Chapter 5

Diagnostics and Troubleshooting

This chapter describes the WinLink 1000 diagnostic functions, which include:

- Get Link Information
- Monitoring Performance
- Error detection and alarms including Link Compatibility
- Diagnostic tests (local and remote loopbacks on E1 or T1 link)
- Troubleshooting
- Frequently asked questions.

5.1 Automatic Link Data Collection (Get Link Information)

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

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

✱ **To get link information**

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

   The Get Link Information dialog box appears. See *Figure 5-1*.

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

   The file is saved as **Link Information.txt**

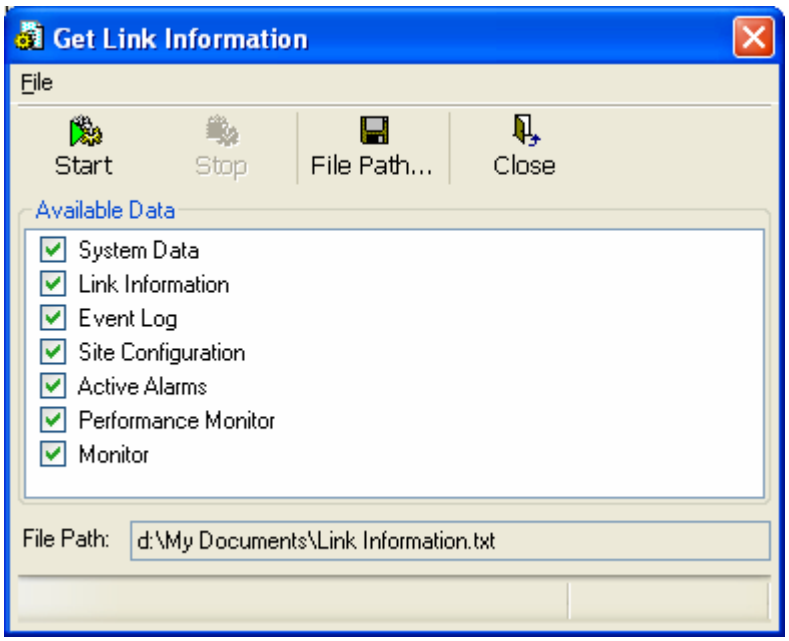


Figure 5-1. Get Link Information

5.2 Monitoring Performance

WinLink 1000 constantly monitors traffic over the radio link and collects the following statistics data:

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

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

Saving the Monitor Log

✱ **To save the monitor log**:

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

   The Preferences dialog box appears (see *Figure 5-2*).

2. Click the **Monitor** Tab.
3. Select the file to save.

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

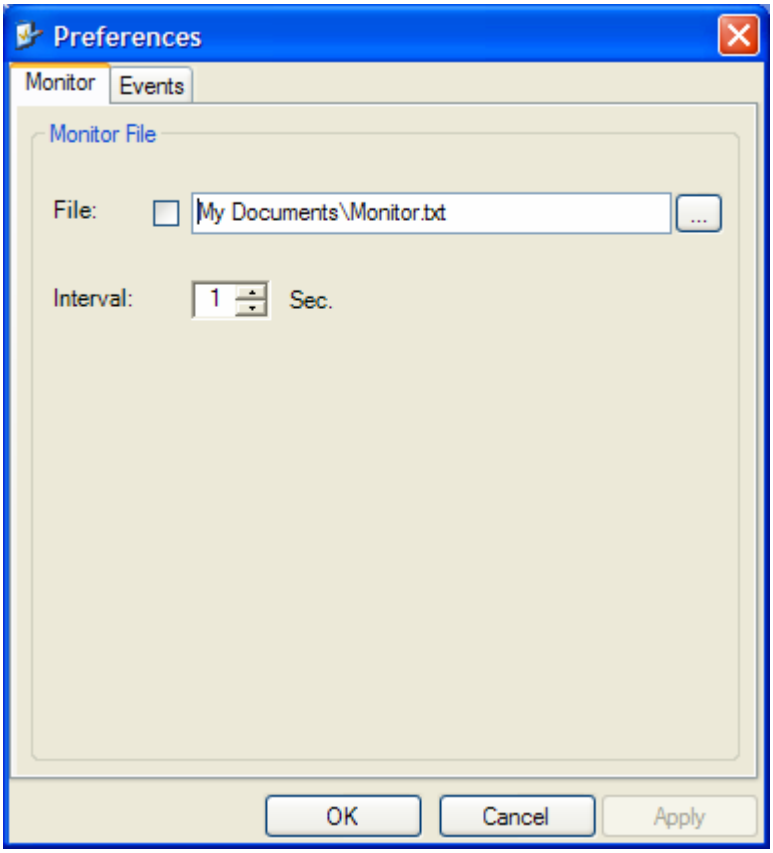


Figure 5-2. Preferences Dialog Box, Monitor Tab

Setting the Events Preferences

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

✱ **To set the trap color:**

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

   The Preferences dialog box appears).

2. Click the **Events** Tab (see *Figure 5-3*).
3. Select the Event priority type and click on the ... button.

   A color chart opens.

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

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

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

❋ **To reset the trap colors:**

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

Saving the Events Log

❋ **To save the event log**:

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

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

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

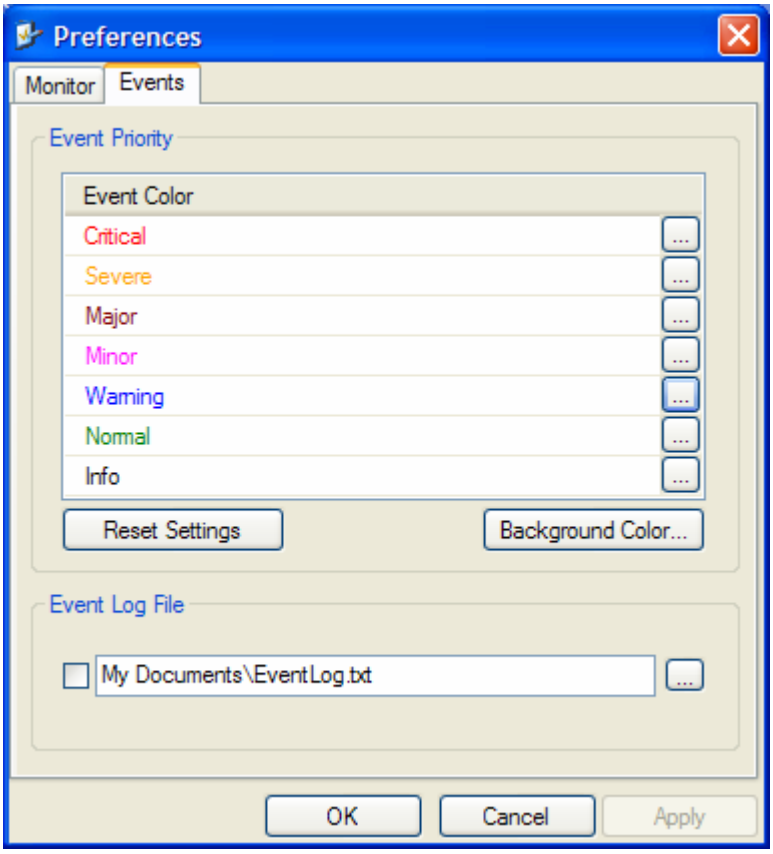


Figure 5-3. Preferences Dialog Box, Event Log Tab

5.3 Viewing Performance Reports

The Performance Monitor Report displays performance views of each of the interfaces[1] (see *Figure 5-4*). Several performance data are collected for each of the interfaces (ES, SES, and UAS), as well as Specific data per Interface type (e.g., TX and RX bytes for Ethernet). For the Air Interface, user defined thresholds data are collected. Refer to *Table 5-1* and *Table 5-2*.

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

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

UAS – This parameter counts the time the air link was not providing any service. There are several 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 some 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 WinLink 1000 provides a loss less Ethernet service, there is throughput degradation in case of interference. The degradation is proportional to the BBER.

Radio RSS Threshold can also be used to indicate problems in the radio channel. After verifying the RSS according to the link budget calculator

[1] Ethernet performance is not collected in PoE systems.

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

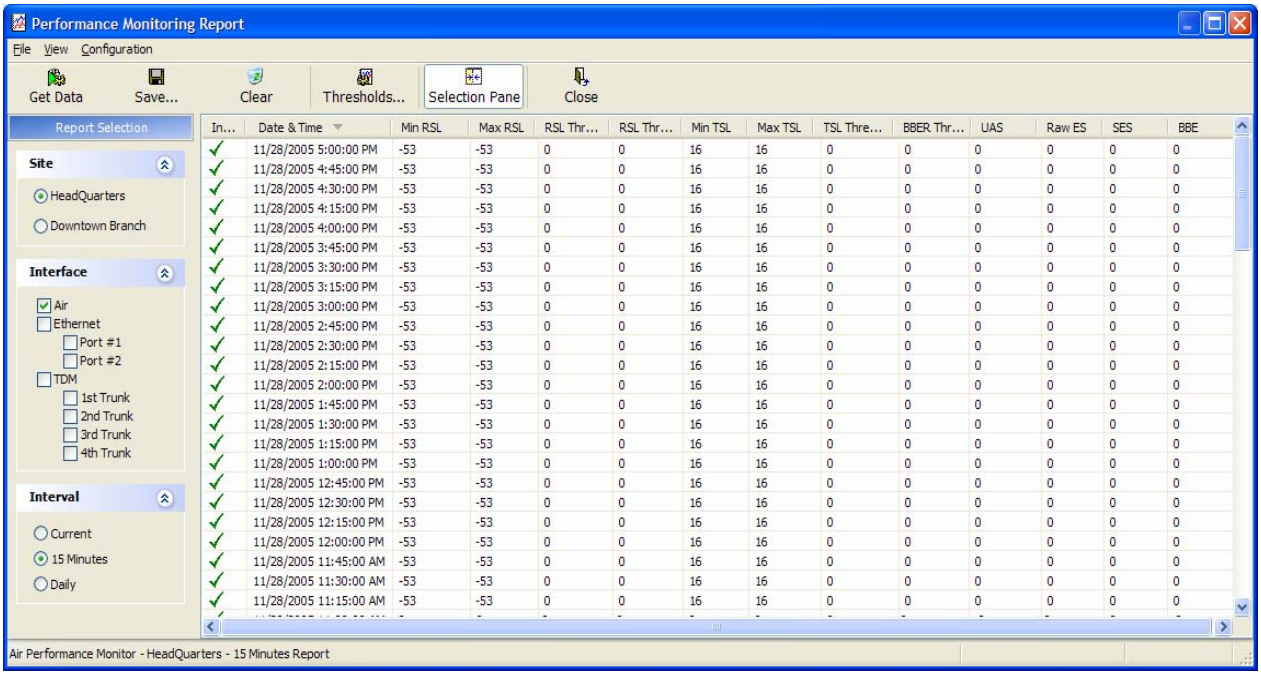


Figure 5-4. Performance Monitoring Report window

Table 5-1. 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[2].
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)[3].

[2] Possible reasons are: Clock changes within the interval and Power up reset

[3] The transmit power is fixed. The value can be changed only by user configuration

Data type	Reported value	Explanation
	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

Data type	Reported value	Explanation
	Transmitted Bytes	The number of Mega bytes received in the specified port within the interval.

Table 5-2. Action of the tool bar button commands

Button	Action
Get Data	Uploads the selected report from the ODU.
Save	Saves the data in a CSV or Text format for additional analysis.
Clear	Removes the current data from the window.
Selection pane	Selects the site, interface, and interval to be displayed.
Threshold	Opens the threshold configuration dialog box (Figure 5-5) to set the Air Interface thresholds. Note that threshold change is effected immediately, but it does not change any historical data.
Close	Closes the Performance Monitor Report window.

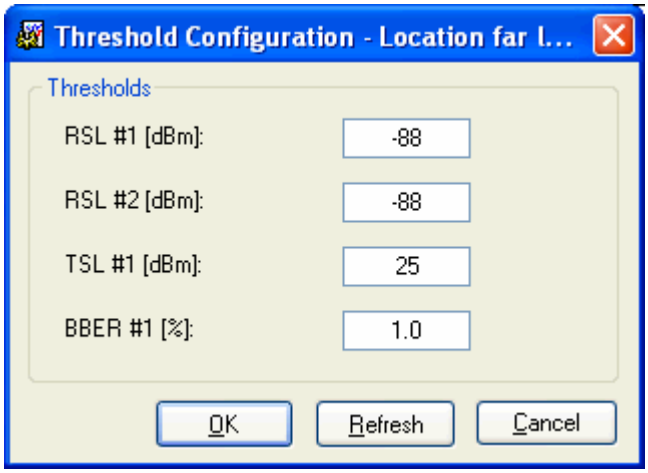


Figure 5-5. Threshold configuration dialog box

5.4 Error Detection and Alarms

WinLink 1000 detects compatibility problems, fault conditions of the radio or user links, and initiates alarms to alert the user.

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

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

The event log includes the following fields:

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

Table 5-3. WinLink 1000 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 Synchronization is reported by TDM interface
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.
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.

✱ **To view summary of saved alarms**

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

  The Active Alarms Summary window opens. See *Table 5-4*; for an explanation of the command buttons.

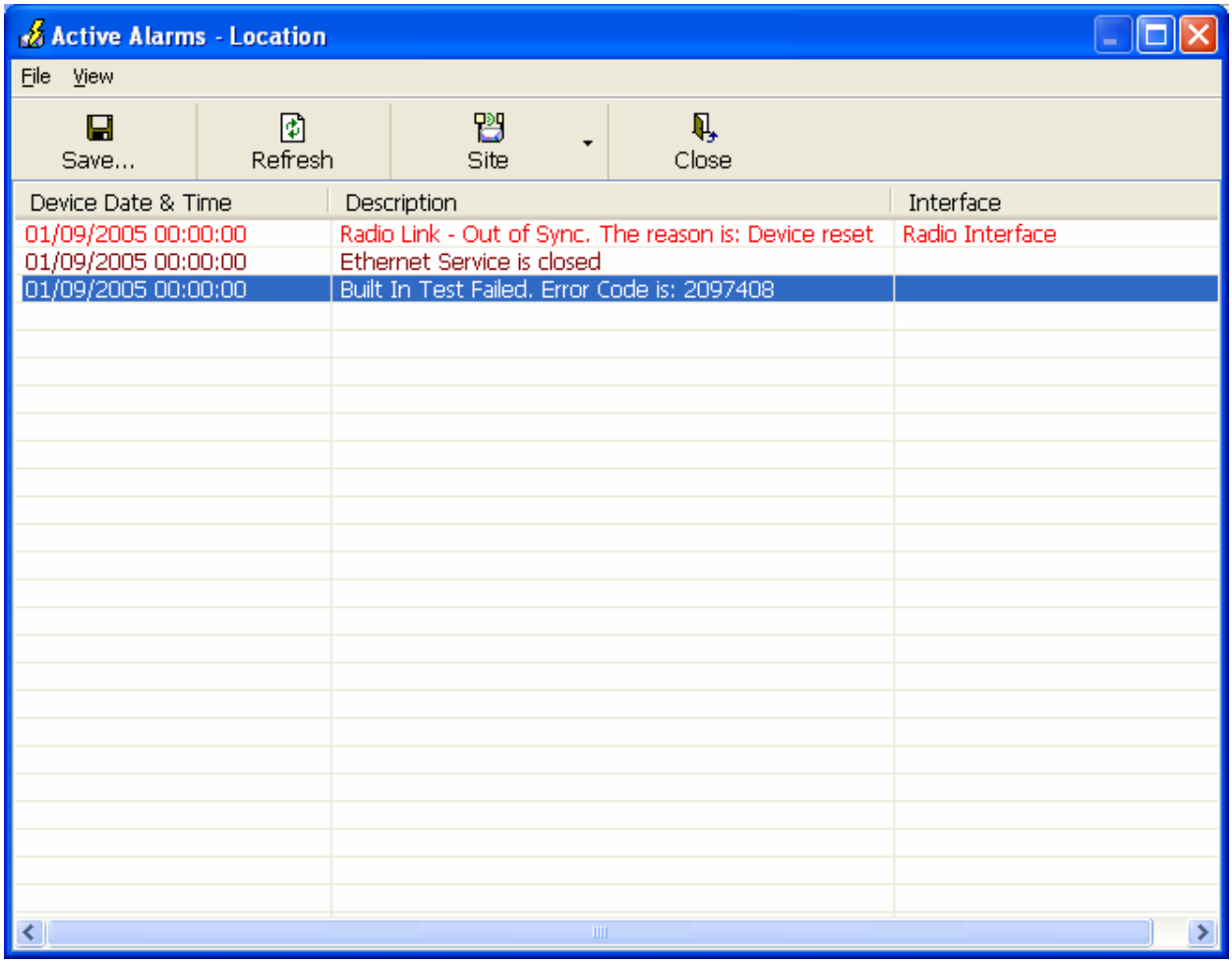


Figure 5-6. Active Alarms Summary

Table 5-4. Active Alarms command buttons

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

Close	Closes the active alarm window.

5.5 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.

5.6 Link Compatibility

WinLink 1000 indicates the version compatibility via software traps. As new hardware is added to existing networks compatibility issues may arise. An incompatibility issue is indicated to the user via a change of color of the Link Status box on the Main Menu screen. Trap messages in the Event Log indicate the problems or limitations and suggest upgrades when appropriate.

The following Link Status messages are given:

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

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

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

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

Table 5-5. Link Compatibility Trap Messages

Link State	Link	Link Status	Site Description	Site	Link Status

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

5.7 Testing WinLink 1000

WinLink 1000 supports activation of the internal and external loopbacks on the local and remote units.

❋ **To activate a loopback**:

1. From the Maintenance menu, choose **Set Loopbacks**.

   The Loopbacks dialog box appears (see *Figure 5-7*).

2. From the Local or Remote drop-down box, select a loopback that you intend to run, and click **OK**.

   A confirmation message appears.

3. Click **OK** to activate a loopback.

   WinLink 1000 activates selected loopback. A loopback status arrow in the Main menu turns green to indicate an active loopback.

❋ **To deactivate a loopback**:

- From the From the Local or Remote drop-down box of the Loopbacks dialog box, select **None** and click **OK**.

A loopback is deactivated and the corresponding status arrow in the Main menu becomes dimmed.

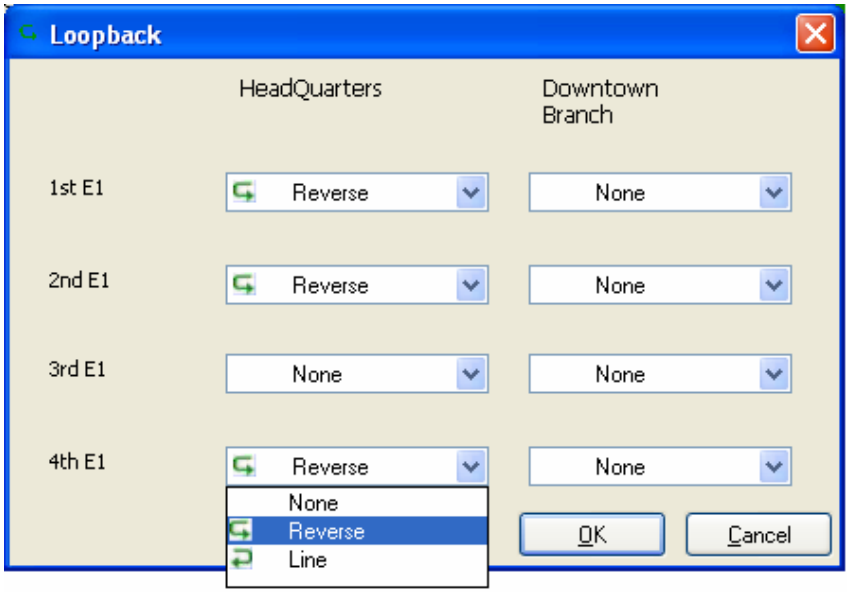


Figure 5-7. Loopbacks Dialog Box

Local External Loopback

Local WinLink 1000 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 (see *Figure 5-8*). This loopback is initiated from a management station connected to the local unit.

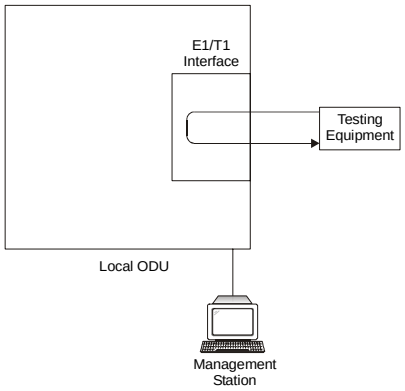


Figure 5-8. Local External Loopback

Remote Internal Loopback

Remote WinLink 1000 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 WinLink 1000 is looped back to it (see *Figure 5-9*). This loopback is initiated from a management station connected to the local unit.

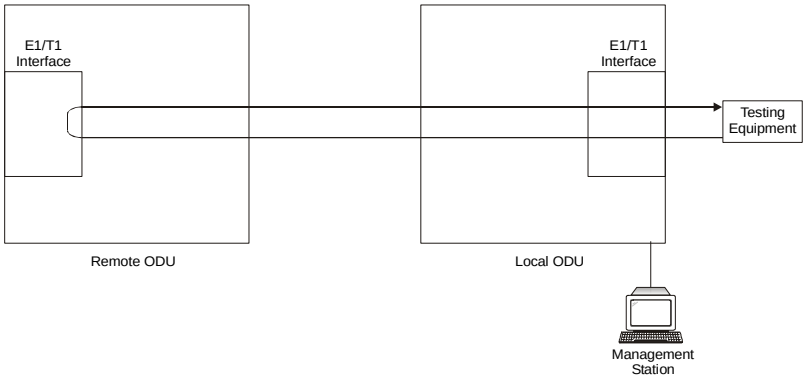


Figure 5-9. Remote Internal Loopback

Remote External Loopback

Remote WinLink 1000 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 (see *Figure 5-10*). This loopback is initiated by an inband command sent from a management station connected to the local unit.

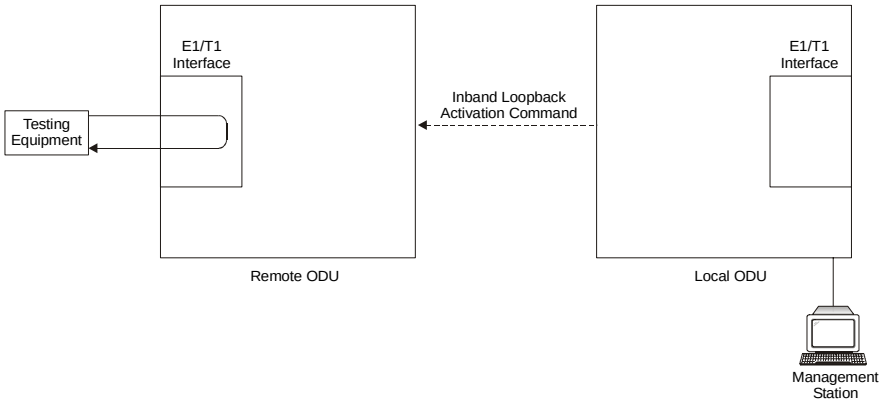


Figure 5-10. Remote External Loopback

Local Internal Loopback

Local WinLink 1000 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 (see *Figure 5-11*). This loopback is initiated by an inband command sent from a management station connected to the local unit.

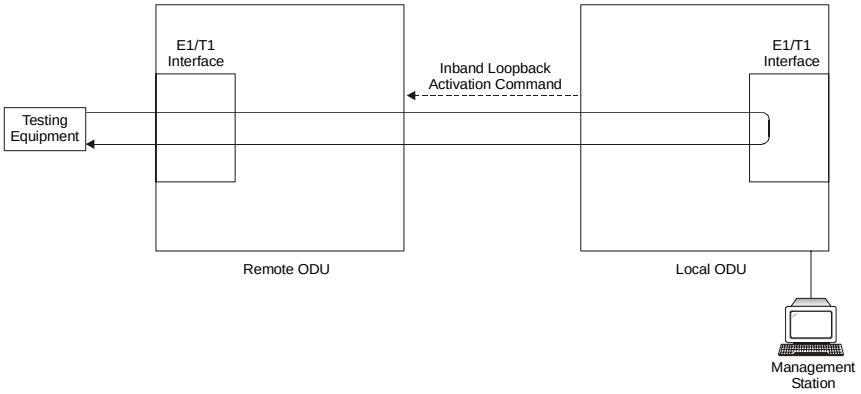


Figure 5-11. Local Internal Loopback

5.8 Troubleshooting

Use *Table 5-7* and *Table 5-7* to diagnose any faults in the system.

Table 5-6. Troubleshooting

Symptom	Remedy
No power	Verify that AC power is connected to the IDU.
	Verify that the ODU cable is properly wired and connected.
No signal	Complete the installation procedure from the management software.
	Verify the ODU alignment. Check that the radio configuration of both site A and site B units are the same (channel and SSID).
Weak signal	Verify the ODU alignment, reconfigure the link.
	Verify the beeper sounds the Best Signal sequence.

The WinLink 1000 LEDs show faults in the system or the link.

Table 5-7. Troubleshooting with WinLink 1000 LEDs

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 SSID).
SERVICE	Off	Check the TDM service configuration in the NMS.
	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.

5.9 Frequently Asked Questions

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

A: WinLink 1000 is not sensitive to environmental conditions. However if heavy rain or snowfall is expected ensure the performance by allowing a higher fade margin in the link budget planning calculations.

Q: When using the WinLink 1000, what is the potential for interference between our system and other cellular or wireless Networks devices?

A: The WinLink 1000 is a robust system. However since it operates in unlicensed band there maybe some interference. Nevertheless, the fact that we can manually set the frequency gives us the flexibility to find a clear channel. In addition each WinLink 1000 link uses unique user configurable SSID code.

Q: What protocol does the WinLink 1000 use, i.e. 802.11?

A: **WinLink 1000** 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 WinLink 1000?

A: WinLink 1000 has three levels of security:

1. vAES hardware mechanism
2. Each unit uses a unique SSID link-specific code (up to 24 alphanumeric characters)
3. Proprietary protocol protects from eavesdropping from other systems.

Q: Can we use horizontal and vertical polarization on the same frequency to double the number of wireless links?

A: Installing two WinLink 1000 systems in the same band with cross polarization provides 20-25 dB separations. Nevertheless, since there are reflections, the cross polarization separation is decreased and spatial separation is recommended.

Q: Could you add the frequency of 5.735 to the manual selection in order to increase the number of 20 MHz channels to six?

A: Currently the system provides fixed channels, with one manual frequency setting. The manual setting provides flexibility of spectrum selection, including 5.735 MHz.

Q: Can we mange WinLink 1000 using SNMPc other than the supplied management software that comes with the units?

A: Yes. The WinLink 1000 is SNMP-based. WinLink 1000 can be managed when using other SNMP software after implementing RADWIN MIB's.

Q: Can WinLink 1000 be managed and configured via Telnet?

A: No. Use only the WinLink 1000 software manager.

Q: Can I use WinLink 1000 with any vendor's external antenna?

A: RADWIN supplies the WinLink 1000 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 RADWIN

authorized with its specific external ODU product can be used. That is given that it can be cascaded to our external unit. Please note that dB losses in the cascading cable between the external ODU and antenna should be taken into consideration. (In the supplied cascading cable of one meter we have 1 dB loss)

Q: Do we need to add external arrestors on WinLink 1000 cables?

A: The WinLink 1000 ODU includes arrestors and lightning protection. Therefore there is no need to add additional arrestors.

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

A: The maximum net throughput of WinLink 1000 is full duplex 18 Mbps.

Note *WinLink 1000 is a symmetrical system*

Q: What is the sensitivity for each rate of the WinLink 1000?

A: The rate sensitivities are:

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

Q: Does WinLink 1000 withhold any MAC Addresses?

A: The WinLink 1000 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?

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

Q: What are the BER values expected in the WinLink 1000 link?

A: 10-11 (according to BER sensitivity threshold)

Q: Does WinLink 1000 use DSSS technique?

A: No, WinLink 1000 uses the advanced OFDM technique.

Q: What are the main advantages of the WinLink 1000 solution (e.g., wireline, wireless, etc.) over other possible alternatives?

A:

- 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 transition channels site-to-site.
- Full backup option – backup and restore using ini files.
- Very light ODU (1.5 kg).
- No RF loses between IDU and ODU.
- Robust Air Interface Layer 2 ARQ insures “error-free” Ethernet service even in harsh conditions. Retransmit mechanism for TDM esures low BER.
- Integrated up to 4 E1/T1 and Ethernet radio over one single product.
- Supports a variety of applications Voice and Data over 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.

5.10 Technical Support

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

For further information, please contact the RADWIN distributor nearest you or one of RADWIN's offices worldwide. This information can be

found at www.radwin.com.

Appendix A

Wiring Specifications

A.1 ODU-IDU Cable

The ODU-IDU cable is standard 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.

Table A-1 shows the connector pinout.

Table A-1. ODU-IDU Cable Connector Pinout

IDU RJ-45	Wire Color	Function	ODU RJ-45
1 twisted	White/Green	Ethernet (RxN)	1
2 pair	Green	Ethernet (RxT)	2
3 twisted	White/Orange	Ethernet (TxT)	3
6 pair	Orange	Ethernet (TxN)	6
4 twisted	Blue	Power (+)	4
5 pair	White/Blue	Power (+)	5
7 twisted	White/Brown	Power (–)	7
8 pair	Brown	Power (–)	8

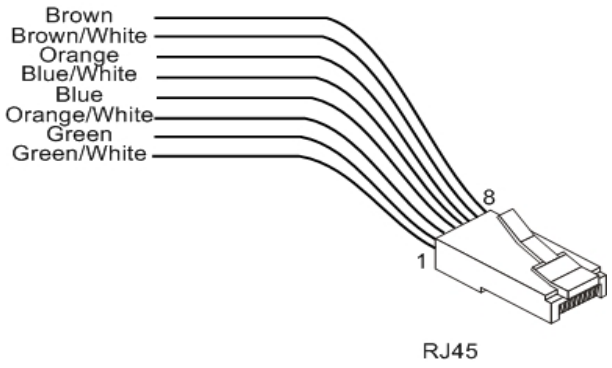


Figure A-1. RJ-45 wiring for IDU-ODU cable

A.2 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 A-2*.

Table A-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 A-3*.

Table A-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)

A.3 IDU-C Connectors

IDU-C DC Power Terminal

Table A-4. Terminal Block 3-pin -48VDC

Pin	Connection
Right	+
Center	Chassis
Left	-

IDU-C Alarm Connector

Table Table A-5 lists the alarm connector pinout.

Table A-5. Alarm Connector (Dry-Contact)

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

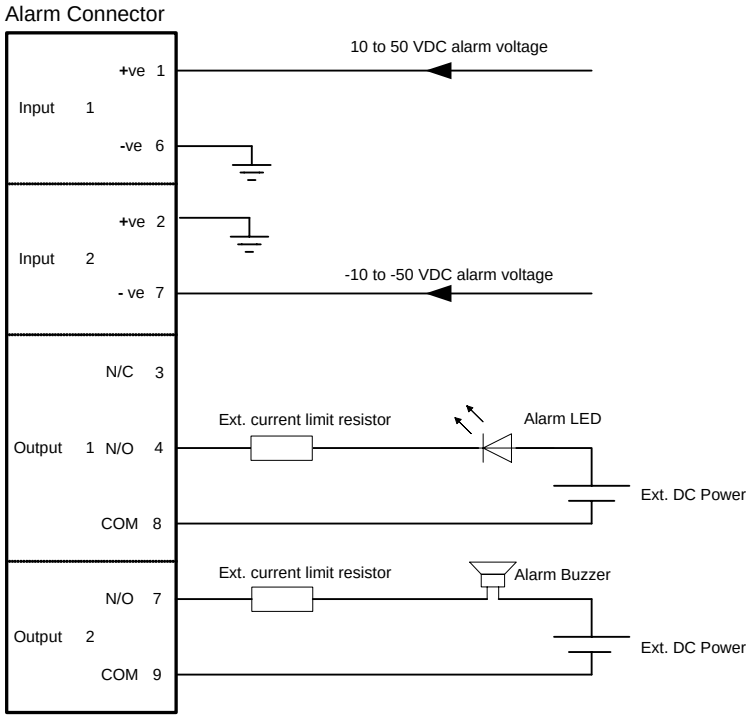


Figure A-2. Example for connecting the alarm connector

Appendix B

Mast and Wall Installation

B.1 Mounting the ODU

The ODU can be mounted on a mast or a wall.

ODU Mounting Kit Contents

The ODU mounting kit includes the following items:

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

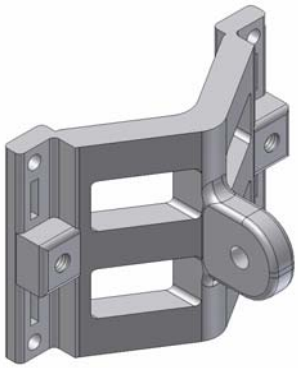


Figure B-1. Large Clamp

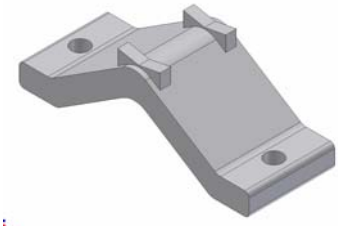
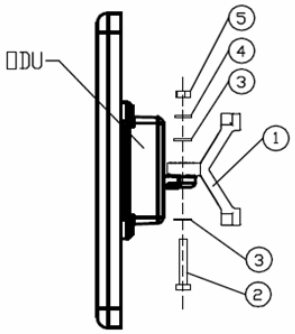


Figure B-2. Small Clamp

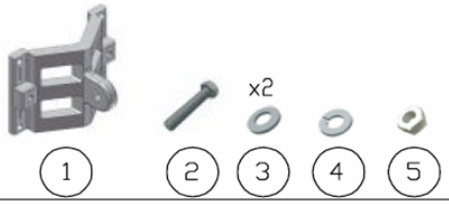
Figure B-3. Arm

Mounting WinLink 1000 on a Mast



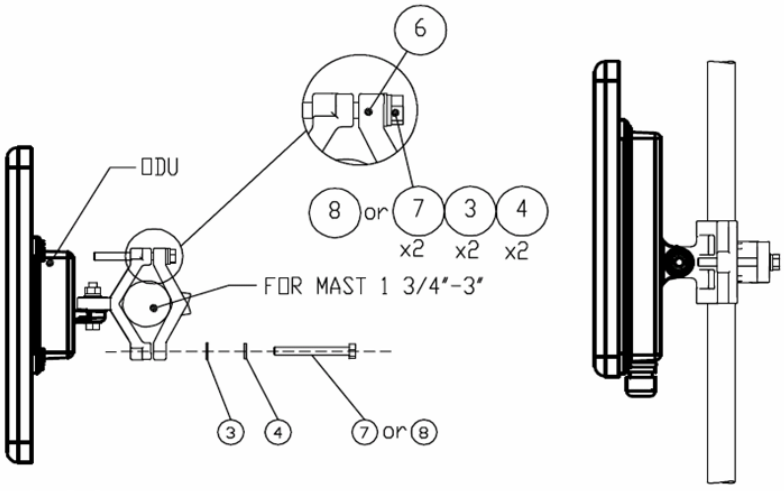
Installation Kit

ITEM	DESCRIPTION	QTY
1	Clamp	1
2	Screw hex head M8x40	1
3	Washer flat M8	4
4	Washer spring M8	3
5	Nut M8	1
6	Clamp	1
7	Screw hex head M8x40 (for 1 3/4" dia mast)	2
8	Screw hex head M8x70 (for greater size of mast)	2



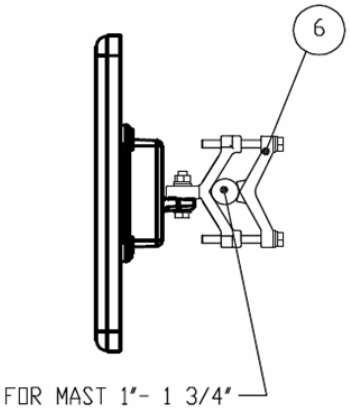
STEP 1

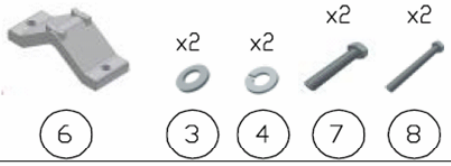
Attach item 1 to the base
(mate knurled surfaces)
using items 2 ,3 ,4 ,5 as shown
Use tightening torque of 24 N/m.



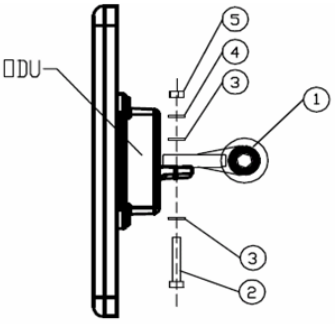
STEP 2

Tighten the antenna to the mast , using item 6,
screws, and washers items 7 ,3 ,4 as shown.
Use tightening torque of 14 N/m.



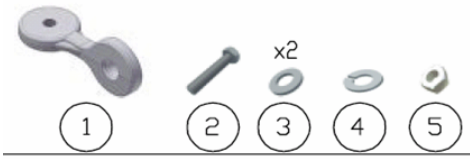


Mounting WinLink1000 on a Wall

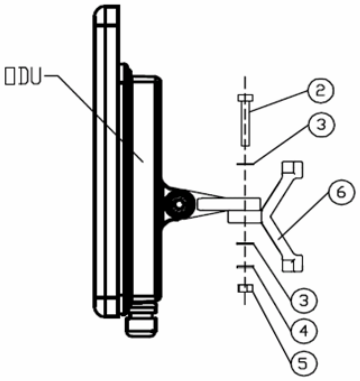


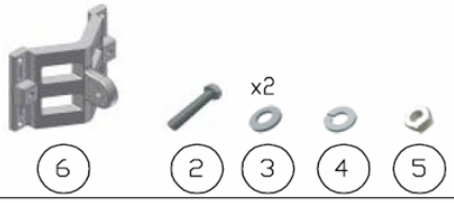
Installation Kit

ITEM	DESCRIPTION	QTY
1	Arm	1
2	Screw hex head M8x40	2
3	Washer flat M8	4
4	Washer spring M8	2
5	Nut M8	2
6	Base wall	1



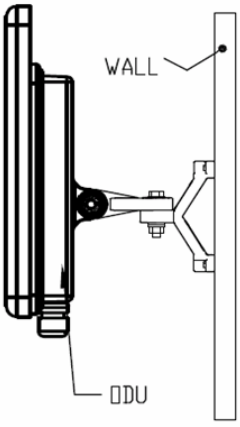
STEP 1
Attach item 1 to the base
(mate knurled surfaces)
using items 2, 3, 4, 5 as shown.
Use tightening torque of 24 N/m.





STEP 2
Attach item 6 to the arm
(mate knurled surfaces)
using items 2 ,3 ,4 ,5 as shown.
Use tightening torque of 24 N/m.

STEP 3
Install ant. to wall
(hardware supplied by customer)



B.2 Mounting an External Antenna

The optional external antenna can be mounted on a mast.

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 C

Link Budget Calculator

C.1 Overview

The Link Budget Calculator is a utility for calculating the expected performance of the WinLink 1000 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.

The Link Budget Calculator is supplied on the WinLink 1000 Manager CD. After installation, it may also be accessed from the menu bar of the WinLink Manager (see Figure C-1).

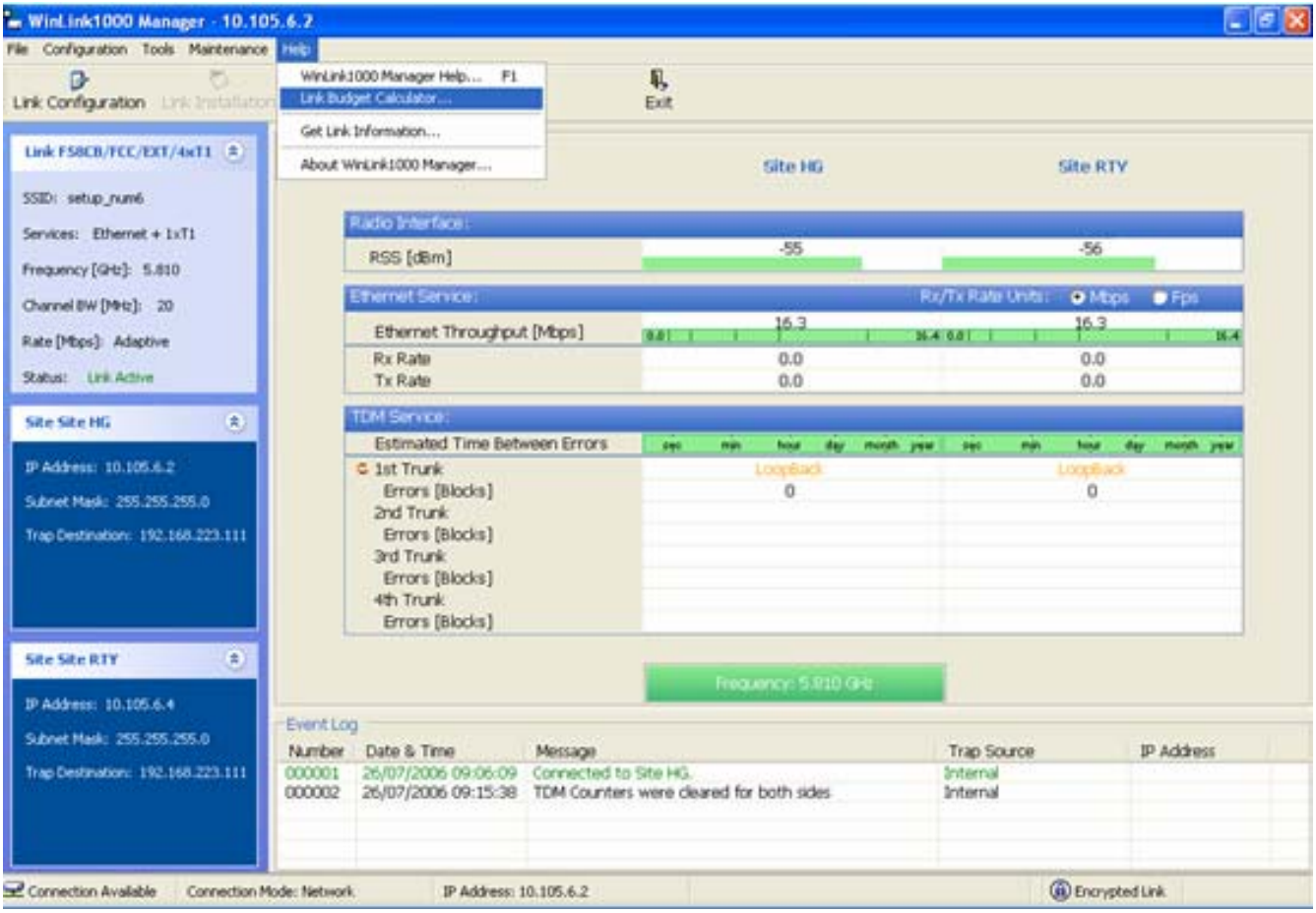


Figure C-1. Accessing the Link Budget Manager Calculator

C.2 Using the Link Budget Calculator

The Link Budget Calculator comprises of one table where all the link parameters are defined.

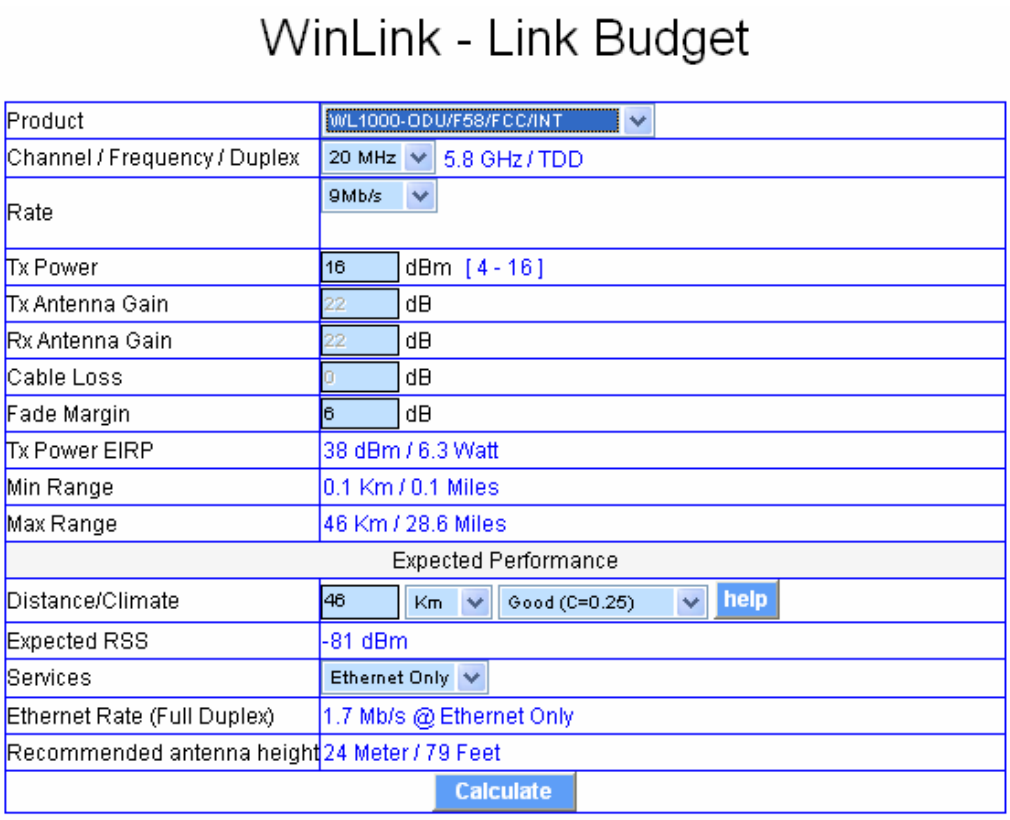


Figure C-2. Link Budget Screen

✱ To calculate the link budget

1. Select your WinLink system product from the dropdown list of products.
2. Select the rate from the dropdown list. The rate defines the air-interface rate in Mbps. The system operates in TDD mode and has overhead of the air-interface protocol and therefore the accurate actual throughput is provided in the 'Service' Row and the effective Ethernet throughput is provided in the 'Ethernet Rate'.

Note *Throughput can be decreased as a function of range due to propagation delay.*

The remaining fields are completed automatically depending on the product selected in the product field. Standard WinLink 1000 system parameters are entered as default. Fields in blue boxes may be edited if non-standard antennas and cables are used.

The Fade margin is the minimum margin that is required for LOS conditions. For degraded link conditions, a larger fade margin should be taken into account.

The Tx power EIRP for the system is given in dBm and Watts.

3. Type the required link distance and select units of distance, kilometers or miles.
4. Select the general conditions
5. Select the services required
6. Click **Calculate**

   The Expected Performance parameters are calculated and displayed in the lower part of the table.

   - Expected RSS – this is the number that the WinLink 1000 Manager software shows when the WinLink 1000 ODUs are best aligned.
   - Ethernet Rate – Maximum throughput available with the chosen system.

If the expected performance is not suitable for your application, select a different data rate and re-calculate.

Appendix D

AIND Antenna Alignment Procedure

Use this procedure when using the all indoor system WinLink 1000-ANID or manually aligning two WinLink 1000 units.

To achieve the best benefit and link budget from the WinLink 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 WinLink alignment, install the hardware and software in accordance with the WinLink 1000 Installation and Operation Manual. *Figure D-1* 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.

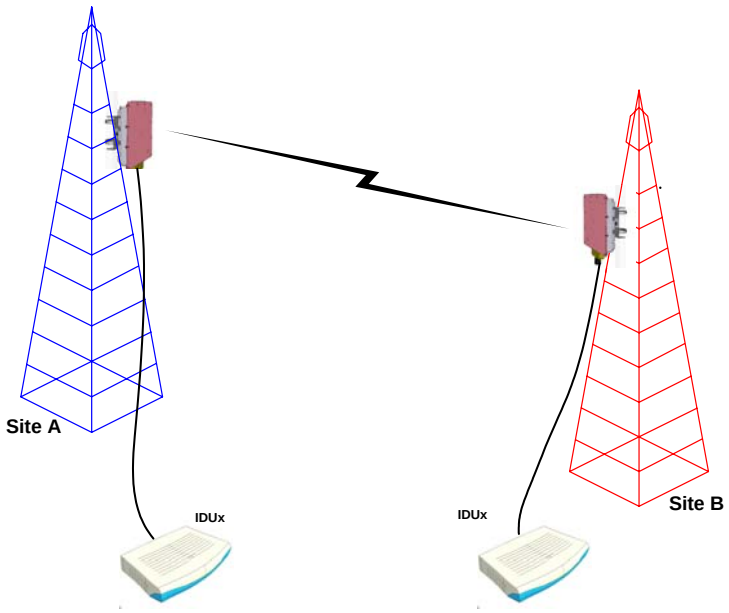


Figure D-1. WinLink 1000 Link Setup

D.1 Expected Signal Level

Based on the link budget parameters of the actual WinLink sites, you need to calculate the expected signal level that will be received by the receiving site.

Use the Link Budget Calculator utility supplied on the WinLink 1000 Manager Software CD-ROM to calculate the expected performance of the WinLink 1000 wireless link. The utility allows you to determine the RSS of the link, and find the number of E1/T1 services available at various data rates, with the minimum and maximum distance.

D.2 Performing WinLink 1000-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 D-1* but connect a spectrum analyzer in place of the remote WinLink 1000-AIND.
3. Turn on the CW transmit signal from site A (from the WinLink 1000 NMS).
4. 4. At site B, tune the SA to the frequency transmitted.
5. 5. Increase the SA sensitivity according to the expected receive signal.

Align the antennas:

Note

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

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.
   Lock the azimuth axis.
3. 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.
4. 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.
5. 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*).

   When the SA reads the expected receive signal, the antennas are aligned and there is an indication of a good link between the sites.
6. Tighten the antenna azimuth axis and elevation axis.
7. Stop the CW function. The NMS will restart the system.
8. Connect WinLink 1000-AIND unit to external antenna. See WinLink 1000 Installation and Operation Manual for details. The operational link is shown in *Figure 2-3*.
9. Configure WinLink 1000 NMS at both sites to operate at the pure channel frequency found in the RF survey. WinLink 1000 is now ready for operation.

D.3 Configuring the Link

1. Run the Installation Wizard in the WinLink 1000 Manager Software to set the configuration of the link. Configure the link in accordance with the parameters calculated in the Link Budget Calculator.
2. WinLink 1000 has a unique identification number, the SSID. Each side of the link looks for its partner with the same SSID. Therefore both sides of the link must be configured with the same SSID.
3. The WinLink 1000 link is now ready for operation.

D.4 Evaluating the Link

With the link operating at a pure channel as determined by the RF survey procedure, the recommended performance threshold of an WinLink 1000 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 *Troubleshooting*.

D.5 Troubleshooting

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

- Verify that both antennas have the same polarization (horizontal/vertical).
- Check all the WinLink 1000-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 E

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.

WinLink 1000 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 E-1. **Antenna Characteristics***

	Type	Gain [dBi]	Max Range [km]	[miles]	Beam [degrees]	Dimensions [mm]	[in]	Weight [kg]	[lb]	Connector	Lightning Protection
5.8, 5.4, 5.3 GHz											
Integrated	Flat panel	22	40	25	9.0	305×305×58	12×12×2.3	0.5	1.1	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	305×305×58	12×12×2.3	0.5	1.1	N-type	Yes
External	Dish	27	80	50	5	Dia 600	Dia 23.6	5.0	11.0	N-type	Yes
2.4 GHz											
Integrated	Flat panel	17	40	25	20	305×305×58	12×12×2.3	0.5	1.1	NR	Yes
External	Grid	24	80	50	7.5	600×997×380	23.5×39.2×15	2.0	4.6	N-type	No

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.

Grid Antenna

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

Appendix F

Hub Site Synchronization

F.1 Introduction

This Appendix is relevant for WinLink 1000-ACCESS-CL hardware only.

WinLink 1000-ACCESS-CL ODU units are supplied with special hardware for easing collocation of several units, using a method called Hub Site Synchronization (HSS). HSS uses an external cable connected to all collocated WinLink 1000 radios. This cable carries pulses sent to each radio, which synchronize their transmission with each other.

This pulse synchronization ensures that the transmission of packets occurs at the same time for all collocated units. This synchronized transmission 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. HSS supports installation of up to eight collocated units.

Figure F-1 shows interference caused by non-synchronized collocated units.

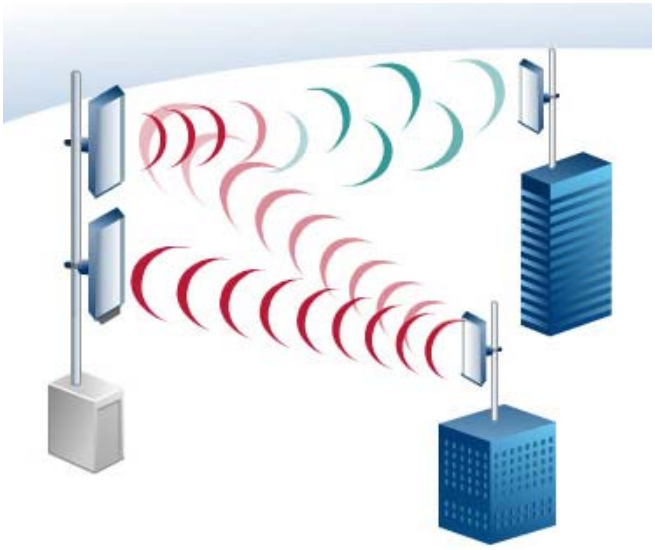


Figure F-1. Interference caused by collocated units

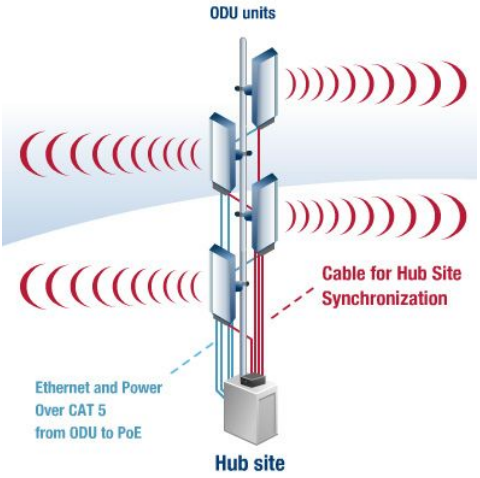


Figure F-2. Collocated units using Hub Site Synchronization

F.2 Hardware Installation

HSS supports installation of up to eight 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.

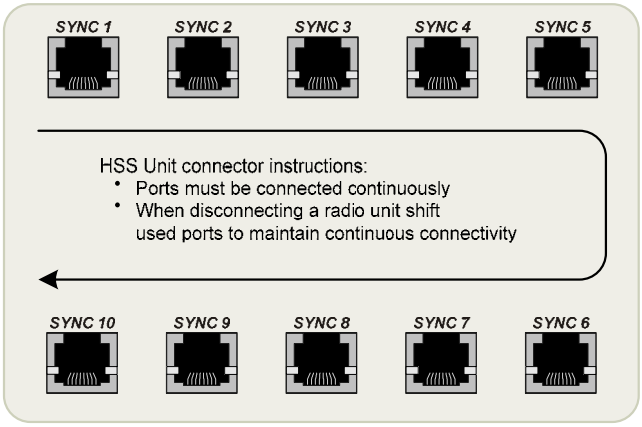


Figure F-3. HSS Interconnection Unit

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.

F.3 Architecture

One of the collocated ODUs at the hub site acts as the Hub Sync Master; 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: 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: 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.

F.4 HSS Link Configuration

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

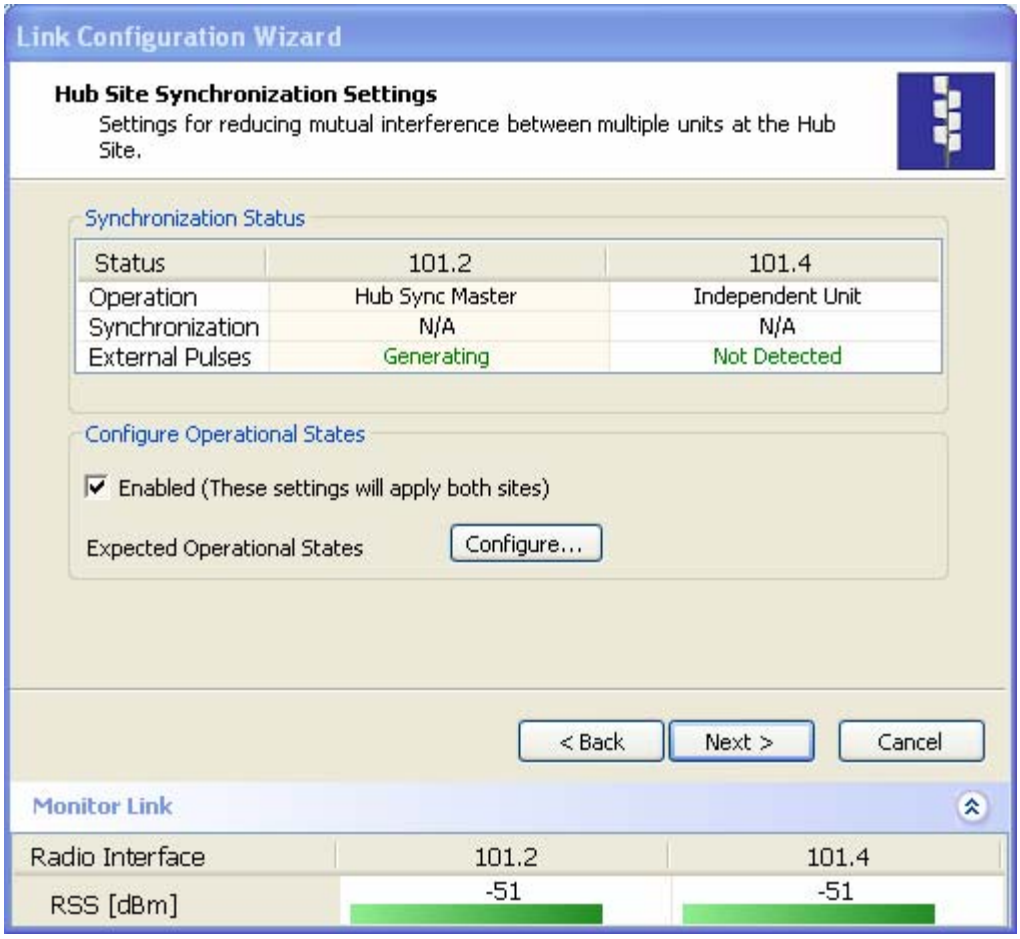


Figure F-4. Hub Site Synchronization Settings dialog box

The Synchronization Status dialog box displays the current status of each side of the link.

- Operation: Type of unit
  - Hub Sync Master
  - Hub Sync Client – Disable Transmission
  - Hub Sync Client – Continue Transmission
- 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:
  - Not Detected (Sync pulses were not detected)

- Generating (No pulses detected)
- Generating and Detected
- Generating and Improper Detected
- Detected (Proper external pulses detected)
- Improper Detected (Improper pulses detected)
- Multiple Sources Detected (Multiple pulses detected).

✱ **To configure the Operational States of the hub site unit**

6. Click the **Enabled** check box
7. Click the **Configure** button.

   The Hub Site Configuration dialog box with the current status of the ODUs is displayed.

8. Select the appropriate radio button and then select 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.

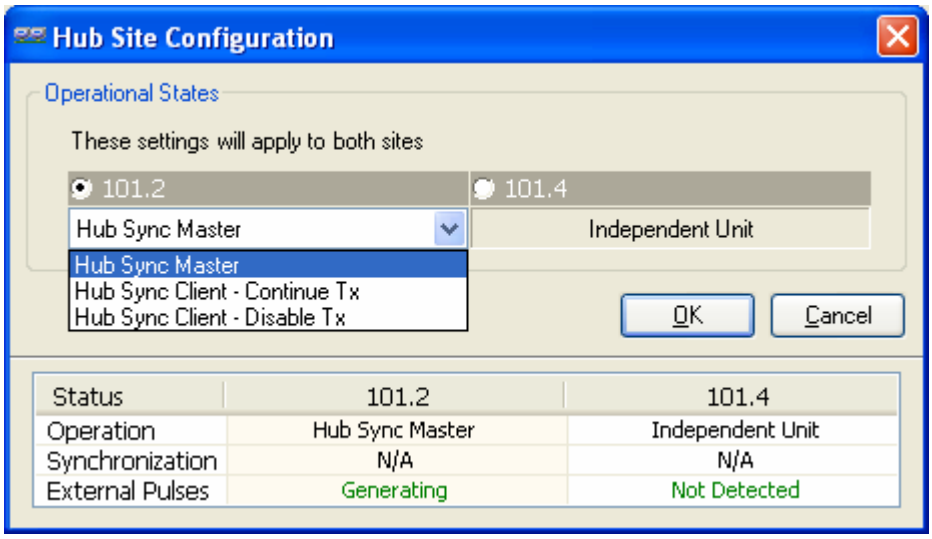


Figure F-5. Hub Site Configuration dialog box

F.5 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.

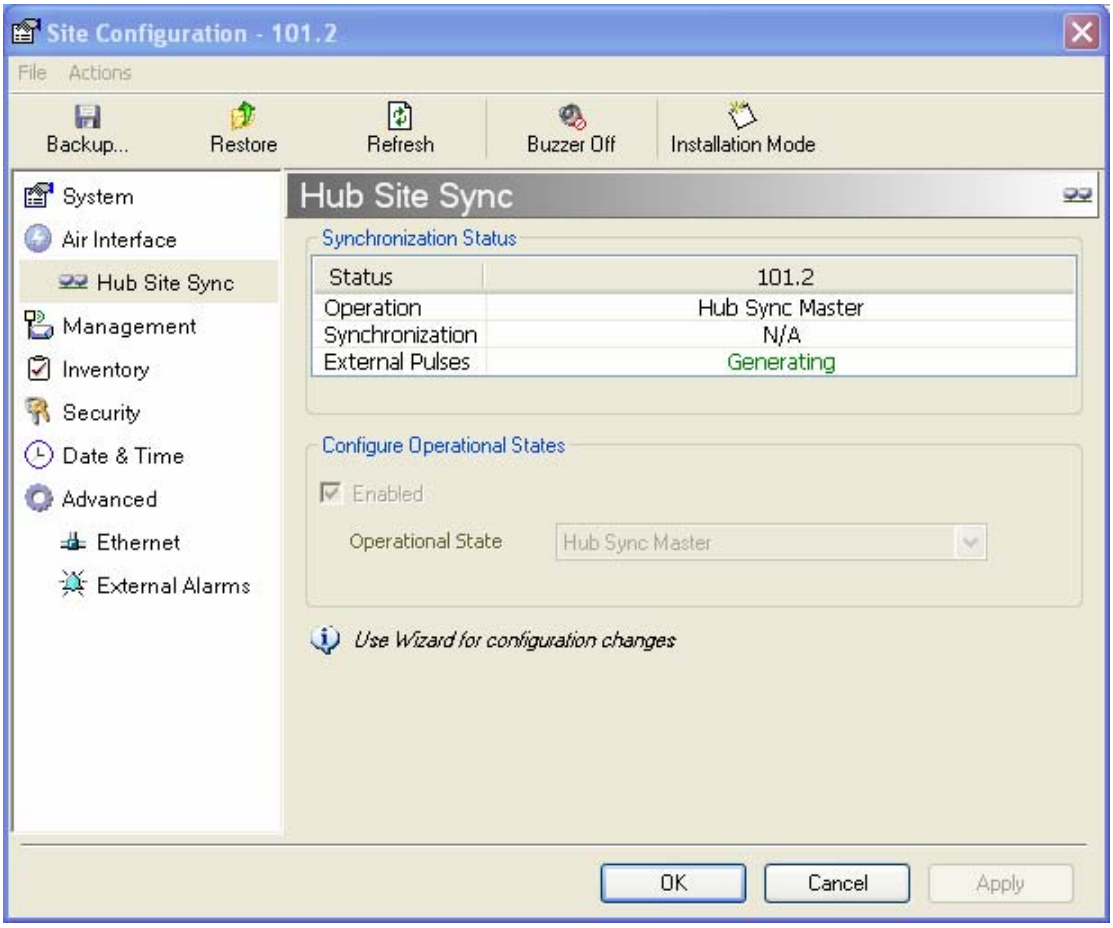


Figure F-6. Site Configuration – Hub Site Sync dialog box

Appendix G

BRS Installation Procedure

G.1 BRS Link Activation

In accordance with 2.5 GHz standard, WinLink 1000-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 WinLink 1000 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.

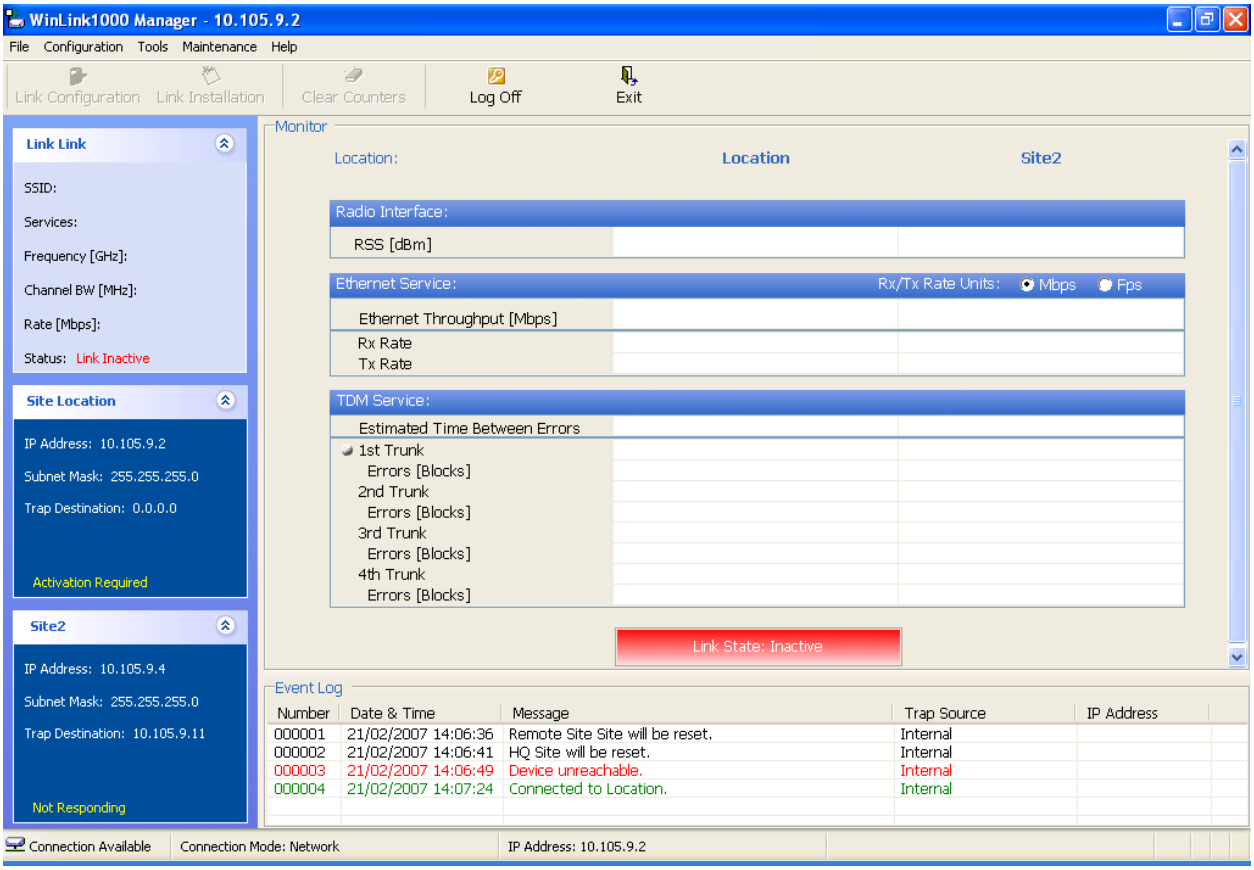


Figure G-1. Inactive Manager Screen

3. Click **Configuration>Configure Location**
   The Air Interface dialog box opens, *Figure G-2*.

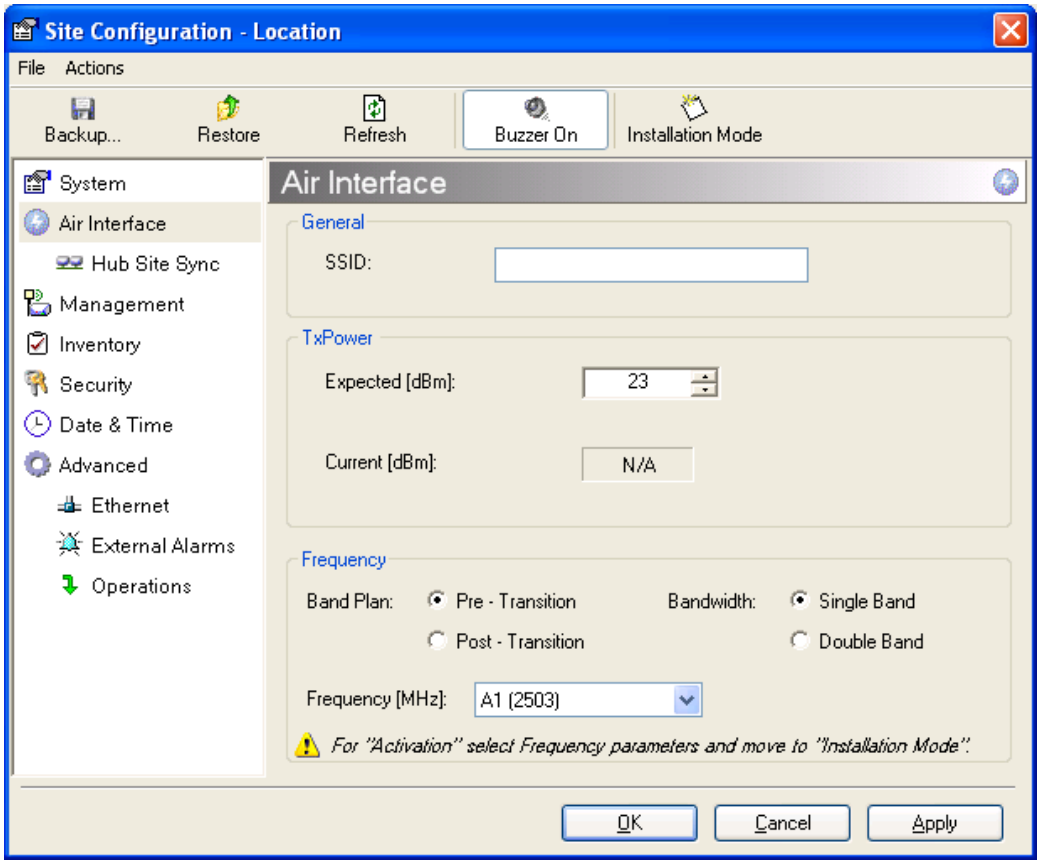


Figure G-2. BRS Air Interface dialog box

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.

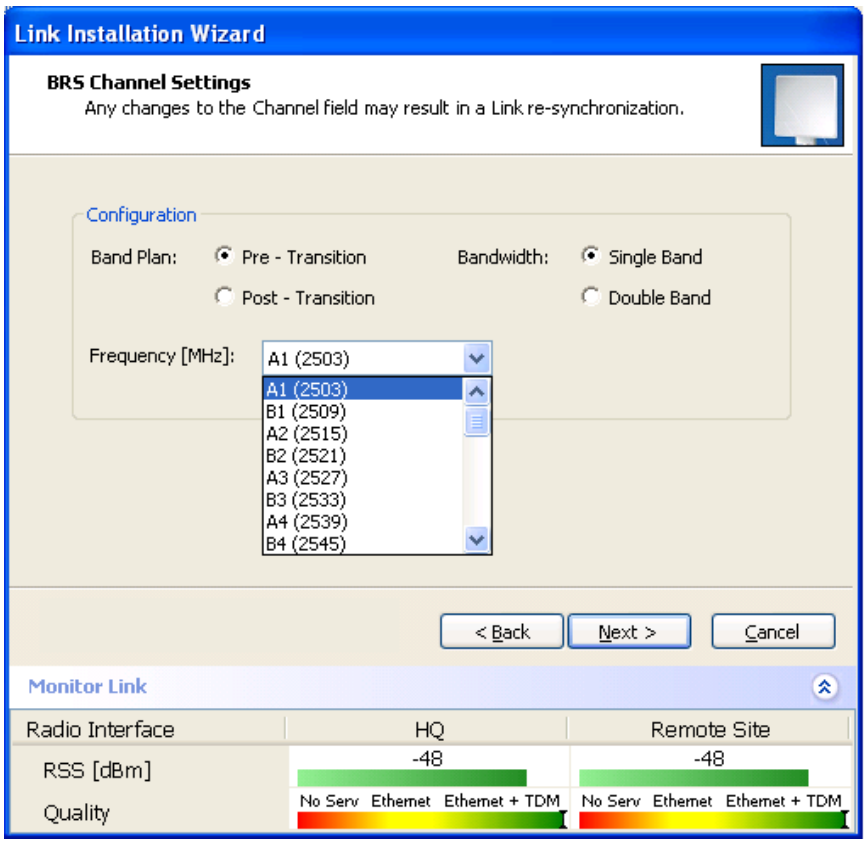


Figure G-3. BRS Channel Settings Pre-Transition

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

G.2 BRS Link Configuration

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

Note

Both sites in a BRS Link must be configured identically. 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.

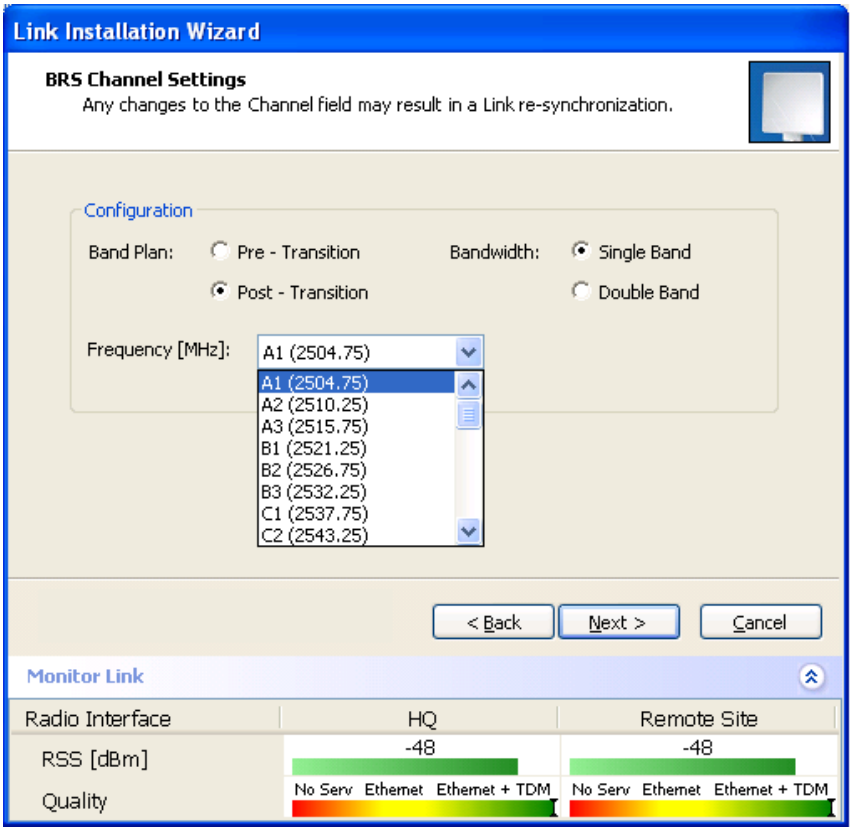


Figure G-4. BRS Channel Settings Post-Transition

Appendix H

RF Exposure

The antennas use 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]
F58A/HE/FCC	Q3KAMWL1580	22	109
F58A/HE/FCC	Q3KAMWL1580	28	217
F58A/HE/FCC F58A/FCC/AIND	Q3KAMWL1580	32.5	364
F24A/FCC	Q3KAMWL1240	16	16
F24A/FCC	Q3KAMWL1240	24	40
F24A/HE/FCC	Q3KAMWL1240H	24	71
F24A/HE/FCC	Q3KAMWL1240H	15.2	37

Index

—A—

AC power
  connecting, 2-6
Active Alarm Summary, 5-10
Adaptive Modulation, 1-3, 4-9
Advanced configuration, 4-16
Advanced Encryption System, 1-3
Advanced Tab, 4-23
AIND All Indoor Radio Unit, 2-5
Air Interface, 1-7
  calculate, 2-11
  configuration, 4-15
  rate, 4-8
Alarm connector, 1-4, 1-8, A-3
Alarms, 5-9
  list of, 5-10
Antenna, 1-4
Antenna characteristics, E-1
Application, 1-1

—B—

Backup, 4-31
  button, 4-16
Beeper
  muting, 4-30
  restore, 4-30
  sequence, 2-10
Bridge configuration, 4-16, 4-22
Buzzer. See Beeper

—C—

Change password, 4-28
Channel select, 2-14
Clear Counters, 3-5
Community String, 4-26
  change dialog box, 4-26
  forgotten string, 4-28
  Read-Only, 4-26
  Read-Write, 4-26
  Trap, 4-26
  types, 4-26
Community values, 4-16
Configuration
  advanced, 4-15
  air interface, 4-15
  bridge, 4-15
  community values, 4-15
  contact details, 4-15
  editing, 4-15
  external alarms, 4-15
  inventory, 4-15
  LAN connection, 4-15
  location details, 4-15
  management, 4-15
  restoring, 4-32
  saving, 4-31
  security, 4-16
  system, 4-15
  transmit power, 4-15, 4-17
  wizard, 4-1
Configure
  system parameters, 4-1
Connecting
  AC power, 2-6
  DC power, 2-7
  user equipment, 2-20
Connectivity icon, 3-6
Connectors
  Alarm, A-3
  IDU-E, A-2
Contact person, 4-15
Contents, of package, 2-1

—D—
Date & Time synchronizing, 4–20
Date and Time, 4–16, 4–20
DC power
  connecting, 2–7
Default Gateway, 4–15, 4–19
Default password
  link password, 4–29
  management, 2–8
Default settings, 3–4
Description, 1–5
DFS, 1–3, 2–16, 4–6
Diagnostics, 1–3, 5–1
Dynamic frequency selection, 1–3
Dynamic Frequency Selection (DFS), 2–16, 4–6

—E—
E1/T1 Connector Pinout, A–2
Editing
  configuration, 4–15
  contact person, 4–15
  location details, 4–15
Encryption icon, 3–6
Environment, 1–8
Equipment required, 2–2
Estimated Time Between Errors, 3–6
ETBE. See Estimated Time Between Errors
Event colors, 5–3
Event log, 3–6, 5–9
  save, 5–4
External antenna, 1–4
  mounting, B–4

—F—
FAQ, 5–16
Fast Ethernet Pinout, A–2
Features, 1–2

—G—
Get Link Information, 5–1
Grid Antenna, E–1

—H—
HSS. See Hub Site Synchronization
Hub Site Synchronization, 1–4, F–1
Hub Sync Clients, F–3
Hub Sync Master, F–3

—I—
Icon
  Connectivity, 3–6
  Encryption, 3–6
IDU Aging time, 4–23
  Ethernet Bridge, 4–24
  Fast aging mode, 4–24
  Hub Mode, 4–24
IDU–2E1–AL
  rear panel, 2–5
IDU–C, 1–5, 1–6
  front panels, 2–5
IDU–E, 1–5, 1–6
  front panel, 2–4
  rear panel, 2–5
Indicators, 1–8
Indoor Unit. See IDU
Information messages, 5–10
Information Rate, 4–25
Install mode, 4–16
  button, 4–16
Installation, 2–1
  management software, 2–6
  sequence, 2–2
  software, 2–5
  wizard, 2–11
Inventory, 4–15
IP address, 4–15, 4–19

—L—
LAN connection, 4–16
LAN interface, 1–2, 1–7
LAN Port, A–2
LEDs
  front panel, 3–2
  rear panel, 3–2
Line code, 2–19, 4–14
Link Budget Calculator
  overview, A–1
  using, A–2
Link Compatibility, 1–4, 5–11
Link configuration, 4–2

Link details, 3-6
Link Information, 5-1
Link installation, 2-11
Link password, 4-16
Link Status, 3-6
Location details, 4-15
Loopback
  activate, 5-12
  deactivate, 5-13
  external, 5-13
  internal, 5-13

—M—
Main menu, 3-5
Management
  addresses, 4-19
  configuration, 4-15
  Default Gateway, 4-15
  definitions, 4-15
  IP address, 4-15
  options, 1-3
  program, 2-6
  Subnet Mask, 4-15
  Trap Destination, 4-15
Monitor log
  save, 5-2
Monitor pane, 3-6
Monitoring, 1-3
Monitoring Performance, 5-2
Mounting
  mast, B-2
  wall, B-3
Mute
  button, 4-16
Muting the beeper, 4-16, 4-30

—O—
ODU, 1-5, 1-6
  aligning, 2-10
  beeper, 2-10
  connecting, 2-4
  mounting, 2-3
ODU Bridge Mode, 4-23
ODU-IDU cable
  pinout, A-1
Operating temperature, 2-1
Outdoor Unit. See ODU
Outdoor Unit (ODU)
  mounting, B-1

—P—
Package contents, 2-1
Panel
  AIND unit, 2-5
  IDU-2E1-AL, 2-5
  IDU-C, 2-4
  IDU-E, 2-4
Parabolic dish antenna, E-1
Password
  changing, 4-28
  default, 2-7
PC requirements, 2-5
Performance Monitor Report, 5-5
  commands, 5-8
  data, 5-7
  time intervals, 5-5
Performance monitoring, 1-3
Physical description, 1-5
Physical dimensions, 1-8
Pinout
  alarm connector, A-3
  DC power connector, A-2
  E1/T1 Connector, A-2
  Fast Ethernet connector, A-2
Pinout ODU-IDU cable, A-1
Power
  IDU, 2-6
  IDU-E, 2-6
Power specifications, 1-8
Power supply, 2-7
  AC, 2-6
Preferences, 5-2, 5-3, 5-4
  event colors, 5-3
  reset event colors, 5-3
Prerequisites, 2-1

—Q—
Quality bar, 2-16, 4-7

—R—
Radio signal strength, 3-6
Re-installing the Link, 4-32

Reselect Channel, 2-16, 4-5, 4-7
Reset, 4-32
  factory defaults, 4-32
Restore
  button, 4-16
Restoring configuration, 4-32

—S—
Saving, 4-31
Saving the Monitor Log, 5-2
Security configuration, 4-16
Service parameters, 4-8
Setup, 2-1
Site requirements, 2-1
SSID, 2-14
Statistics, 3-6, 5-2
Status Bar, 3-6
Subnet Mask, 4-15, 4-19
System Configuration, 4-15

—T—
TDM
  interface, 1-3, 1-7
  Traffic LEDs, 3-3
TDM clock
  automatic mode, 4-11
TDM status, 3-6
Technical Specifications, 1-7
Toolbar, 3-5
TPC, 1-4
Traffic rate, 3-6
Transmission Rate, 4-8
Transmit power, 4-17
  limits, 4-19
Transmit Power Control, 1-4
Trap colors
  background, 5-3
  reset, 5-3
  set, 5-3
Trap Destination, 4-15, 4-19
Troubleshooting, 5-1, 5-15
Trunk Port, A-2
Turning off, 3-7
Turning on, 3-1
Typical application, 1-1
Typical installation, 2-3

—U—
User equipment, 2-20

—W—
Wireless link, 1-2