package Contents

- One MHS cable
- One Hot Standby Patch Panels

Figure K-2: MRL Standby Patch Panel

Installing a MRL Hot Standby Link

The following two figures provide schematics of figure **K-1** above:

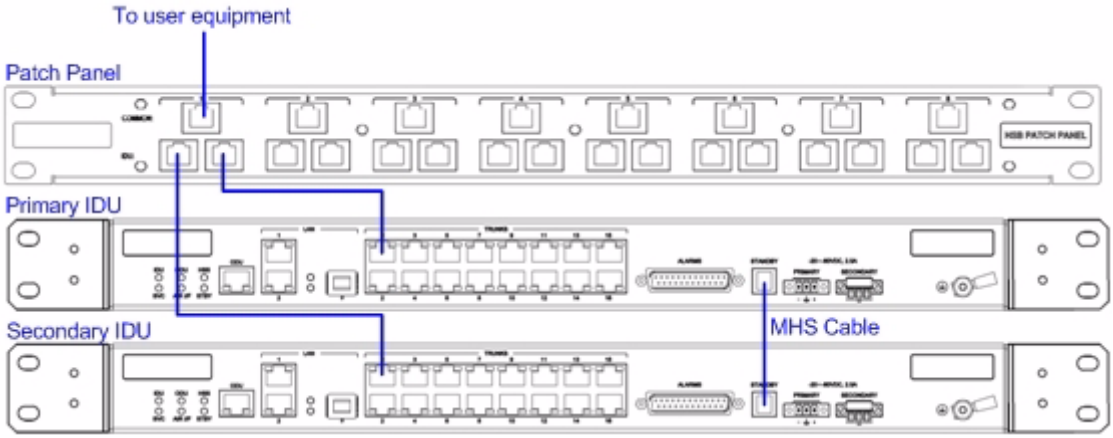


Figure K-3: How to connect the IDUs to the Patch Panel

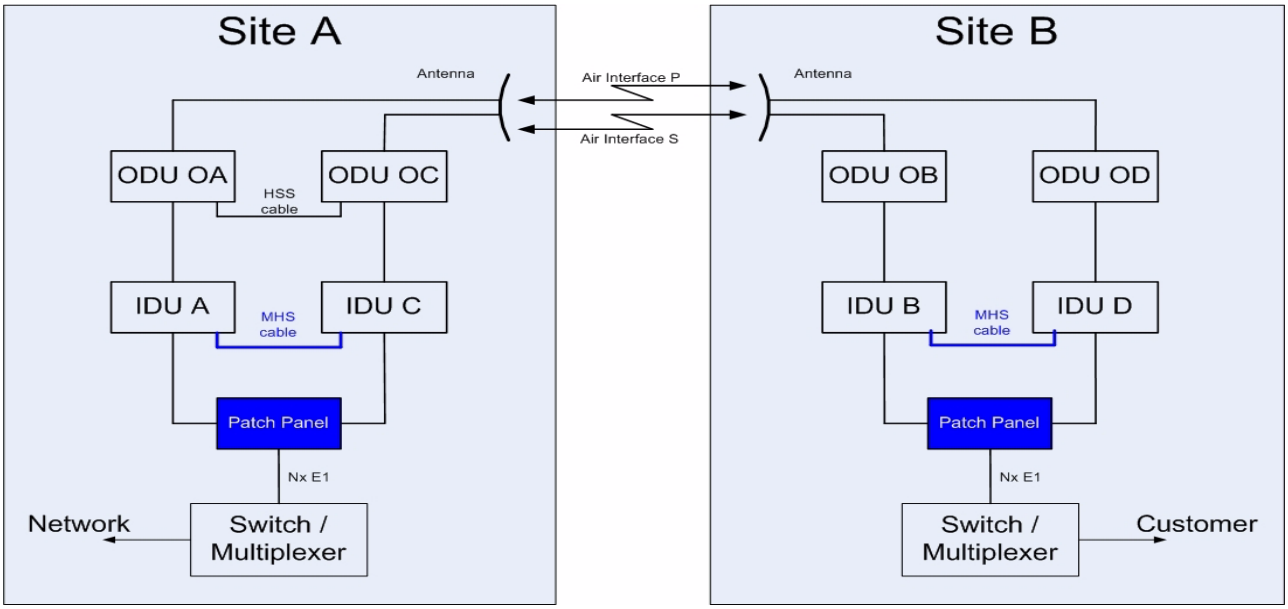


Figure K-4: Schematic of a MRL Hot Standby Link

Note

Ensure that you are using a bipolar antenna at both sites.

In what follows, it will be assumed that –

1. The link will be managed from Site A as shown in figure **K-4** 1above. Site B may be a remote site.
2. The links intended as the primary and secondary will be referred to their respective names, Primary Link and Secondary Link as shown in figure **K-4** 1above, 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 MRL User Manual.

Note

Do not proceed unless this condition is fully met!

2. Connect user equipment to Site B.
3. At site A, 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 A. The ODU belonging to the primary link (OA in figure **K-4** above) should be configured as HSM, whereas the ODU belonging to the secondary link (OC in figure **K-4** above) 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 5MHz apart.**
6. Connect the HSB cable at Site A as shown in figure **K-4** 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:

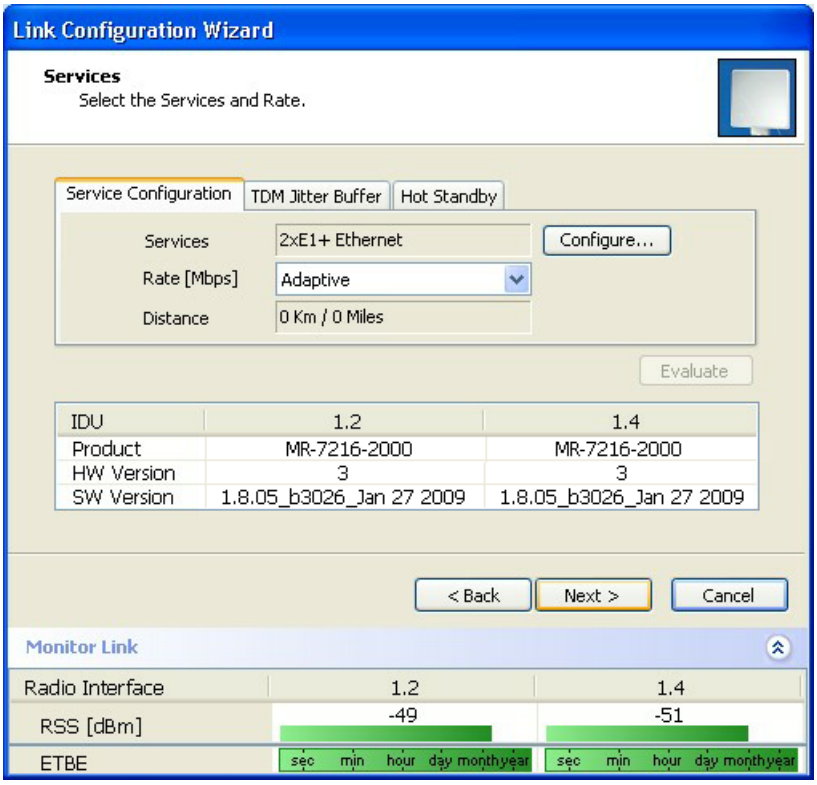


Figure K-5: Services Configuration Panel showing Hot Standby tab

After you have configured TDM services, click the new Hot Standby tab:

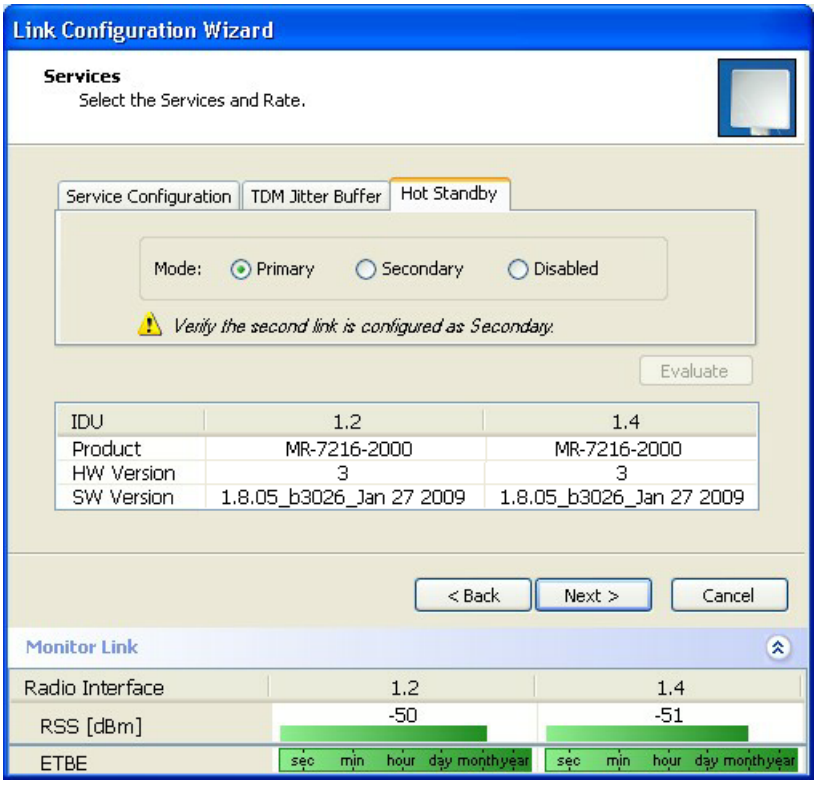


Figure K-6: Services Configuration Panel: Hot Standby mode selection

Check the Primary button to configure Primary Link as the primary link.

8. Complete the Wizard, and then move to Secondary Link.
9. Repeat step 8 for Secondary Link. For the Services Hot Standby tab, this time, check the Secondary button.
10. Complete the Wizard.
11. At Site A, 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 MRL Managermain windows should look like this:

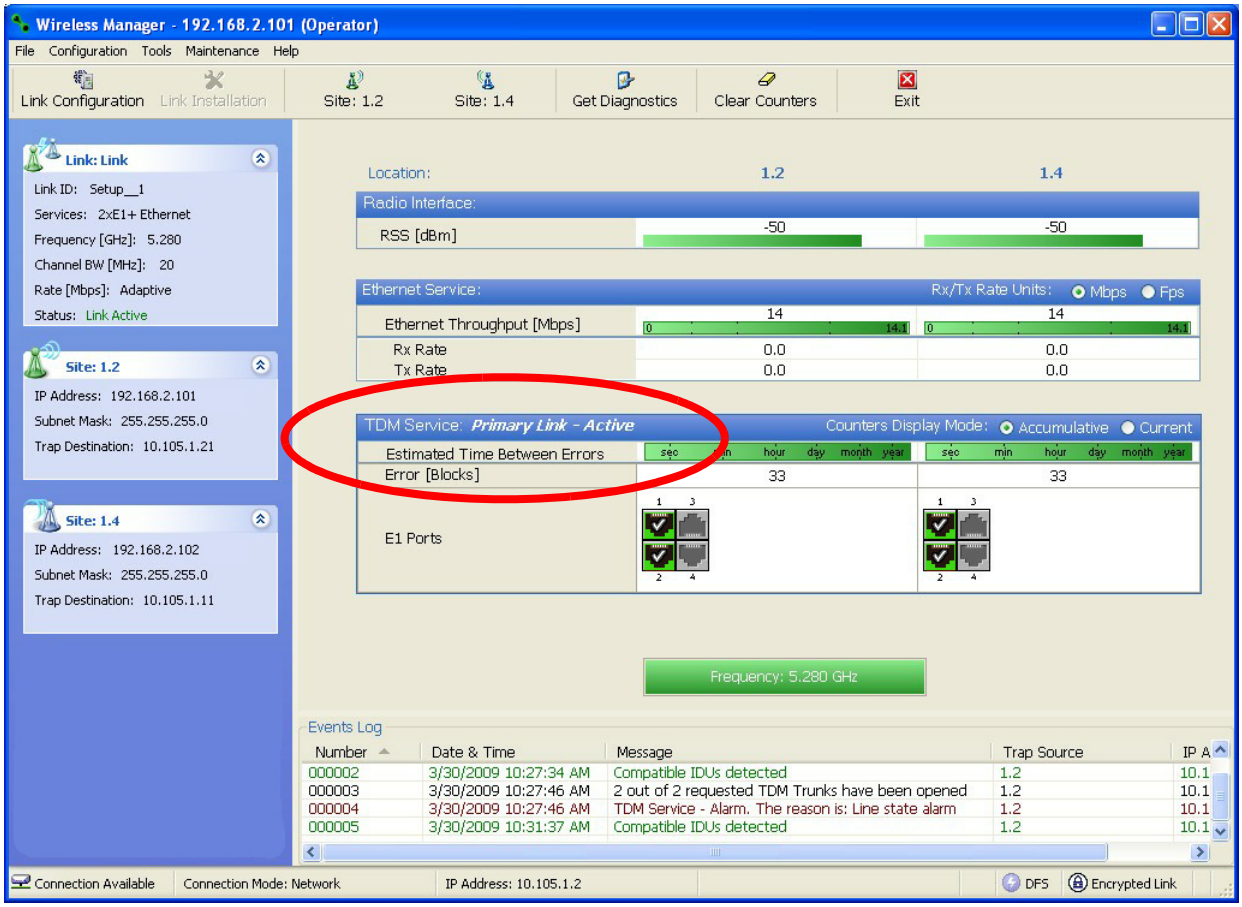


Figure K-7: The primary link under normal operation

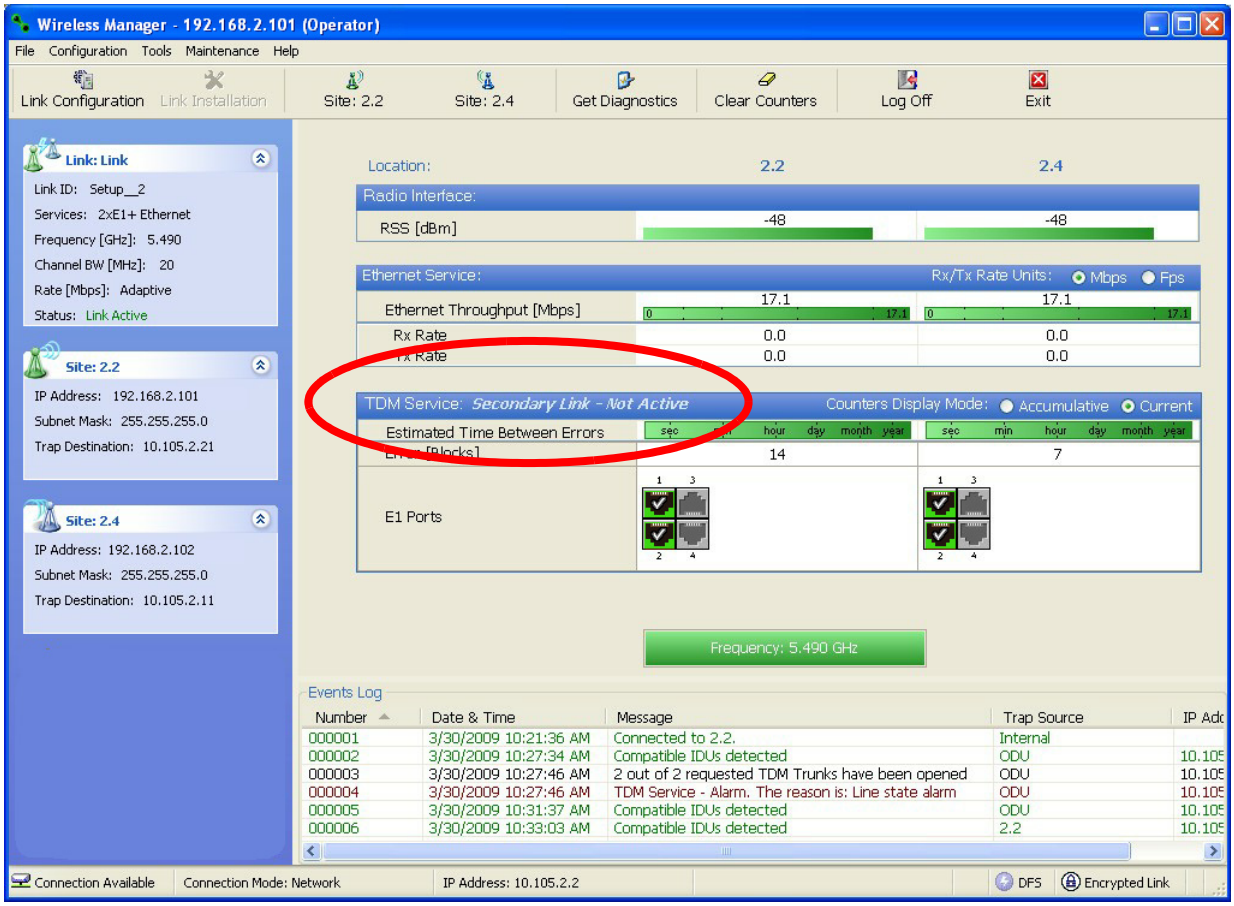


Figure K-8: The secondary link under normal operation

To see what happens following a cut-over from the primary link to the secondary link, you need to have running two copies of the MRL Manager – one logged into the primary link, and one logged into the secondary link. To see how to run two copies of the MRL Manager, see section 7 below.

Here then, is the situation after a cut-over to the secondary link:

For the primary link, the following window will appear for a few seconds:

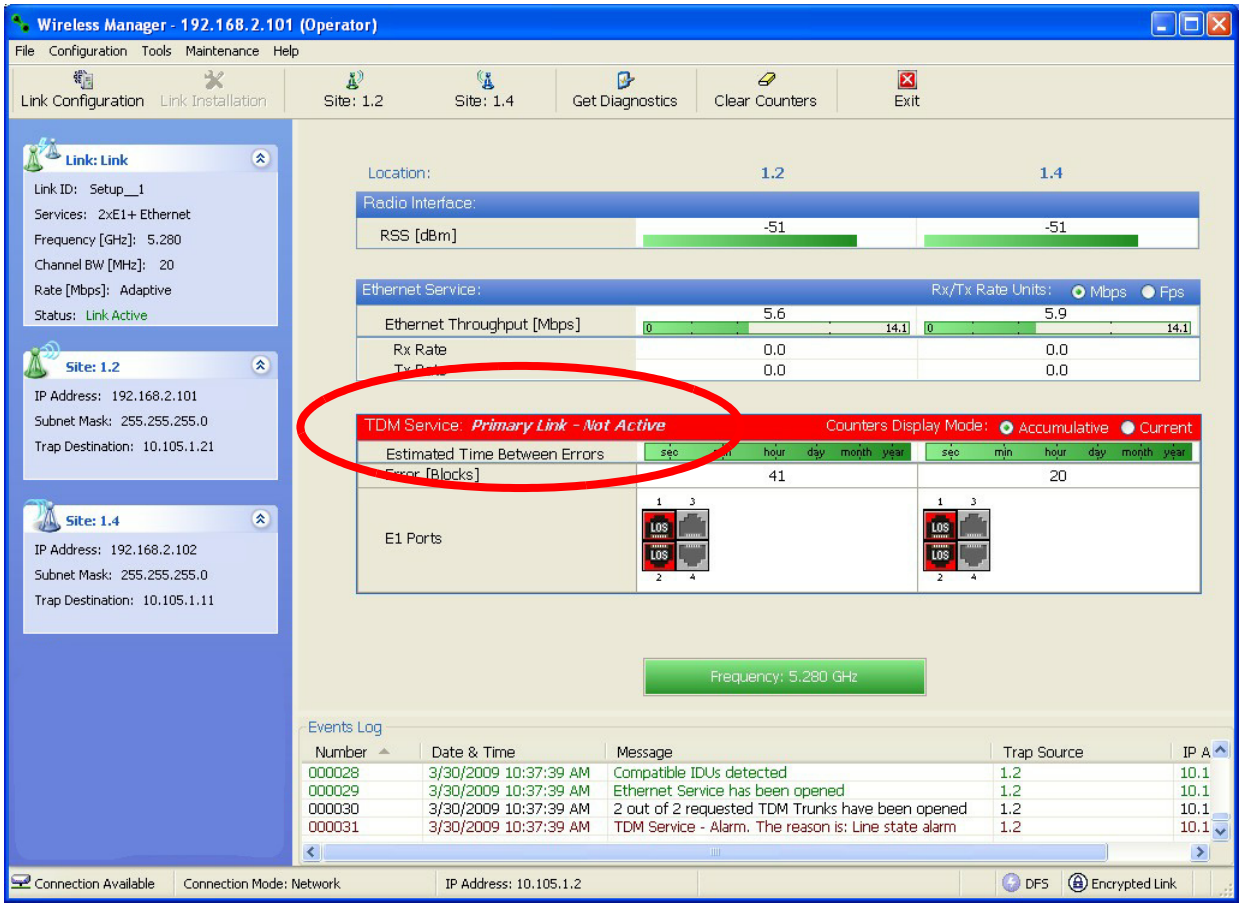


Figure K-9: Primry link a few seconds before regular No-Link display

It will then revert to the standard No-Link-available window.

On the secondary link Manager window, you will see a window like this:

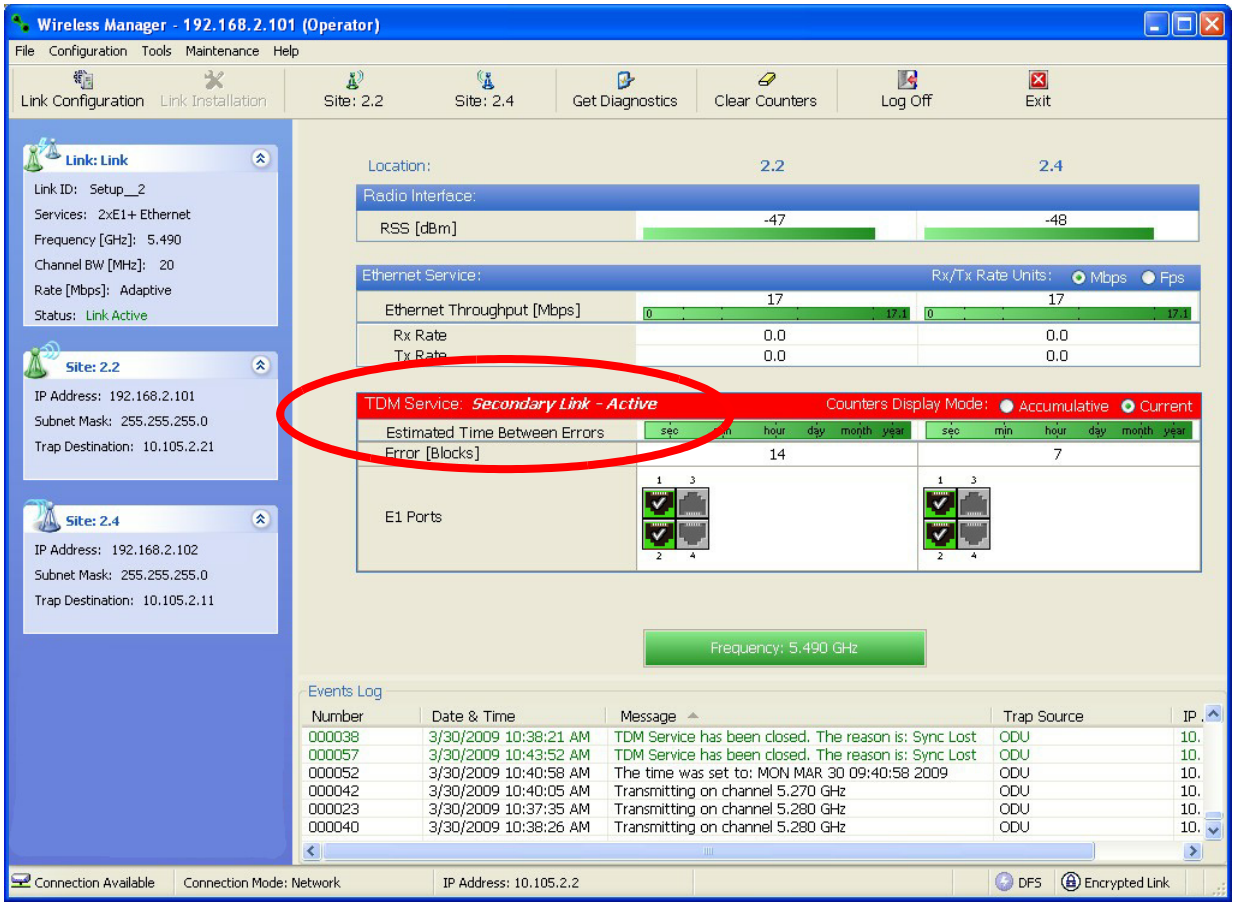


Figure K-10: Secondary Link operating as the Hot Standby link

Notice that the active link notice is highlighted in red, so that there is no mistaking which link is operational.

Maintaining a MRL Hot Standby Link

IDU Replacement

There are two situations, which must be treated differently.

Situation 1:

To replace either of the IDUs at Site B or the secondary IDU at Site A, 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 service. Disconnecting the Site B primary IDU activates Hot Standby. After the Site B primary IDU is replaced, the Link will detect the change and switch back to the primary link.

If you replaced the Site A secondary IDU, remember to reconnect the Hot Standby Alarm cable.

Situation 2:

Replacing the Site A primary IDU is different, and requires several steps.

To replace the Site A primary link IDU:

1. Power off the site A 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 **K-6** above, check the Disabled button.
3. Replace the Site A primary IDU without connecting it to the ODU (to prevent transmission by the primary link with the undefined IDU).
4. Reconnect the HSB cable between the IDUs at Site A.
5. Again, run the Configuration Wizard on the secondary link, and in the panel of figure **K-6** above, check the Secondary button to re-enable the link as secondary.
6. Connect the new Site A primary IDU to its ODU.

   The Hot Standby will automatically revert to the primary link within 50ms.

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 as shown in figure **K-4** above.
- Link ID
- Frequency
- Hot Standby mode – using the new Services panel in figure **K-6** above
- IP address (optional)

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 MRL Manager and use Hot Standby tab of figure **K-6** 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 **K-4** above. Enter the required Link ID and frequency.

To replace an ODU for primary or secondary link, at either site:

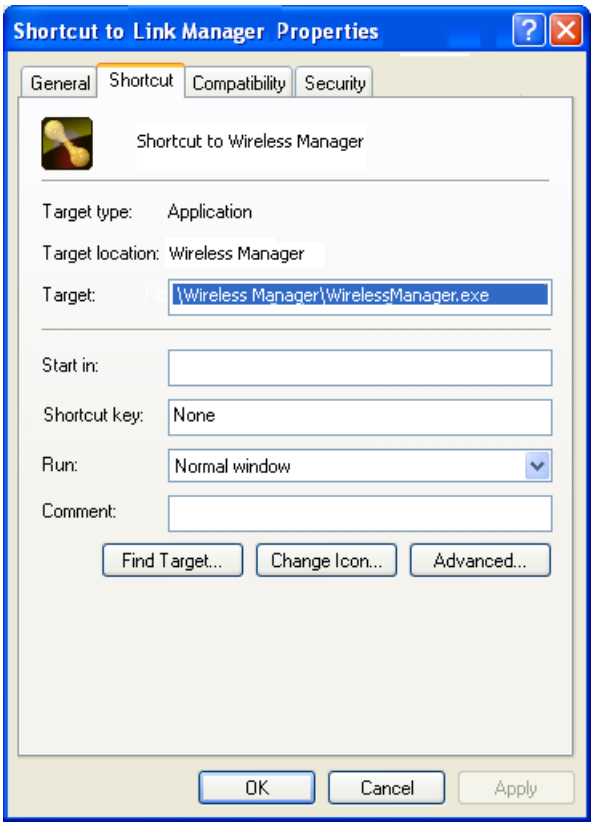
- Install the pre-configured ODU. (Since the other link is working normally, nothing need be done with it. If the secondary ODU was replaced, service remains as is on the primary link. If the primary ODU was replaced, then the service will shift back to the primary link.)

Monitoring the Links

If the MRL Manager is logged in to a link, you cannot run a second copy of it simply by clicking its desktop icon. It is assumed that your running copy of the MRL Manager is logged into the primary link.

➢ **To setup a MRL Manager desktop icon for the secondary link:**

1. Using copy and paste create a copy of the MRL Manager icon on your desktop.
2. Right-click it to get the properties menu. You should see something similar to this:



3. Scroll to the end of the Target field, and outside the inverted commas add a space, followed by the IP address of Site A for the secondary link. If for example it is 10.0.0.125, the above Target filed would look like

"C:\Program Files\MRL\MRL Manager\MRLManager.exe" 10.0.0.125

4. lick **OK**.
5. At the desktop, re-label the new icon to something recognizable like "MRL Manager Secondary"

You may now use the new icon to run a second copy of the MRL Manager. It will run against the IP address you nominated, bypassing the log on process.

Switching Logic

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 24ms
- 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:

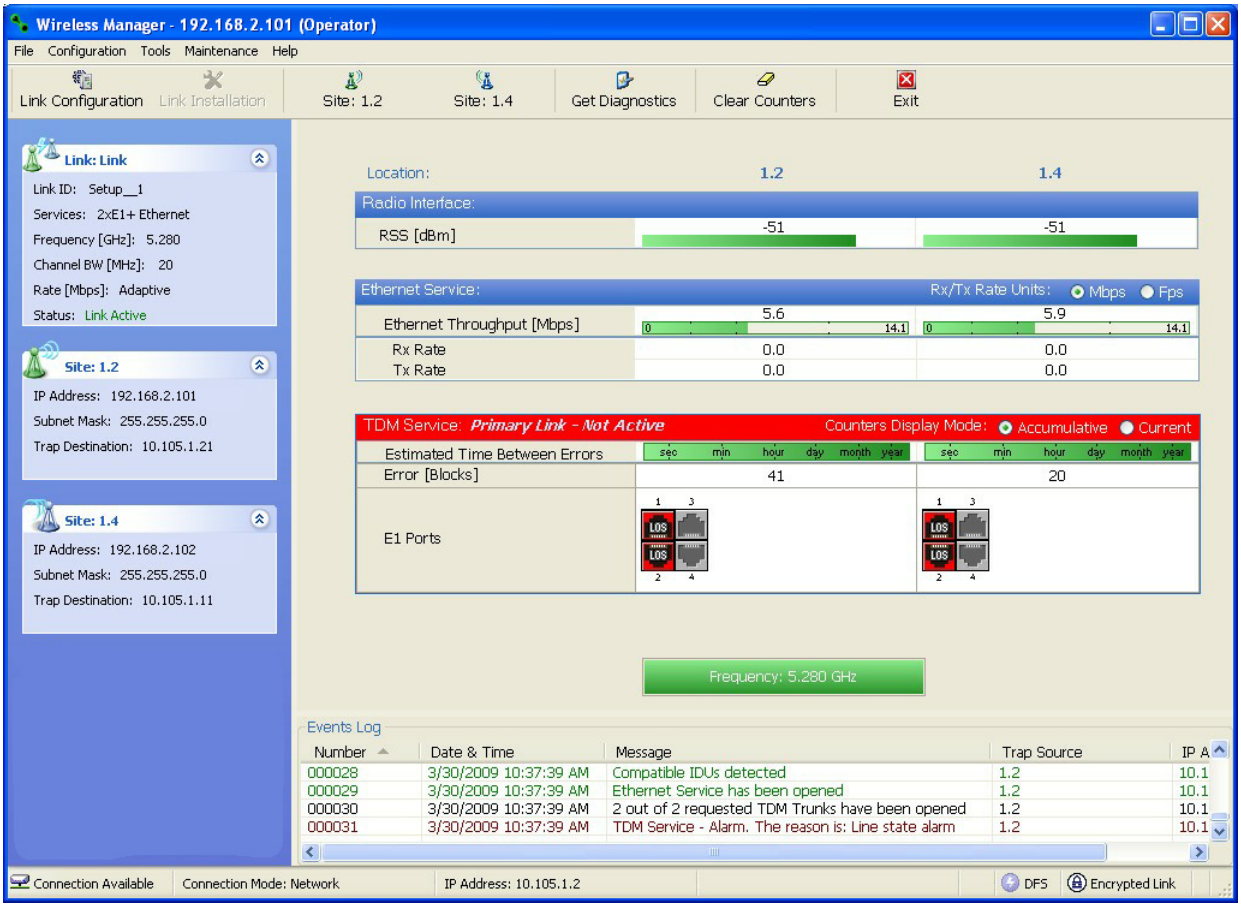


Figure K-11: Primary link after the switch over to secondary link (After a few seconds the display moves to No-Link display, with TDM ports grayed out.)

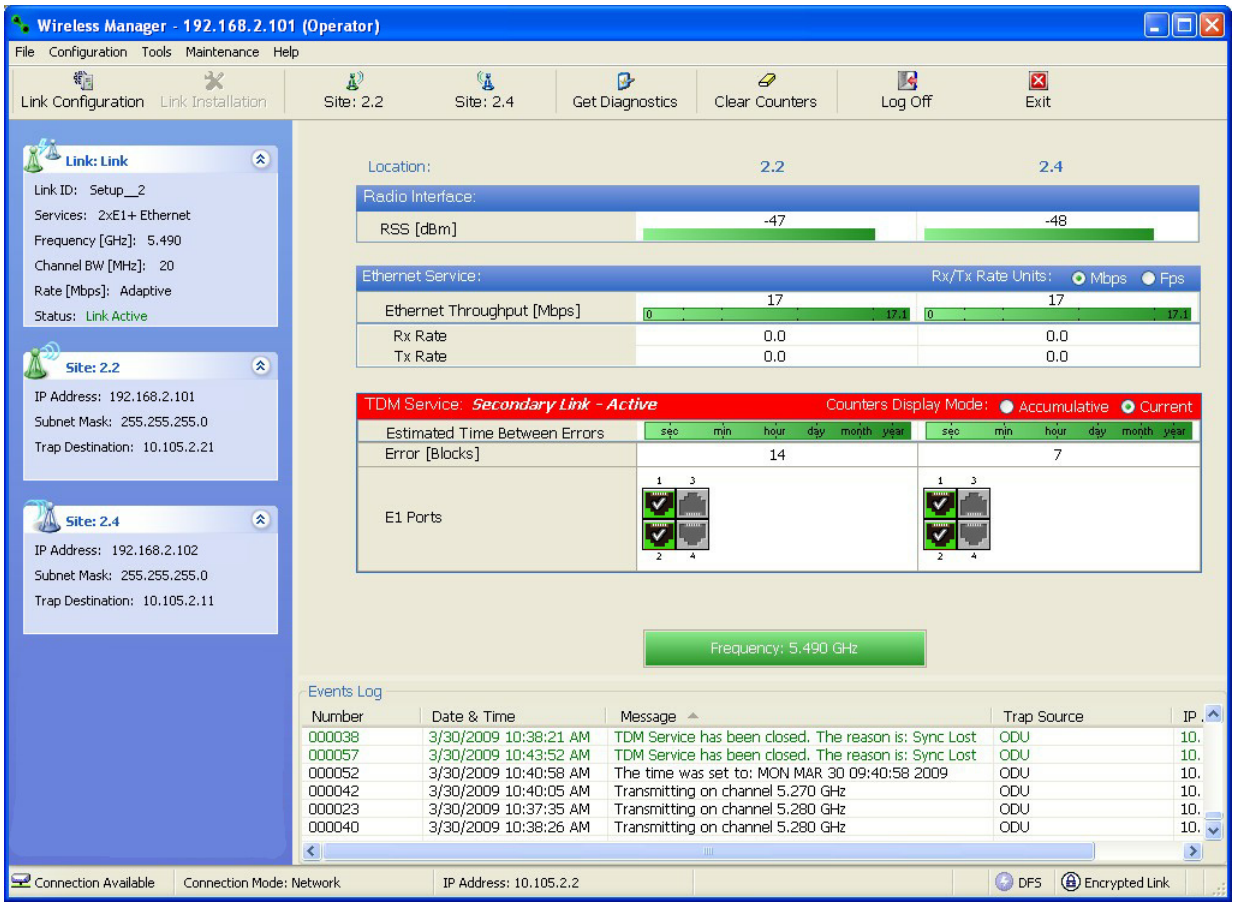


Figure K-12: Secondary link operating after the switch over to secondary. (After a few moments the TDM icons become green.)

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:

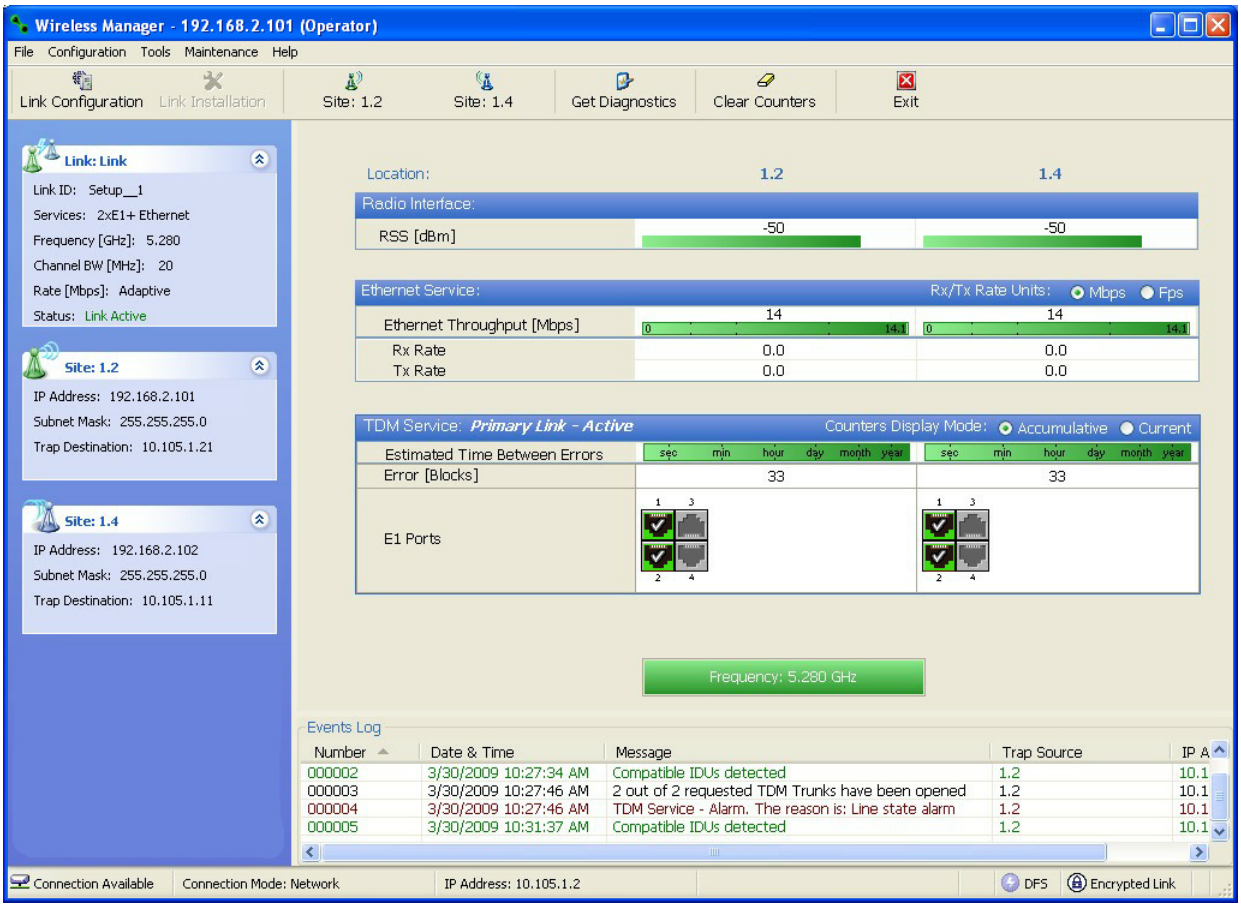


Figure K-13: Primary link operating after the switch back from secondary

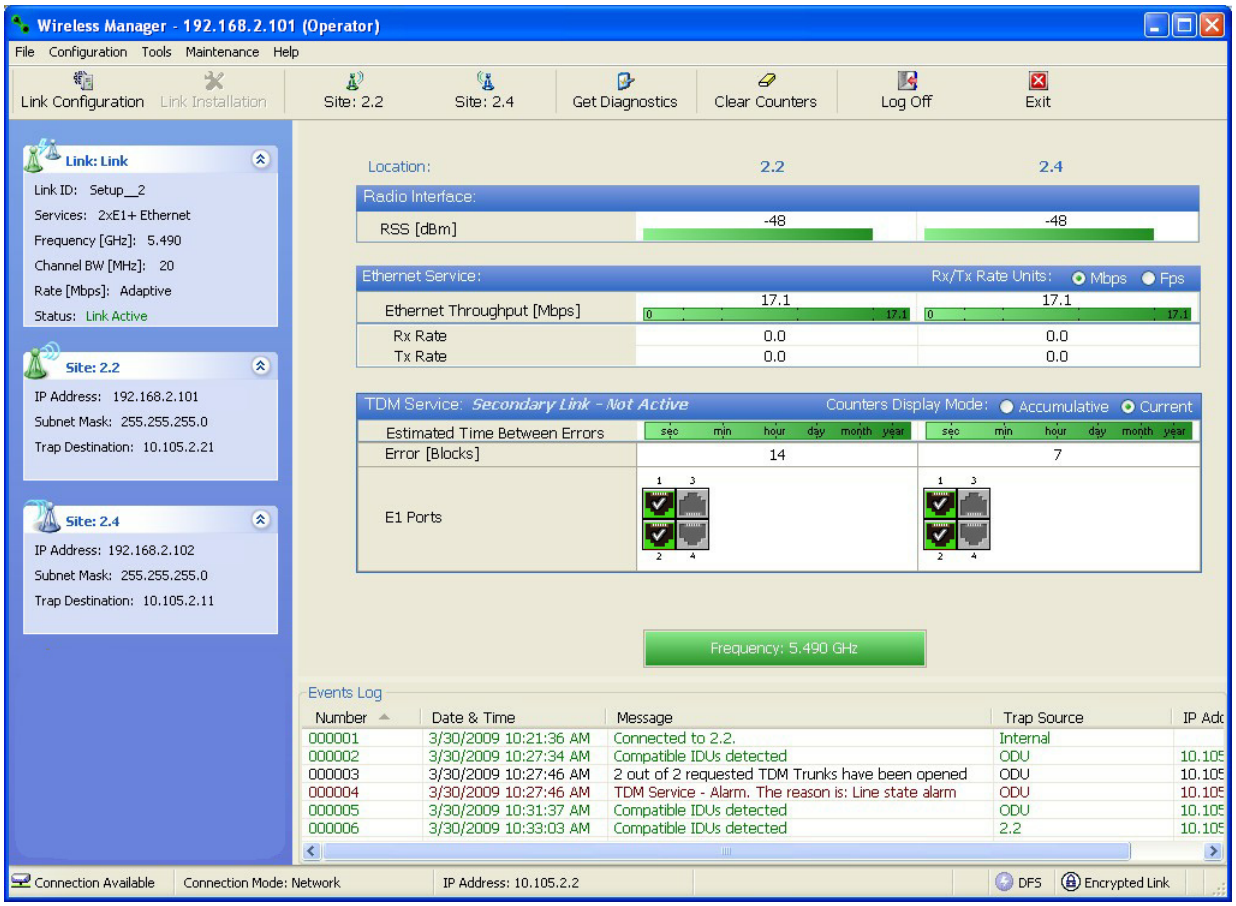


Figure K-14: Secondary Link operating after the switch back to Primary

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	• Switching to secondary will occur in the following cases:
	  • 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 24ms
	  • Primary equipment power off (either ODU or IDU, local or remote)
	• The switching result would be:
	  • 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
Switching back to primary	• Switching back to primary will occur as soon as the Primary link is fully functional for 1 second

MRL

Part 3: Technical Information

Broadband Wireless Transmission

User Manual

Version 1.8

UM 2000-22/03.09

Appendix L

Wiring Specifications

Connector Pinouts

The ODU-IDU cable is shielded/outdoor CAT-5, 4 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.

The following table shows the connector pinout:

Table L-1: ODU-IDU Connector Pinout

IDU RJ-45		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

User Port Connectors

The IDU includes ports for connecting E1/T1 and 10/100BaseT Ethernet user devices.

Trunk Port

The Trunk (E1/T1) interface terminates in an 8-pin RJ-45 balanced connector, wired in accordance to **table L-2**.

Table L-2: E1/T1 Connector Pinout

Pin	Function
4,5	Receive (input)
1,2	Transmit (output)

LAN Port

The LAN 10/100BaseT interface terminates in an 8-pin RJ-45 connector, wired in accordance to **table L-3**.

Table L-3: 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)

LAN Port for PoE-8

When connecting the PoE-8 LAN port cable directly to PC, a crossed LAN cable, terminated with RJ-45 connectors on both ends must be used, wired according to the following table:

Table L-4: Fast Ethernet Connector Pinout

Pin		Wire Color	Function	PC
1	wisted	White/Green	Ethernet (RxN)	3
2	pair	Green	Ethernet (RxT)	6
3	twisted	White/Orange	Ethernet (TxT)	1
6	pair	Orange	Ethernet (TxN)	2
4	twisted	Blue	NA	4
5	pair	White/Blue	NA	5
7	twisted	White/Brown	NA	7
8	pair	Brown	NA	8

IDU-C Connectors

IDU-C DC Power Terminal

Table L-5: Terminal Block 3-pin -48VDC

Pin	Function
Right	+
Center	Chassis
Left	–

IDU-C Alarm Connector

table L-6 lists the IDU-C Alarm connector pinout.

Table L-6: IDU-C Alarm Connector (Dry-Contact)

Pin	I/O	Description
1	Input 1	Positive
2	Input 2	Positive
3	Output 1	Normally Closed
4	Output 1	Normally Open
5	Output 2	Normally Open
6	Input 1	Negative
7	Input 2	Negative
8	Output 1	Common
9	Output 2	Common

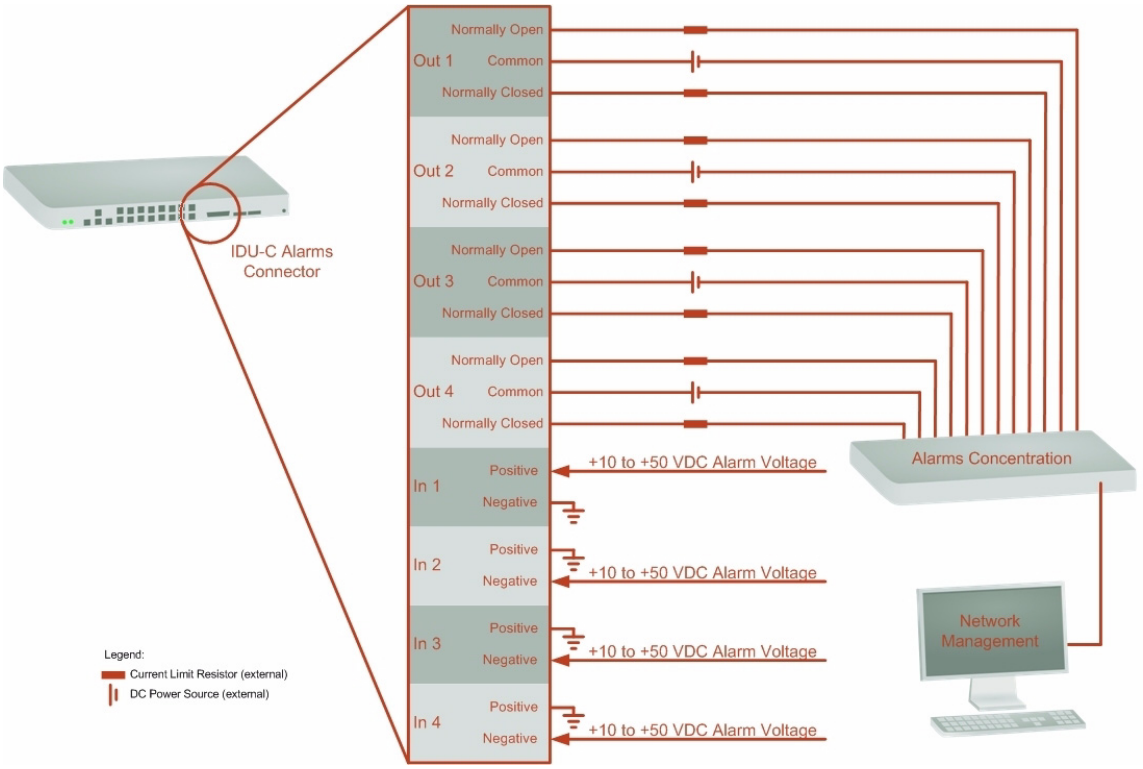


Figure L-1: Example for connecting the alarm connector

Hot Standby Port RJ11

Table L-7: Hot Standby RJ11 Port Pinout

Pin	Signal
1	Alarm out
2	Alarm in
3	Ground
4	Ground

Uplink Ethernet RJ-45 Port Connectors

The Uplink Ethernet RJ-45 10/100/1000BaseT interface terminates in an 8-pin RJ-45 connector, wired in accordance to table **L-8**.

Table L-8: Uplink Ethernet Connector Pinout

Pin	Signal	Function
1	BI_DA+	Transmit Data
2	BI_DA-	Receive Data
3	BI_DB+	Transmit Data
4	BI_DC+	Transmit Data
5	BI_DC-	Receive Data

Table L-8: Uplink Ethernet Connector Pinout

Pin	Signal	Function
6	BI_DB-	Receive Data
7	BI_DD+	Transmit Data
8	BI_DD-	Receive Data

10/100/1000baseT ports support 1000bps using four pairs hence cannot support power. This is applies to the Uplink Ethernet RJ-45 port as shown in table **L-8**.

PoE Alarm Connector

The following table lists the PoE Alarm connector pinout.

Table L-9: PoE Alarm Connector (Dry-Contact)

Pin	I/O	Description
1	NA	NA
2	NA	NA
3	Output 1	Normally Closed
4	Output 1	Normally Open
5	Output 2	Normally Open
6	NA	NA
7	Output 2	Normally Closed
8	Output 1	Common
9	Output 2	Common

IDU-R and IDU-AL Alarm Connectors

The following table shows the pinout for the IDU-R and IDU-AL Alarm Connectors.

Table L-10: Alarm Connector (Dry-Contact)

Pin	I/O	Description
1	Input 1	Positive
2	Input 2	Positive
3	Output 1	Normally Closed
4	Output 1	Normally Open
5	Output 2	Normally Open
6	Input 1	Negative
7	Input 2	Negative
8	Output 1	Common
9	Output 2	Common

O-PoE to PC LAN Cable

When connecting the O-PoE ETH port cable directly to PC, a crossed LAN CAT-5, 4 twisted-pair 24 AWG FTP, terminated with RJ-45 connectors on both ends must be used.

The following table shows the connector pinout:

Table L-11: O-POE to PC Cable Connector Pinout

O-PoE (ETH) RJ-45		Wire Color	Function	PC
1	twisted	White/Green	Ethernet (RxN)	3
2	pair	Green	Ethernet (RxT)	6
3	twisted	White/Orange	Ethernet (TxT)	1
6	pair	Orange	Ethernet (TxN)	2
4	twisted	Blue	NA	4
5	pair	White/Blue	NA	5
7	twisted	White/Brown	NA	7
8	pair	Brown	NA	8

Appendix M

Small Form-factor Pluggable Transceiver

MRL IDU-C SFP Support

The Small Form-factor Pluggable (SFP) transceiver, is a compact, hot-pluggable transceiver used in communications applications.

The SFP transceiver technology allows almost any protocol converter implementation with seamless integration to a standard Ethernet switch.

The MRL IDU-C supports SFP transceivers to provide and support several network applications.

Any standard Fast Ethernet (FE) SFP transceiver can be plugged into the IDU-C. These SFPs support various Ethernet interfaces. For example a fibre optic interface can be used to support long fibre distances.

In addition, System on SFP transceivers can be used, supporting a ***protocol converter*** concept. The main application for such SFP transceivers is ***TDM over Ethernet*** providing E1/T1 or E3/T3 over full duplex Ethernet Remote Bridge

The following table provides a few SFP types that can be used with the MRL IDU-C:

Table M-1: SFP Type and Interface description

SFP Type	Interface Description
100baseT	100BaseT, IEEE 802.3, UTP CAT5
100baseFX	Multimode fiber-optic (MMF) link spans up to 2km long
100baseLX	Single-mode fiber optic (SMF) links pans up to 10km
100baseBX	SMF single-strand link spans up to 10 km or 40 km
MiRICi-E3T3/FE (manufactured by RAD data communications)	E3/T3

Appendix N

Antenna

Antenna Characteristics

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 transmission range is a function of the antenna gain and transmitting power. These factors are limited by country regulations.

The MRL may be operated with an integrated antenna attached to the ODU unit, or with an external antenna wired to the ODU via an N-type connector. All cables and connections must be connected correctly to reduce losses. The required antenna impedance is 50Ω.

Table N-1: Antenna Characteristics

Type		Gain [dBi]	Max Range		Beam width	Dimensions		Weight		Connector	Lightening Protection
			[km]	[miles]	[degrees]	mm	in	Kg	lb		
5.8, 5.4, 5.3 GHz											
Integrated	Flat panel	22	40	25	9.0	305×305×15	12×12×0.6	1.2	2.6	NR	Yes
External	Flat panel	28	80	50	4.5	600×600×51	23.6×23.6×2	5.0	11.0	N-type	No
5.8 GHz only											
External	Dish	32.5	80	50	4.5	Dia 900	Dia 35.4	10	22	N-type	No
4.9 GHz											
External	Flat panel	21	24	15	9.0	305×305×15	12×12×0.6	1.2	2.6	N-type	Yes
External	Dish	27	80	50	5	Dia 600	Dia 23.6	5.0	11.0	N-type	Yes
Integrated	Flat panel	18.5	40	25	10	305x305x15	12x12x0.6	1.2	2.6	NR	Yes
2.4 GHz											
Integrated	Flat panel	16	40	25	20	305×305×25	12×12×1	1.2	2.6	NR	Yes
External	Grid	24	80	50	H:10 V:14	600×997×380	23.5×39.2×15	2.0	4.6	N-type	No
2.5 GHz											
Integrated	Flat panel	17.5	40	25	25	305×305×25	12×12×1	1.2	2.6	NR	Yes
External	Grid	24	80	50	H:9 V:13	600x900	23.6x35.4	2.5	5.5	N-type	No

Antenna Types

Figure N-1: Parabolic Dish Antenna

The Parabolic dish antenna is a high-gain, reflector antenna used for radio, television, and data communications. The relatively short wavelength of electromagnetic (radio) energy at these frequencies allows reasonably sized reflectors to exhibit the very desirable highly directional response for both receiving and transmitting.

Figure N-2: Grid Antenna

Used for 2.4 GHz applications. Due to the large size, the grid design minimizes weight and windloading.

Appendix O

MIB Reference

Introduction

About the MIB

The MRL MIB is a set of APIs that enables external applications to control MRL 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 MRL and supplements the public group.

This appendix describes the public and private MIB used by MRL.

Terminology

The following terms are used in this appendix.

Term	Meaning
MIB	Management Information Base
API	Application Programming Interface
SNMP	Simple Network Management Protocol

In addition, the MIB uses internally, the older notions of **Local site** and **Remote site** where this manual would use site A and site B.

To avoid burdening the reader, this appendix will follow the MIB usage.

Interface API

Control Method

The MRL Manager application provides all the means to configure and monitor a MRL 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.

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. Please refer to the operation in the parameters description.
- Some of the MIB parameters values are product dependent. It is strongly recommend using the MRL Manager Application for changing these values. Setting wrong values may cause indeterminate results.

Community String

To control a link, all SNMP requests should go to the local site IP address.

Private MIB Structure

The sections in the private MRL MIB and its location in the MIB tree are shown in figure **O-1** below:

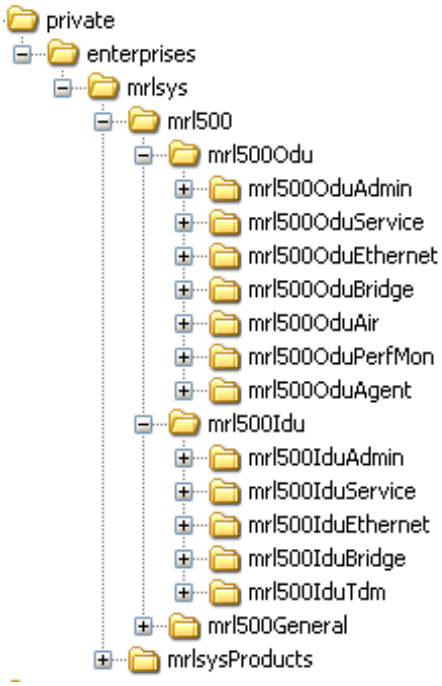


Figure O-1: Top Level Sections of the private MIB

The ODU MIB contains the sections: Admin, Service, Ethernet, Bridge, Air, PerfMon and Agent.

The general MIB include a single generic parameter that is used by all traps as a trap description parameter.

MIB Parameters

The following section describes all of the MIB parameters. The MIB parameters follow the following naming convention:

<mrl500><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.

Supported Variables from the RFC 1213 MIB

Table O-1: Supported RFC 1213 Variables

Name	OID	Type	Access	Description
ifIndex	.1.3.6.1.2.1.2.2.1.1.x[a]	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 ontain the nominal bandwidth.
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 be transmitted to a subnetwork-unicast address, including those that were discarded or not sent.
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.

a. x is the interface ID

MIB Parameters

Table O-2: Private MIB Parameters (Sheet 1 of 14)

Name	OID	Type	Access	Description
mrl500OduAdmProductType	1.3.6.1.4.1.4458.1000.1.1.1	DisplayString	RO	ODU configuration description.
mrl500OduAdmHwRev	1.3.6.1.4.1.4458.1000.1.1.2	DisplayString	RO	ODU Hardware Version.
mrl500OduAdmSwRev	1.3.6.1.4.1.4458.1000.1.1.3	DisplayString	RO	ODU Software Version.
mrl500OduAdmLinkName	1.3.6.1.4.1.4458.1000.1.1.4	DisplayString	RW	Link Name. A change is effective immediately.
mrl500OduAdmResetCmd	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.
mrl500OduAdmAddres	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: mrl500OduAdmIpParamsCnfg is recommended.
mrl500OduAdmMask	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: mrl500OduAdmIpParamsCnfg is recommended.
mrl500OduAdmGateway	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: mrl500OduAdmIpParamsCnfg is recommended.
mrl500OduAdmBroadcast	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.
mrl500OduAdmHostsTable			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.
mrl500OduAdmHostsEntry			N/A	Trap destinations table entry. INDEX { mrl500OduAdmHostsIndex }
mrl500OduAdmHostsIndex			RO	Trap destinations table index.
mrl500OduAdmHostsIp	1.3.6.1.4.1.4458.1000.1.1.12.1.2	IpAddress	RW	Trap destination IP address. A change is effective immediately.
mrl500OduAdmHostsPort	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.
mrl500OduBuzzerAdminState	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).
mrl500OduProductId	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.
mrl500OduReadCommunity	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.
mrl500OduReadWriteCommunity	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.
mrl500OduTrapCommunity	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.
mrl500OduAdmSnmpAgentVersion	1.3.6.1.4.1.4458.1000.1.1.18	Integer	RO	Major version of the SNMP agent.

Table O-2: Private MIB Parameters (Sheet 2 of 14)

Name	OID	Type	Access	Description
mrl500OduAdmRemoteSiteName	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.
mrl500OduAdmSnmpAgentMinorVersion	1.3.6.1.4.1.4458.1000.1.1.20	Integer	RO	Minor version of the SNMP agent.
mrl500OduAdmLinkPassword	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.
mrl500OduAdmSiteLinkPassword	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.
mrl500OduAdmDefaultPassword	1.3.6.1.4.1.4458.1000.1.1.23	Integer	RO	This parameter indicates if the current Link Password is the default password.
mrl500OduAdmConnectionType	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.
mrl500OduAdmBackToFactorySettingsCmd	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.
mrl500OduAdmIpParamsCnfg	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>|
mrl500OduAdmVlanID	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.
mrl500OduAdmVlanPriority	1.3.6.1.4.1.4458.1000.1.1.28	Integer	RW	VLAN Priority. 0 is lowest priority 7 is highest priority.
mrl500OduAdmSN	1.3.6.1.4.1.4458.1000.1.1.29	DisplayString	RO	IDU Serial Number
mrl500OduAdmProductName	1.3.6.1.4.1.4458.1000.1.1.30	DisplayString	RO	This is the product name as it exists at EC
mrl500OduAdmActivationKey	1.3.6.1.4.1.4458.1000.1.1.31	DisplayString	RW	Activates a general key.
mrl500OduSrvMode	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.
mrl500OduSrvBridging	1.3.6.1.4.1.4458.1000.1.2.3	Integer	RO	Bridging Mode. Valid values are: disabled (0) enabled (1).
mrl500OduEthernetRemainingRate	1.3.6.1.4.1.4458.1000.1.3.1	Integer	RO	Current Ethernet bandwidth in bps.
mrl500OduEthernetIfTable			N/A	ODU Ethernet Interface table.
mrl500OduEthernetIfEntry			N/A	ODU Ethernet Interface table entry. INDEX { mrl500OduEthernetIfIndex }
mrl500OduEthernetIfIndex	1.3.6.1.4.1.4458.1000.1.3.2.1.1	Integer	RO	ODU Ethernet Interface Index.
mrl500OduEthernetIfAddress	1.3.6.1.4.1.4458.1000.1.3.2.1.5	DisplayString	RO	ODU MAC address.
mrl500OduEthernetIfAdminStatus	1.3.6.1.4.1.4458.1000.1.3.2.1.6	Integer	RW	Required state of the interface.
mrl500OduEthernetIfOperStatus	1.3.6.1.4.1.4458.1000.1.3.2.1.7	Integer	RO	Current operational state of the interface.
mrl500OduEthernetIfFailAction	1.3.6.1.4.1.4458.1000.1.3.2.1.8	Integer	RW	Failure action of the interface.
mrl500OduEthernetNumOfPorts	1.3.6.1.4.1.4458.1000.1.3.3	Integer	RO	Number of ODU network interfaces.
mrl500OduBridgeBasePortTable			N/A	ODU Bridge Ports table.
mrl500OduBridgeBasePortEntry			N/A	ODU Bridge Ports table entry. INDEX { mrl500OduBridgeBasePortIndex }
mrl500OduBridgeBasePortIndex			RO	ODU Bridge Port Number.
mrl500OduBridgeBaseIfIndex			RO	IfIndex corresponding to ODU Bridge port.
mrl500OduBridgeTpMode	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).

Table O-2: Private MIB Parameters (Sheet 3 of 14)

Name	OID	Type	Access	Description
mrl500OduBridgeTpPortTable			N/A	ODU Transparent Bridge Ports table.
mrl500OduBridgeTpPortEntry			N/A	ODU Transparent Bridge Ports table entry. INDEX { mrl500OduBridgeTpPortIndex }
mrl500OduBridgeTpPortIndex			RO	ODU Transparent Bridge Port Number.
mrl500OduBridgeTpPortInFrames	1.3.6.1.4.1.4458.1000.1.4.4.3.1.3	Counter	RO	Number of frames received by this port.
mrl500OduBridgeTpPortOutFrames	1.3.6.1.4.1.4458.1000.1.4.4.3.1.4	Counter	RO	Number of frames transmitted by this port.
mrl500OduBridgeTpPortInBytes	1.3.6.1.4.1.4458.1000.1.4.4.3.1.101	Counter	RO	Number of bytes received by this port.
mrl500OduBridgeTpPortOutBytes	1.3.6.1.4.1.4458.1000.1.4.4.3.1.102	Counter	RO	Number of bytes transmitted by this port.
mrl500OduAirFreq	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.
mrl500OduAirDesiredRate	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.
mrl500OduAirSSID	1.3.6.1.4.1.4458.1000.1.5.3	DisplayString	RW	Reserved for the Manager application provided with the product.
mrl500OduAirTxPower	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.
mrl500OduAirSesState	1.3.6.1.4.1.4458.1000.1.5.5	Integer	RO	Current Link State. The value is active (3) during normal operation.
mrl500OduAirMstrSlv	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.
mrl500OduAirResync	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.
mrl500OduAirRxPower	1.3.6.1.4.1.4458.1000.1.5.9.1	Integer	RO	Received Signal Strength in dBm.
mrl500OduAirTotalFrames	1.3.6.1.4.1.4458.1000.1.5.9.2	Counter	RO	Total Number of received radio frames.
mrl500OduAirBadFrames	1.3.6.1.4.1.4458.1000.1.5.9.3	Counter	RO	Total number of received radio frames with CRC error.
mrl500OduAirCurrentRate	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.
mrl500OduAirCurrentRateIdx	1.3.6.1.4.1.4458.1000.1.5.9.5	Integer	RO	Index of current air rate.
mrl500OduAirTxPower36	1.3.6.1.4.1.4458.1000.1.5.10	Integer	RW	Deprecated parameter. Actual behavior is read-only.
mrl500OduAirTxPower48	1.3.6.1.4.1.4458.1000.1.5.11	Integer	RW	Deprecated parameter. Actual behavior is read-only.
mrl500OduAirCurrentTxPower	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.
mrl500OduAirMinFrequency	1.3.6.1.4.1.4458.1000.1.5.13	Integer	RO	Minimum center frequency in MHz.
mrl500OduAirMaxFrequency	1.3.6.1.4.1.4458.1000.1.5.14	Integer	RO	Maximum center frequency in MHz.
mrl500OduAirFreqResolution	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.
mrl500OduAirCurrentFreq	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.
mrl500OduAirNumberOfChannels	1.3.6.1.4.1.4458.1000.1.5.17	Integer	RO	Number of channels that can be used.

Table O-2: Private MIB Parameters (Sheet 4 of 14)

Name	OID	Type	Access	Description
mrl500OduAirChannelsTable			N/A	Table of channels used by automatic channels selection (ACS).
mrl500OduAirChannelsEntry			N/A	ACS channels table entry. INDEX { mrl500OduAirChannelsIndex }
mrl500OduAirChannelsIndex	1.3.6.1.4.1.4458.1000.1.5.18.1.1	Integer	RO	Channel Index.
mrl500OduAirChannelsFrequency	1.3.6.1.4.1.4458.1000.1.5.18.1.2	Integer	RO	Channel frequency in MHz.
mrl500OduAirChannelsOperState	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).
mrl500OduAirChannelsAvail	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).
mrl500OduAirChannelsDefaultFreq	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).
mrl500OduAirDfsState	1.3.6.1.4.1.4458.1000.1.5.19	Integer	RO	Radar detection state. Valid values: disabled (0) enabled (1).
mrl500OduAirAutoChannelSelectionState	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).
mrl500OduAirEnableTxPower	1.3.6.1.4.1.4458.1000.1.5.21	Integer	RO	Indicating Transmit power configuration enabled or disabled.
mrl500OduAirMinTxPower	1.3.6.1.4.1.4458.1000.1.5.22	Integer	RO	Minimum Transmit power in dBm.
mrl500OduAirMaxTxPowerTable			N/A	Table of Maximum transmit power per air rate in dBm.
mrl500OduAirMaxTxPowerEntry			N/A	Maximum Transmit power table entry. INDEX { mrl500OduAirMaxTxPowerIndex }
mrl500OduAirMaxTxPowerIndex	1.3.6.1.4.1.4458.1000.1.5.23.1.1	Integer	RO	Air interface rate index.
mrl500OduAirMaxTxPower	1.3.6.1.4.1.4458.1000.1.5.23.1.2	Integer	RO	Maximum Transmit power in dBm.
mrl500OduAirChannelBandwidth	1.3.6.1.4.1.4458.1000.1.5.24	Integer	RW	Channel bandwidth in KHz. A change is effective after reset.
mrl500OduAirChannelBWTable			N/A	Channel Bandwidths table.
mrl500OduAirChannelBWEntry			N/A	Channel Bandwidth table entry. INDEX { mrl500OduAirChannelBWIndex }
mrl500OduAirChannelBWIndex	1.3.6.1.4.1.4458.1000.1.5.25.1.1	Integer	RO	Channel Bandwidth index.
mrl500OduAirChannelBWAvail	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.
mrl500OduAirChannelsAdminState	1.3.6.1.4.1.4458.1000.1.5.25.1.3	DisplayString	RO	Channels' availability per CBW.
mrl500OduAirRFD	1.3.6.1.4.1.4458.1000.1.5.26	Integer	RO	Current radio frame duration in microseconds.
mrl500OduAirRatesTable			N/A	Air Rate indexes table for current channel bandwidth.
mrl500OduAirRatesEntry			N/A	Air Rate indexes table entry. INDEX { mrl500OduAirRatesIndex }
mrl500OduAirRatesIndex	1.3.6.1.4.1.4458.1000.1.5.27.1.1	Integer	RO	Air Rate index.
mrl500OduAirRatesAvail	1.3.6.1.4.1.4458.1000.1.5.27.1.2	Integer	RO	Air Rate availability depending on air interface conditions.

Table O-2: Private MIB Parameters (Sheet 5 of 14)

Name	OID	Type	Access	Description
mrl500OduAirDesiredRateIdx	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.
mrl500OduAirLinkDistance	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.
mrl500OduAirLinkWorkingMode	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.
mrl500OduAirMajorLinkIfVersion	1.3.6.1.4.1.4458.1000.1.5.31	Integer	RO	Major link interface version
mrl500OduAirMinorLinkIfVersion	1.3.6.1.4.1.4458.1000.1.5.32	Integer	RO	Minor link interface version
mrl500OduAirHssDesiredOpState	1.3.6.1.4.1.4458.1000.1.5.40.1	Integer	RW	Required Hub Site Synchronization operating state.
mrl500OduAirHssCurrentOpState	1.3.6.1.4.1.4458.1000.1.5.40.2	Integer	RO	Current Hub Site Synchronization operating state.
mrl500OduAirHssSyncStatus	1.3.6.1.4.1.4458.1000.1.5.40.3	Integer	RO	Hub Site Synchronization sync status.
mrl500OduAirHssExtPulseStatus	1.3.6.1.4.1.4458.1000.1.5.40.4	Integer	RO	Hub Site Synchronization external pulse detection status.
mrl500OduAirHssExtPulseType	1.3.6.1.4.1.4458.1000.1.5.40.5	Integer	RO	Hub Site Synchronization external pulse type.
mrl500OduAirHssDesiredExtPulseType	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)}. Valid value for read only: {notApplicable(1)}.
mrl500OduAirHssRfpTable			N/A	ODU Radio Frame Patterns (RFP) Table.
mrl500OduAirHssRfpEntry			N/A	ODU RFP Table entry. INDEX { mrl500OduAirHssRfpIndex }
mrl500OduAirHssRfpIndex	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).
mrl500OduAirHssRfpEthChannelBW5MHz	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.
mrl500OduAirHssRfpTdmChannelBW5MHz	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.
mrl500OduAirHssRfpEthChannelBW10MHz	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.
mrl500OduAirHssRfpTdmChannelBW10MHz	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.
mrl500OduAirHssRfpEthChannelBW20MHz	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.
mrl500OduAirHssRfpTdmChannelBW20MHz	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.

Table O-2: Private MIB Parameters (Sheet 6 of 14)

Name	OID	Type	Access	Description
mrl500OduAirLockRemote	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.
mrl500OduAirAntennaGain	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 .
mrl500OduAirFeederLoss	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.
mrl500OduAirMaxAntennaGain	1.3.6.1.4.1.4458.1000.1.5.44	Integer	RO	Maximum allowed Antenna Gain in 0.1 dBi resolution.
mrl500OduAirMinAntennaGain	1.3.6.1.4.1.4458.1000.1.5.45	Integer	RO	Minimum allowed Antenna Gain in 0.1 dBi resolution.
mrl500OduAirMaxEIRP	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.
mrl500OduAirAntennaGainConfigSupport	1.3.6.1.4.1.4458.1000.1.5.47	Integer	RO	Antenna Gain Configurability options are product specific: supported not supported.
mrl500OduAirAntennaType	1.3.6.1.4.1.4458.1000.1.5.48	Integer	RW	External Antenna Type: Monopolar or Bipolar.
mrl500OduAirRssBalance	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.
mrl500OduAirTotalTxPower	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.
mrl500OduAirInstallFreqAndCBW	1.3.6.1.4.1.4458.1000.1.5.51	DisplayString	RW	Installation frequency Channel BW.
mrl500OduAirDFStype	1.3.6.1.4.1.4458.1000.1.5.52	Integer	RO	DFS regulation type.
mrl500OduAirComboSubBandTable			N/A	ODU Multi-band Sub Bands Table.
mrl500OduAirComboSubBandEntry			N/A	ODU Multi-band Sub Bands Table entry. INDEX { mrl500OduAirComboSubBandIndex }
mrl500OduAirComboSubBandIndex	1.3.6.1.4.1.4458.1000.1.5.53.1.1.1	Integer	RO	ODU Multi-band sub bands table index.
mrl500OduAirComboSubBandId	1.3.6.1.4.1.4458.1000.1.5.53.1.1.2	DisplayString	RO	Represents the Multi-band sub band ID.
mrl500OduAirComboSubBandDescription	1.3.6.1.4.1.4458.1000.1.5.53.1.1.3	DisplayString	RO	Multi-band sub band description.
mrl500OduAirComboSubBandInstallFreq	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.
mrl500OduAirComboSubBandAdminState	1.3.6.1.4.1.4458.1000.1.5.53.1.1.5	Integer	RO	Represents the Multi-band sub band administrative state.
mrl500OduAirComboSubBandInstallationAllowed	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.
mrl500OduAirComboNumberOfSubBands	1.3.6.1.4.1.4458.1000.1.5.53.2	Integer	RO	Represents the number of Multi-band sub bands.
mrl500OduAirComboSwitchSubBand	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.
mrl500OduPerfMonCurrTable			N/A	This table defines/keeps the counters of the current 15 min interval.
mrl500OduPerfMonCurrEntry			N/A	This is an entry in the Current Interval Table. INDEX {ifIndex }
mrl500OduPerfMonCurrUAS	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.

Table O-2: Private MIB Parameters (Sheet 7 of 14)

Name	OID	Type	Access	Description
mrl500OduPerfMonCurrES	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.
mrl500OduPerfMonCurrSES	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.
mrl500OduPerfMonCurrBBE	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.
mrl500OduPerfMonCurrIntegrity	1.3.6.1.4.1.4458.1000.1.6.1.1.5	Integer	RO	Indicates the integrity of the entry.
mrl500OduPerfMonIntervalTable			N/A	This table defines/keeps the counters of the current 15 min interval.
mrl500OduPerfMonIntervalEntry			N/A	This is an entry in the Interval Table. INDEX {ifIndex mrl500OduPerfMonIntervalIdx }
mrl500OduPerfMonIntervalIdx			RO	This table is indexed per interval number. Each interval is of 15 minutes and the oldest is 96.
mrl500OduPerfMonIntervalUAS			RO	The current number of Unavailable Seconds per interval.
mrl500OduPerfMonIntervalES			RO	Current number of Errored Seconds per interval.
mrl500OduPerfMonIntervalSES			RO	Current number of Severely Errored Seconds per interval.
mrl500OduPerfMonIntervalBBE			RO	Current number of Background Block Errors per interval.
mrl500OduPerfMonIntervalIntegrity			RO	Indicates the integrity of the entry per interval.
mrl500OduPerfMonDayTable			N/A	This table defines/keeps the counters of the current 15 min interval.
mrl500OduPerfMonDayEntry			N/A	This is an entry in the Days Table. INDEX {ifIndex mrl500OduPerfMonDayIdx }
mrl500OduPerfMonDayIdx			RO	This table is indexed per interval number. Each interval is of 24 hours and the oldest is 30.
mrl500OduPerfMonDayUAS			RO	The current number of Unavailable Seconds per interval of 24 hours.
mrl500OduPerfMonDayES			RO	Current number of Errored Seconds per interval of 24 hours.
mrl500OduPerfMonDaySES			RO	Current number of Severely Errored Seconds per interval of 24 hours.
mrl500OduPerfMonDayBBE			RO	Current number of Background Block Errors per interval of 24 hours.
mrl500OduPerfMonDayIntegrity			RO	Indicates the integrity of the entry per interval of 24 hours.
mrl500OduPerfMonAirCurrTable			N/A	This table defines/keeps the counters of the current 15 min interval.
mrl500OduPerfMonAirCurrEntry			N/A	This is an entry in the Current Interval Table. INDEX {ifIndex }
mrl500OduPerfMonAirCurrMinRSL	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.
mrl500OduPerfMonAirCurrMaxRSL	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.
mrl500OduPerfMonAirCurrRSLThresh1Exceed	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.
mrl500OduPerfMonAirCurrRSLThresh2Exceed	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.
mrl500OduPerfMonAirCurrMinTSL	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.

Table O-2: Private MIB Parameters (Sheet 8 of 14)

Name	OID	Type	Access	Description
mrl500OduPerfMonAirCurrMaxTSL	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.
mrl500OduPerfMonAirCurrTSLThresh1Exceed	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.
mrl500OduPerfMonAirCurrBBERThresh1Exceed	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.
mrl500OduPerfMonAirIntervalTable			N/A	This table defines/keeps the counters of the current 15 min interval.
mrl500OduPerfMonAirIntervalEntry			N/A	This is an entry in the Interval Table. INDEX {ifIndex mrl500OduPerfMonAirIntervalIdx }
mrl500OduPerfMonAirIntervalIdx			RO	This table is indexed per interval number. Each interval is of 15 minutes and the oldest is 96.
mrl500OduPerfMonAirIntervalMinRSL			RO	Current Min Received Level Reference per interval.
mrl500OduPerfMonAirIntervalMaxRSL			RO	Current Max Received Level Reference per interval.
mrl500OduPerfMonAirIntervalRSLThresh1Exceed			RO	Number of seconds Receive Signal Level exceeded the RSL1 threshold per interval.
mrl500OduPerfMonAirIntervalRSLThresh2Exceed				Number of seconds Receive Signal Level exceeded the RSL2 threshold ACCESS read-only per interval.
mrl500OduPerfMonAirIntervalMinTSL			RO	Current Min Transmit Signal Level per interval.
mrl500OduPerfMonAirIntervalMaxTSL			RO	Current Max Transmit Signal Level per interval.
mrl500OduPerfMonAirIntervalTSLThresh1Exceed			RO	Number of seconds Transmit Signal Level exceeded the TSL1 threshold per interval.
mrl500OduPerfMonAirIntervalBBERThresh1Exceed			RO	Number of seconds Background Block Error Ratio exceeded the BBER1 threshold per interval.
mrl500OduPerfMonAirDayTable			N/A	This table defines/keeps the counters of the current 15 min interval.
mrl500OduPerfMonAirDayEntry			N/A	This is an entry in the Days Table. INDEX {ifIndex mrl500OduPerfMonAirDayIdx }
mrl500OduPerfMonAirDayIdx			RO	This table is indexed per Day number. Each Day is of 15 minutes and the oldest is 96.
mrl500OduPerfMonAirDayMinRSL			RO	Current Min Received Level Reference per Day.
mrl500OduPerfMonAirDayMaxRSL			RO	Current Max Received Level Reference per Day.
mrl500OduPerfMonAirDayRSLThresh1Exceed			RO	Number of seconds Receive Signal Level exceeded the RSL1 threshold per Day.
mrl500OduPerfMonAirDayRSLThresh2Exceed			RO	Number of seconds Receive Signal Level exceeded the RSL2 threshold per Day.
mrl500OduPerfMonAirDayMinTSL			RO	Current Min Transmit Signal Level per Day.
mrl500OduPerfMonAirDayMaxTSL			RO	Current Max Transmit Signal Level per Day.
mrl500OduPerfMonAirDayTSLThresh1Exceed			RO	Number of seconds Transmit Signal Level exceeded the TSL1 threshold per Day.
mrl500OduPerfMonAirDayBBERThresh1Exceed			RO	Number of seconds Background Block Error Ratio exceeded the BBER1 threshold per Day.
mrl500OduPerfMonEthCurrTable			N/A	This table defines/keeps the counters of the current 15 min interval.
mrl500OduPerfMonEthCurrEntry			N/A	This is an entry in the Current Interval Table. INDEX {ifIndex }
mrl500OduPerfMonEthCurrRxMBytes	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.

Table O-2: Private MIB Parameters (Sheet 9 of 14)

Name	OID	Type	Access	Description
mrl500OduPerfMonEthCurrTxMBytes	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.
mrl500OduPerfMonEthIntervalTable			N/A	This table defines/keeps the counters of the current 15 min interval.
mrl500OduPerfMonEthIntervalEntry			N/A	This is an entry in the Interval Table. INDEX {ifIndex mrl500 OduPerfMonEthIntervalIdx }
mrl500OduPerfMonEthIntervalIdx			RO	This table is indexed per interval number. Each interval is of 15 minutes and the oldest is 96.
mrl500OduPerfMonEthIntervalRxMBytes			RO	Current RX Mega Bytes per interval.
mrl500OduPerfMonEthIntervalTxMBytes			RO	Current Transmit Mega Bytes per interval.
mrl500OduPerfMonEthDayTable			N/A	This table defines/keeps the counters of the current 15 min interval.
mrl500OduPerfMonEthDayEntry			N/A	This is an entry in the Days Table. INDEX {ifIndex mrl500OduPerfMonEthDayIdx }
mrl500OduPerfMonEthDayIdx			RO	This table is indexed per Day number. Each interval is of 15 minutes and the oldest is 96.
mrl500OduPerfMonEthDayRxMBytes			RO	Current RX Mega Bytes per day.
mrl500OduPerfMonEthDayTxMBytes			RO	Current Transmit Mega Bytes per day.
mrl500OduPerfMonTdmCurrTable			N/A	This table defines/keeps the counters of the current 15 min interval.
mrl500OduPerfMonTdmCurrEntry			N/A	This is an entry in the Current Interval Table. INDEX {ifIndex }
mrl500OduPerfMonTdmCurrActiveSeconds	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.
mrl500OduPerfMonTdmIntervalTable			N/A	This table defines/keeps the counters of the current 15 min interval.
mrl500OduPerfMonTdmIntervalEntry			N/A	This is an entry in the Interval Table. INDEX {ifIndex mrl500OduPerfMonTdmIntervalIdx }
mrl500OduPerfMonTdmIntervalIdx			RO	This table is indexed per interval number. Each interval is of 15 minutes and the oldest is 96.
mrl500OduPerfMonTdmIntervalActiveSeconds			RO	Parameter indicating whether the TDM service was active. Under TDM backup link the parameter indicates whether the backup link was active.
mrl500OduPerfMonTdmDayTable			N/A	This table defines/keeps the counters of the current 15 min interval.
mrl500OduPerfMonTdmDayEntry			N/A	This is an entry in the Days Table. INDEX {ifIndex mrl500OduPerfMonTdmDayIdx }
mrl500OduPerfMonTdmDayIdx			RO	This table is indexed per Day number. Each interval is of 15 minutes and the oldest is 96.
mrl500OduPerfMonTdmDayActiveSeconds			RO	Parameter indicating whether the TDM service was active. Under TDM backup link the parameter indicates whether the backup link was active.
mrl500OduPerfMonTxThresh1	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.
mrl500OduPerfMonRxThresh1	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.
mrl500OduPerfMonRxThresh2	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.

Table O-2: Private MIB Parameters (Sheet 10 of 14)

Name	OID	Type	Access	Description
mrl500OduPerfMonBBERThresh1	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.
mrl500OduAgnGenAddTrapExt	1.3.6.1.4.1.4458.1000.1.7.1.1	Integer	RW	If 'yes' is chosen the ifIndex Unit Severity Time_T and Alarm Id from the mrl500OduAgnCurrAlarmTable will be bind to the end of each private trap.
mrl500OduAgnGenSetMode	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.
mrl500OduAgnNTPCfgTimeServerIP	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.
mrl500OduAgnNTPCfgTimeOffsetFromUTC	1.3.6.1.4.1.4458.1000.1.7.2.2	Integer	RW	Offset from Coordinated Universal Time (minutes). Possible values: -1440..1440.
mrl500OduAgnRealTimeAndDate	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)
mrl500OduAgnCurrAlarmLastChange	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 mrl500OduAgnCurrAlarmTable (either an addition or removal of an entry).
mrl500OduAgnCurrAlarmTable			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.
mrl500OduAgnCurrAlarmEntry			N/A	Entry containing the details of a currently RAISED trap. INDEX { mrl500OduAgnCurrAlarmCounter }
mrl500OduAgnCurrAlarmCounter	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.
mrl500OduAgnCurrAlarmSeverity	1.3.6.1.4.1.4458.1000.1.7.3.2.1.2	Integer	RO	Current Alarm severity.
mrl500OduAgnCurrAlarmId	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.
mrl500OduAgnCurrAlarmIfIndex	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 specific interface will have the following value: 65535.
mrl500OduAgnCurrAlarmUnit	1.3.6.1.4.1.4458.1000.1.7.3.2.1.5	Integer	RO	Unit associated with the alarm.
mrl500OduAgnCurrAlarmTrapID	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.

Table O-2: Private MIB Parameters (Sheet 11 of 14)

Name	OID	Type	Access	Description
mrl500OduAgnCurrAlarmTimeT	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.
mrl500OduAgnCurrAlarmText	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).
mrl500OduAgnLastEventsNumber	1.3.6.1.4.1.4458.1000.1.7.4.1	Integer	RO	This counter indicates the size of the mrl500OduAgnLastEventsTable
mrl500OduAgnLastEventsTable			N/A	This table includes the last events. When a trap is sent an event entry is added to the table.
mrl500OduAgnLastEventsEntry			N/A	Entry containing the details of last traps. INDEX { mrl500OduAgnLastEventsIndex }
mrl500OduAgnLastEventsIndex	1.3.6.1.4.1.4458.1000.1.7.4.2.1.1	Integer	RO	The index of the table
mrl500OduAgnLastEventsSeverity	1.3.6.1.4.1.4458.1000.1.7.4.2.1.2	Integer	RO	Current Trap severity.
mrl500OduAgnLastEventsIfIndex	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.
mrl500OduAgnLastEventsTimeT	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.
mrl500OduAgnLastEventsText	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).
mrl500IduAdmProductType	1.3.6.1.4.1.4458.1000.2.1.1	DisplayString	RO	IDU configuration description.
mrl500IduAdmHwRev	1.3.6.1.4.1.4458.1000.2.1.2	DisplayString	RO	IDU Hardware Revision.
mrl500IduAdmSwRev	1.3.6.1.4.1.4458.1000.2.1.3	DisplayString	RO	IDU Software Revision.
mrl500OduAdmNumOfExternalAlarmIn	1.3.6.1.4.1.4458.1000.2.1.4	Integer	RO	Indicates the number of currently available External Alarm Inputs.
mrl500OduAdmExternAlarmInTable			N/A	This is the External Alarm Inputs table.
mrl500OduAdmExternAlarmInEntry			N/A	Entry containing the elements of a single External Alarm Input. INDEX { mrl500OduAdmExternAlarmInIndex}
mrl500OduAdmExternAlarmInIndex	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.
mrl500OduAdmExternAlarmInText	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 of the External Alarm Input. DEFVAL {Alarm Description}
mrl500OduAdmExternAlarmInAdminState	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.
mrl500OduAdmExternAlarmInStatus	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.
mrl500IduAdmSN	1.3.6.1.4.1.4458.1000.2.1.6	DisplayString	RO	IDU Serial Number
mrl500IduAdmIduDetectionMode	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.
mrl500IduAdmMountedTrunks	1.3.6.1.4.1.4458.1000.2.1.8	Integer	RO	Number of mounted trunks in the IDU
mrl500IduAdmLicensedTrunks	1.3.6.1.4.1.4458.1000.2.1.9	Integer	RO	Number of Licensed Trunks in the IDU
mrl500IduSrvDesiredTrunks	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.

Table O-2: Private MIB Parameters (Sheet 12 of 14)

Name	OID	Type	Access	Description
mrl500IduSrvServices	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.
mrl500IduSrvActiveTrunks	1.3.6.1.4.1.4458.1000.2.2.6	Integer	RO	A bitmap describing the currently open TDM trunks.
mrl500IduSrvAvailableTrunks	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.
mrl500IduSrvPossibleServicesTable			N/A	IDU Possible Services table.
mrl500IduSrvPossibleServicesEntry			N/A	IDU Services table entry. INDEX { mrl500IduSrvPossibleServicesIndex }
mrl500IduSrvPossibleServicesIndex	1.3.6.1.4.1.4458.1000.2.2.10.1.1	Integer	RO	Table index Rate index of the air interface.
mrl500IduSrvPossibleTdmServices	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.
mrl500IduSrvPossibleEthServices	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).
mrl500IduSrvRemainingRate	1.3.6.1.4.1.4458.1000.2.2.10.1.4	Integer	RO	Current Ethernet bandwidth in bps per air rate.
mrl500IduSrvTrunkCost	1.3.6.1.4.1.4458.1000.2.2.10.1.5	Integer	RO	Cost of the TDM Service in bps.
mrl500IduSrvAvailServicesTable			N/A	ODU Possible TDM Services table.
mrl500IduSrvAvailServicesEntry			N/A	ODU TDM Services table entry. INDEX { mrl500IduSrvAvailServicesIndex }
mrl500IduSrvAvailServicesIndex	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.
mrl500IduSrvAvailServicesState	1.3.6.1.4.1.4458.1000.2.2.11.1.2	Integer	RO	Represents the TDM service availability.
mrl500IduSrvAvailServicesMinRateIdx	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.
mrl500IduSrvAvailServicesMaxRateIdx	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.
mrl500IduSrvAvailServicesReason	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.
mrl500IduSrvEthActive	1.3.6.1.4.1.4458.1000.2.2.12	Integer	RO	Represents the Ethernet service activation state.
mrl500IduSrvEthAvailable	1.3.6.1.4.1.4458.1000.2.2.13	Integer	RO	Represents the Ethernet service availability state.
mrl500IduSrvEthThroughput	1.3.6.1.4.1.4458.1000.2.2.14	Gauge	RO	Current available Ethernet service throughput in bps.
mrl500IduSrvEthMaxInfoRate	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.
mrl500IduSrvAvailableTrunksT1	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.
mrl500IduEthernetIfTable			N/A	IDU Ethernet Interface table.

Table O-2: Private MIB Parameters (Sheet 13 of 14)

Name	OID	Type	Access	Description
mrl500IduEthernetIfEntry			N/A	IDU Ethernet Interface table entry. INDEX { mrl500IduEthernetIfIndex }
mrl500IduEthernetIfIndex			RO	If Index corresponding to this Interface.
mrl500IduEthernetIfAddress	1.3.6.1.4.1.4458.1000.2.3.1.1.5	DisplayString	RO	IDU MAC address.
mrl500IduEthernetNumOfLanPorts	1.3.6.1.4.1.4458.1000.2.3.3	Integer	RO	Number of LAN interfaces in the IDU.
mrl500IduEthernetNumOfSfpPorts	1.3.6.1.4.1.4458.1000.2.3.4	Integer	RO	The number of SFP interfaces in the IDU.
mrl500IduEthernetSfpProperties	1.3.6.1.4.1.4458.1000.2.3.5	DisplayString	RO	SFP venfor properties : Vendor Name PN and Revision.
mrl500IduBridgeTpAging	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.
mrl500IduTdmTxClockAvailStates	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
mrl500IduTdmTxClockDesiredState	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.
mrl500IduTdmTxClockActualState	1.3.6.1.4.1.4458.1000.2.6.1.3	Integer	RO	Actual state of the TDM Transmit Clock Control.
mrl500IduTdmMasterClockAvailOptions	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 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
mrl500IduTdmMasterClockDesired	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.
mrl500IduTdmMasterClockActual	1.3.6.1.4.1.4458.1000.2.6.2.3	Integer	RO	Actual Trunk used for TDM Master Clock.
mrl500IduTdmConfigTable			N/A	IDU TDM Links Configuration table.
mrl500IduTdmConfigEntry			N/A	IDU TDM Links Configuration table entry. INDEX { mrl500IduTdmConfigIndex }
mrl500IduTdmConfigIndex			RO	Table index.
mrl500IduTdmIfIndex			RO	Link index in the interface table.
mrl500IduTdmLineCoding	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.
mrl500IduTdmLoopbackConfig	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.
mrl500IduTdmLineStatus	1.3.6.1.4.1.4458.1000.2.6.6.1.10	Integer	RO	Line status.
mrl500IduTdmCurrentTable			N/A	IDU TDM Links Statistics table.
mrl500IduTdmCurrentEntry			N/A	IDU TDM Links Statistics table entry. INDEX { mrl500IduTdmCurrentIndex }
mrl500IduTdmCurrentIndex			RO	Table index (Same as mrl500IduTdmLineIndex).
mrl500IduTdmCurrentBlocks	1.3.6.1.4.1.4458.1000.2.6.7.1.101	Counter	RO	Number of correct blocks transmitted to the line.
mrl500IduTdmCurrentDrops	1.3.6.1.4.1.4458.1000.2.6.7.1.102	Counter	RO	Number of error blocks transmitted to the line.

Table O-2: Private MIB Parameters (Sheet 14 of 14)

Name	OID	Type	Access	Description
mrl500IduTdmCurrentTxClock	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.
mrl500IduTdmCurrentBlocksHigh	1.3.6.1.4.1.4458.1000.2.6.7.1.104	Counter	RO	High part of the 64 bits counter Current Blocks
mrl500IduTdmRemoteQual	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.
mrl500IduTdmRemoteQualEval	1.3.6.1.4.1.4458.1000.2.6.9	Integer	RO	Estimated average interval between error second events during evaluation process. The valid values are 1-2^31 where a value of -1 is used to indicate an undefined state.
mrl500IduTdmSrvEval	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.
mrl500IduTdmBackupAvailableLinks	1.3.6.1.4.1.4458.1000.2.6.11	Integer	RO	Number of TDM backup trunks.
mrl500IduTdmBackupTable			N/A	IDU TDM Links Statistics table.
mrl500IduTdmBackupEntry			N/A	IDU TDM Links Statistics table entry. INDEX { mrl500IduTdmBackupIndex }
mrl500IduTdmBackupIndex	1.3.6.1.4.1.4458.1000.2.6.12.1.1	Integer	RO	Table index.
mrl500IduTdmBackupMode	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.
mrl500IduTdmBackupCurrentActiveLink	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.
mrl500IduTdmJitterBufferSize	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.
mrl500IduTdmJitterBufferDefaultSize	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.
mrl500IduTdmJitterBufferMinSize	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.
mrl500IduTdmJitterBufferMaxSize	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.
mrl500IduTdmJitterBufferSizeEval	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.
mrl500IduTdmType	1.3.6.1.4.1.4458.1000.2.6.18	Integer	RW	TDM Type (The value undefined is read-only).
mrl500IduTdmTypeEval	1.3.6.1.4.1.4458.1000.2.6.19	Integer	RW	TDM Type for evaluation.
mrl500IduTdmLineStatusStr	1.3.6.1.4.1.4458.1000.2.6.20	DisplayString	RO	Line status.
mrl500IduTdmHotStandbySupport	1.3.6.1.4.1.4458.1000.2.6.21	Integer	RO	Indicates if Hot Standby is supported.
mrl500IduTdmDesiredHotStandbyMode	1.3.6.1.4.1.4458.1000.2.6.22	Integer	RW	Desired Hot Standby Mode.
mrl500IduTdmHotStandbyOperationStatus	1.3.6.1.4.1.4458.1000.2.6.23	Integer	RO	The Link Actual Status.
mrl500GeneralTrapDescription	1.3.6.1.4.1.4458.1000.100.1	DisplayString	RO	Trap's Description. Used for Trap parameters.
mrl500GeneralTrapSeverity	1.3.6.1.4.1.4458.1000.100.2	Integer	RO	Trap's Severity. Used for Trap parameters.
mrl500GeneralCookie	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.
mrl500GeneralEcChangesCounter	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.

MIB Traps

General

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 **O-3** for additional information.

Trap Parameters

Table O-3: MIB Traps (Sheet 1 of 4)

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.
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 truncks 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.
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.

Table O-3: MIB Traps (Sheet 2 of 4)

Name	ID	Severity	Description
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.
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.
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

Table O-3: MIB Traps (Sheet 3 of 4)

Name	ID	Severity	Description
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.
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.
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.
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).

Table O-3: MIB Traps (Sheet 4 of 4)

Name	ID	Severity	Description
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
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)
compatibleIdus	228	normal	Indicates that the ODU has identified compatible Idus on both sides of the link.

MRL Manager Traps

The MRL Manager application issues traps to indicate various events. These traps are shown in the MRL Managerr Events Log.

Appendix P

Alarms System Specification

Alarms System Specification

The IDU-C supports external input and output alarms through a standard DB25 pin female connector Input alarm

1. Input Alarm

The input alarms are raised by events from external equipment such as a fire warning or an air conditioner failure.

2. Output alarm

Output alarms are generated by the external link, for example from a sync loss, disconnection.

Table P-1: Alarms pinout - IDU-C

IDU Configuration	Name	Description	Alarm On State	Alarm Off State
IDU-C	Input 1	User External Alarm	User External Alarm On	User External Alarm Off
	Input 2	User External Alarm	User External Alarm On	User External Alarm Off
	Input 3	User External Alarm	User External Alarm On	User External Alarm Off
	Input 4	User External Alarm	User External Alarm On	User External Alarm Off
	Output 1	Air Link Alarm	1. Link is Down 2. Link in Instal-lation mode 3. Link Authentication Problem	Link is up or Equipment Alarm is ON
	Output 2	Equipment Alarm	1. Built in Test (BIT) Error 2. No connection to the ODU	Both ODU and IDU are in operational state
	Output 3	Service Alarm Remote End	Link is up, but at least one of the ports (with service configured) at remote is at LOS or AIS (only for TDM serv.) state.	Link is down or Equipment Alarm is ON or Link is up and ALL ports (with service configured) at the remote IDU's are at NORMAL state.
	Output 4	Link Loss due to Power Fail at the remote End	A Link Loss occurred while a power fail was detected by the remote end IDU.	Link is up or Link is down without the power fail indication within the last two seconds of the active link

Appendix Q

RF Exposure

Safety Distances

The antennas used for the following transmitters must be installed to provide a separation distance as specified. They must not be co-located or operated in conjunction with any other antenna or transmitter.

Product	FCC ID	Antenna gain [dBi]	Min. Safety Distance [cm]
	Q3KAMWL1580	**22**	**109**
F58A/HE/FCC	**Q3KAMWL1580**	**28**	**217**
F58A/HE/FCC F58A/FCC/AIND	**Q3KAMWL1580**	**32.5**	**364**
F24/FCC	**Q3KAMWL1240**	**16**	**16**
F24/FCC	**Q3KAMWL1240**	**24**	**40**
F24A/HE/FCC	**Q3KAMWL1240H**	**24**	**71**
F24A/HE/FCC	**Q3KAMWL1240H**	**15.2**	**37**
F25/HE/BRS	**Q3KAMWL1250**	**17**	**200**
F25/HE/BRS	**Q3KAMWL1250**	**24**	**200**
F25/HE/BRS/AIND	**Q3KAMWL1250**	**24**	**200**

Table Q-1: RF Exposure

Appendix R

Regional Notice: French Canadian

Procédures de sécurité

Généralités

Avant de manipuler du matériel connecté à des lignes électriques ou de télécommunications, il est conseillé de se défaire de bijoux ou de tout autre objet métallique qui pourrait entrer en contact avec les éléments sous tension.

Mise à la terre

Tous les produits MRL doivent être mis à la terre pendant l'usage courant. La mise à la terre est assurée en reliant la fiche d'alimentation à une prise de courant avec une protection de terre. En outre:

- La cosse de masse sur l'IDU-C doit être constamment connectée à la protection de terre, par un câble de diamètre de 18 AWG ou plus. Le matériel monté sur rack doit être installé seulement sur des racks ou armoires reliés à la terre
- Une ODU doit mise à la terre par un câble de diamètre de 12 AWG ou plus
- Il ne doit pas y avoir de fusibles ou d'interrupteurs sur la connection à la terre

De plus:

- Il faut toujours connecter la terre en premier et la déconnecter en dernier
- Il ne faut jamais connecter les câbles de télécommunication à du matériel non à la terre
- Il faut s'assurer que tous les autres câbles sont déconnectés avant de déconnecter la terre

Protection contre la foudre

L'utilisation de dispositifs de protection contre la foudre dépend des exigences réglementaires et de l'utilisateur final. Toutes les unités extérieures MRL sont conçues avec des circuits de limitation de surtension afin de minimiser les risques de dommages dus à la foudre. MRL conseille l'utilisation d'un dispositif de parafoudre supplémentaire afin de protéger le matériel de coups de foudre proches.

Matériel supplémentaire requis

L'équipement requis pour l'installation du matériel est le suivant:

- Pince à sertir RJ-45 (si un câble pré-assemblé ODU/IDU n'est pas utilisé)
- Perceuse (pour le montage sur mur seulement)
- Câbles de terre IDU et ODU
- Clef 13 mm (½″)
- Câble ODU - IDU si non commandé (type extérieur, CAT-5e, 4 paires torsadées, 24 AWG)
- Colliers de serrage
- Ordinateur portable avec Windows 2000 ou Windows XP.

Précautions de sécurité pendant le montage de ODU

Avant de connecter un câble à l'ODU, la borne protectrice de masse (visse) de l'ODU doit être connectée à un conducteur externe protecteur ou à un pylône relié à la terre. Il ne doit pas y avoir de fusibles ou d'interrupteurs sur la connection à la terre.

Seulement un personnel qualifié utilisant l'équipement de sécurité approprié doit pouvoir monter sur le pylône d'antenne. De même, l'installation ou le démontage de ODU ou de pylônes doit être effectuée seulement par des professionnels ayant suivi une formation.

➢ **Pour monter l'ODU:**

1. Vérifier que les supports de fixation de l'ODU sont correctement mis à la terre.
2. Monter l'unité ODU sur le pylône ou sur le mur; se référer à la **Installation sur pylône et mur** au dessous.
3. Connecter la câble de terre au point de châssis sur l'ODU.
4. Relier le câble ODU-IDU au connecteur ODU RJ-45.
5. Visser les presses-étoupe de câbles pour assurer le scellement hermétique des unités ODU.
6. Attacher le *câble au pylône ou aux supports en utilisant des colliers classés* UV.
7. Répéter la procédure sur le site distant.

Ne pas se placer en face d'une ODU sous tension.

Connecter la terre à IDU-C

Connecter un câble de terre de 18 AWG à la borne de masse de l'appareil. L'appareil doit être constamment connecté à la terre.

- Les appareils sont prévus pour être installés par un personnel de service.
- Les appareils doivent être connectés à une prise de courant avec une protection de terre.
- Le courant CC du IDU-C doit être fourni par l'intermédiaire d'un disjoncteur bipolaire et le diamètre du câble doit être de 14 mm avec un conduit de 16 mm.

Installation sur pylône et mur

L' ODU ou l'O-PoE peuvent être montés sur un pylône ou un mur.

Contenu du kit de montage ODU

Le kit de montage ODU comprend les pièces suivantes:

- une grande clame (voir figure **R-1**)
- une *petite clame* (voir figure **R-2**)
- un bras (voir figure **R-3**)
- quatre visses hex tête M8x40
- deux visses hex tête M8x70
- quatre rondelles plates M8
- trois rondelles élastiques M8
- deux écrous M8.

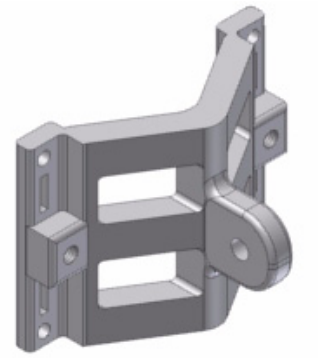


Figure R-1: grande clame

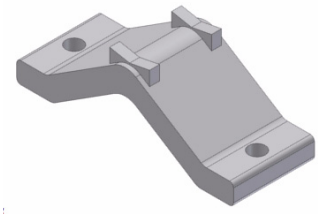


Figure R-2: petite clame

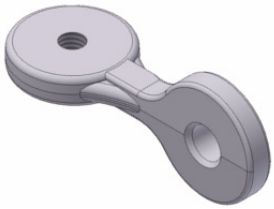


Figure R-3: bras

Montage sur un pylône

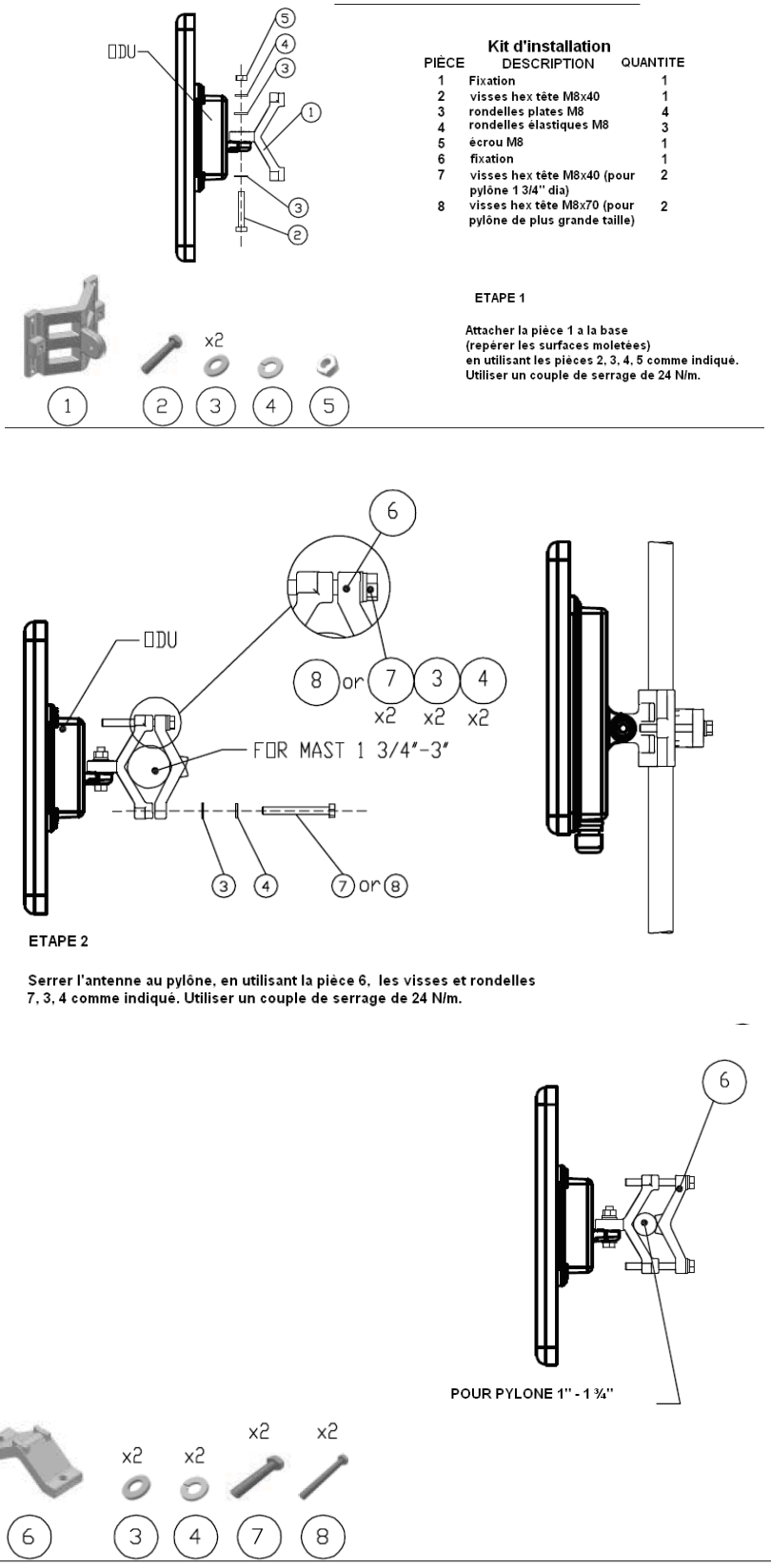
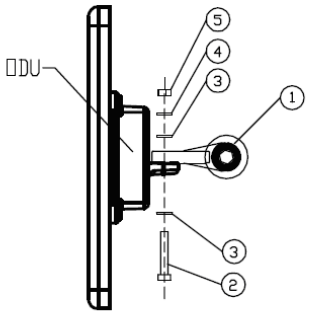


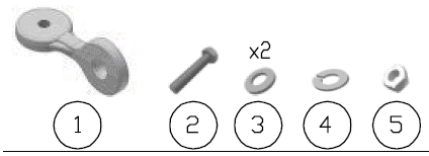
Figure R-4: Montage sur un pylône

Montage sur un mur



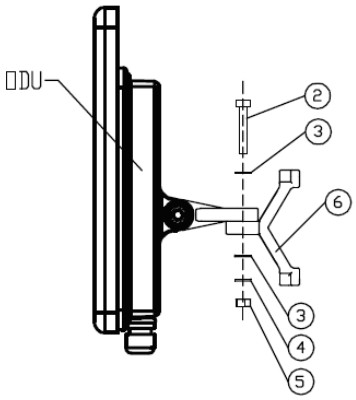
Kit d'installation

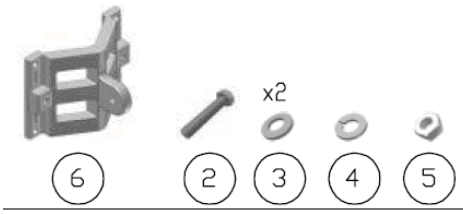
PIÈCE	DESCRIPTION	QUANTITE
1	Bras	1
2	visses hex tête M8x40	2
3	rondelles plates M	4
4	rondelles élastiques M8	2
5	écrou M8	2
6	base	1



ETAPE 1

Attacher la pièce 1 a la base (repé rer les surfaces moletées) en utilisant les pièces 2, 3, 4, 5 comme indiqué. Utiliser un couple de serrage de 24 N/m.





ETAPE 2

Attacher la pièce 6 au bras (repérer les surfaces moletées) en utilisant les pièces 2, 3, 4, 5 comme indiqué. Utiliser un couple de serrage de 24 N/m.

ETAPE 3

Installer l'antenne sur le mur (maté riel fourni par le client)

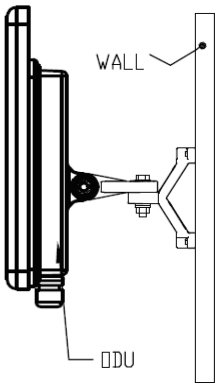


Figure R-5: Montage sur un mur

Montage d'une antenne externe

L'antenne externe optionnelle peut être montée sur un pylône.

Contenu du kit de montage d'une antenne externe

Le kit de montage d'une antenne externe comprend les pièces suivantes

- Douze rondelles plates
- Huit rondelles élastiques
- Huit écrous hex
- Quatre boulons
- Un support en U
- Un support à pivotement
- Deux courroies de fixation en métal

Pour installer une antenne externe sur un pylône:

1. Attacher le support en U à l'arrière de l'antenne en utilisant quatre rondelles plates, quatre rondelles élastiques et quatre écrous hex.
2. Attacher le support à pivotement au support en U en utilisant huit rondelles plates, quatre rondelles élastiques, quatre écrous hex et quatre boulons.
3. Passer les deux courroies de fixation par les fentes verticales dans le support à pivotement.
4. Attacher l'antenne au pylône en utilisant les deux courroies de fixation .

Ajuster l'inclinaison nécessaire en utilisant l'échelle angulaire et serrer tous les boulons et écrous à la position requise.

Index

A

B

C

D

E

F

G

H

I

L

M

N

O

P

Q

R

S

T

U

W