Preface

Welcome!

This manual is intended for the technical personnel who will install and operate the Aeras WaveLink. Such personnel are typically experienced and skilled technicians familiar with on site, physical installation and connection of equipment, including maintenance work. It is also intended for system administration personnel performing initial configuration and subsequent system reconfiguration, as well as current system maintenance activities.

Document Organization

This manual provides a detailed description of the Aeras WaveLink components, and operating, installation and management procedures.

- Chapter 1 provides an overview and briefly describes typical applications.
- Chapter 2 provides an installation steering guide with references to subsequent installation sections.
- Chapter 3 describes how to plan the Aeras WaveLink network, radio links, and remote element and network management links, and individual Aeras WaveLink radios.
- Chapter 4 provides detailed hardware installation and acceptance test procedures.
- Chapter 5 describes final configuration procedures and the Web browser user interface.
- Chapter 6 presents procedures for monitoring and performing trend analysis on the Aeras WaveLink.
- Chapter 7 provides instructions for troubleshooting the Aeras WaveLink.
- Appendixes provide detailed technical information for carrying out the installation and maintenance activities described in the other chapters of this manual.

Microwave Radiation Warnings

Radio Warning

Under normal operating conditions, Aeras WaveLink radio equipment complies with the limits for human exposure to radio frequency (RF) fields adopted by the Federal Communications Commission (FCC). All Aeras Networks, Inc. microwave radio equipment is designed so that under normal working conditions, microwave radiation directly from the radio is negligible when compared with the permissible limit of continuous daily exposure recommended in the United States by ANSI/IEEE C95.1-1991 (R1997), Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

Microwave signal levels that give rise to hazardous radiation levels can exist within transmitter power amplifiers, associated RF multiplexers, and antenna systems.

Antenna Warning

Designed for point-to-point operation, the Aeras WaveLink microwave radio system uses directional antennas to transmit and receive microwave signals. These directional antennas are usually circular or rectangular in shape, are generally located outdoors, and are usually mounted with the Aeras WaveLink on a tower or mast.

The Aeras WaveLink is classified as a fixed installation product, and per FCC (Federal Communications Commission) policy guidelines regarding maximum permissible exposure (MPE), antennas used for this Aeras Networks radio must be installed to provide a separation distance of 2 m (79 in.) or more from all persons during normal operation to satisfy FCC RF exposure limits. As the Aeras WaveLink is typically mounted on a building or mast high enough to clear ground-level path obstructions, the general population will be further than 2 m (79 in.) from the radio antenna, and the FCC RF exposure limits will be met.

Aeras Networks, Inc. fully supports the FCC's adopted MPE limits, and recommends that personnel stay 2 m (79 in.) from the front of all directional microwave antennas. Should you have questions about Aeras WaveLink microwave signal radiation, please contact the Aeras Networks Customer Support.

Regulatory Information

FCC Compliance

The Aeras WaveLink is FCC certified for use in the 5.3 GHz unlicensed band in the United States.

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The 5.3 GHz version of the Aeras WaveLink is certified under FCC part 15.407, U-NII regulations covering the frequency band of 5250-5350 MHz.

5.3 GHz (5.25-5.35 GHz)

When deployed in an area regulated by the FCC, 5.3 GHz Aeras WaveLink radios are equipped with an integral antenna only, and operate under the FCC Part 15, subpart E, U-NII license-exempt regulations, which certify the radios for .0063 output watts. The 5.3 GHz Aeras WaveLink radio has been FCC certified in the following configuration:

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Deleted: –1.0 dBm average, or +7.4 dBm peak transmit power

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Deleted: <#>Aeras WaveLink, 5.3 GHz, integral antenna¶

Other Regulation Compliance

Other countries have varying RF licensing and operating requirements, and it is imperative that operators and professional installers ensure that the Aeras WaveLink is configured and installed per regional regulations.

For instance, ETSI I-ETS 300 440 describes the bands that the Aeras WaveLink is permitted to operate in, and limits transmissions to 25 milliwatts EIRP (Power Class 9).

Related Documentation

All Aeras Networks manuals are available in an online format on our protected Internet site. To order user documentation, please contact Aeras Networks, Inc. Sales department online at http://www.aerasnetworks.com.

Updates to this manual will be posted on the Aeras Networks, Inc. Customer Support website at http://www.aerasnetworks.com/custsupport. Registered Aeras Networks customers can access the Aeras Networks online information and support service, available 24 hours a day, seven days a week. The Aeras Networks online service provides users with a wealth of up-to-date information, with documents being added or updated each month.

Deleted: ***5.8 GHz (5.725-5.825 GHz)***¶
When deployed in an area regulated by the FCC, 5.8 GHz Aeras WaveLink radios operate under the FCC Part 15.247 band regulations, which certify the radios for +16 dBm average or +24.1 dBm peak transmit power for intentional radiators in a point-to-point configuration. The 5.8 GHz Aeras WaveLink radios are equipped with an integral or an external antenna. The 5.8 GHz Aeras WaveLink radios have been FCC certified in the following configurations:¶
<#>Aeras WaveLink, 5.8 GHz, integral antenna¶
<#>Aeras WaveLink, 5.8 GHz, 2 ft. (61 cm) external Radio Waves, Inc. Model SP2-5.2 parabolic antenna¶
<#>Aeras WaveLink, 5.8 GHz, 2 ft. (61 cm) external Gabriel Electronics, Inc. Model SSP2-52B parabolic antenna¶
<#>Aeras WaveLink, 5.8 GHz, 4 ft. (122 cm) external Gabriel Electronics, Inc. Model SSP4-52B parabolic antenna¶

Customer Support Services

Aeras Networks has regional Customer Support centers that handle day-to-day customer issues. Each center is staffed with a local technical support group. The exact services to be performed by the Aeras Networks Customer Support department are specified in a support contract. Below is an example of the types of services available:

- Telephone support
- Site surveys
- Installations
- Off-line and online commissioning
- Network integration activities
- Troubleshooting and fault isolation
- Escalation of problems to appropriate Aeras Networks technical departments

Aeras Networks can physically perform all or a portion of these processes for the operator, as specified in the support contract. The Customer Support department can also provide documentation outlining corrective and preventive maintenance procedures and troubleshooting guides for fault isolation.

Contact your local Sales Support office, or Aeras Networks headquarters directly via the Internet at http://www.aerasnetworks.com.

If possible, please have the following information available when making a call:

- Site number or name
- Full description of product(s) (e.g., model and part number) and configuration
- Serial number of product(s)
- Purchase order number
- Contact name and telephone number
- Ship to address
- Bill to address

For support on installing or configuring all Aeras Networks equipment, contact your Regional Aeras Networks Customer Support Center at:

- +1.877-737-2741 or usa_support@aerasnetworks.com -- North and South America, Europe, Africa, and Middle East

Deleted: 888.592.7205

Deleted: or via the Internet at http://www.aerasnetworks.com/custsupport

Return Materials Authorization

In the event that a depot repair or hardware replacement is required after contacting Customer Support, please contact Aeras Networks for return authorization. The following information is required by Aeras Networks:

- Full description of the product(s): model and part number
- Serial number of the product(s)
- Purchase order number
- Quantity that needs to be returned to Aeras Networks, if applicable
- Description of observed problem

All Aeras Networks products carry a one year manufacturing warranty from the date of shipment. At the time of a request for a return authorization, if the product has exceeded the warranty period, Aeras Networks will require a new purchase order number to cover the cost of non-warranty repair.

Contact Sales Operations via the Internet at http://www.aerasnetworks.com or email at rma@aerasnetworks.com.

Training

Aeras Networks has developed an extensive series of training courses designed to teach you how to use our products. The courses are developed by a combination of subject matter experts and training specialists in order to create highly technical materials in modern training format. Each of our course offerings are designed around specific learning objectives that keep our classes on track to learning specific job skills related to Aeras Networks products.

The Aeras Networks training catalog contains a listing of the Aeras Networks training services available along with descriptions of each course. Our training materials are divided into specific subsystem training series, depending upon the topic and job requirements.

Contact Customer Support via the Internet at http://www.aerasnetworks.com or email at training@aerasnetworks.com.

Conventions Used in this Manual

The following type and style conventions are used in this manual:

Table 1 Conventions Used in This Manual (continued)

Convention	Meaning
Body text	Used for regular body text
Bold	Indicates a menu or button choice
`Command`	Indicates computer generated text and prompts
`User Input`	Indicates user input
<hostname>	In command syntax, indicates user-specified command line parameters
<variable>	In body text, indicates user-specified command line parameters
[BRACKETS]	Indicates a key on the keyboard or instrument
	
	
	

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System Description

This chapter contains a functional description of the Aeras WaveLink product family, and contains the following sections:

- Section , General
- Section , System Overview

Section ,

- Features

Section ,

- Aeras WaveLink Basic Structure
- Section , Typical Applications

Welcome to the Aeras Networks WaveLink Series product family. This manual is designed to introduce you to the Aeras WaveLink products, and to provide you with information necessary to plan, install, operate and maintain a Aeras WaveLink wireless communication system.

The Aeras WaveLink is intended for professional installation only. However, this manual is also designed for personnel who plan, operate and administer the Aeras WaveLink communication system. Please review the entire manual before powering up or deploying any Aeras WaveLink.

0-1 General

0-0.1 Products

The Aeras WaveLink family comprises two separate products, the Aeras WaveLink-DSX, and the Aeras WaveLink-ITU. The Aeras WaveLink products are cost-effective, all-outdoor, pole-mounted, high-capacity, line-of-sight (LOS) digital radio transmission systems, each operating in the license-exempt 5.25-5.35 GHz (5.3 GHz) frequency band. The Aeras WaveLink can be used for the following applications: point-to-point or building-to-building, WLL (wireless local loop), backup solutions, temporary links, and mesh cellular backhaul.

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- The 5.3 GHz Aeras WaveLink-DSX DS-3 and 10/100 versions conform to the FCC (Federal Communications Commission) Part 15.407 Subpart E describing U-NII (Unlicensed National Information Infrastructure) operation. It operates at up to -1.0 dBm average transmit power, and is intended for short-distance use.
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Deleted: The 5.8 GHz Aeras WaveLink-DSX DS-3 and 10/100 versions conform to the FCC Part 15.247 describing intentional radiators. It operates at up to +16 dBm average power, and is intended for use over longer distances.

The 5.3 GHz Aeras WaveLink-DSX DS-3 and 10/100 versions can operate at up to +10.0 dBm average transmit power, and are intended for short-distance use.

- The 5.3 GHz Aeras WaveLink-ITU E3 and 10/100 versions can operate at up to +10.0 dBm average transmit power, and are intended for short-distance use.

All Aeras WaveLink-DSX versions provide either a standard DS-3 (44.736 Mbps) interface adhering to Bellcore GR-499-CORE (DSX-3) standards, or provide two Ethernet 10/100Base-T interfaces adhering to IEEE 802.3 standards, with a combined nominal line rate of 45 Mbps.

All Aeras WaveLink-ITU versions provide either a standard E3 (34.368 Mbps) interface adhering to ITU-T G.703 standards, or provide two Ethernet 10/100Base-T interfaces adhering to IEEE 802.3 standards, with a combined nominal line rate of 35 Mbps.

Each Aeras WaveLink is powered by an external ±21 to ±60 VDC power supply.

Deleted: <#>The 5.8 GHz Aeras WaveLink-DSX DS-3 and 10/100 versions can operate at up to +16.0 dBm average transmit power, and are intended for short-distance use. ¶
<#>The 5.8 GHz Aeras WaveLink-ITU E3 and 10/100 versions conform to ETSI (European Telecommunications Standards Institute) Power Class 9 operation. They operate at up to 25 milliwatts peak EIRP (Equivalent Isotropic Radiated Power). ¶

Deleted: <#>The 5.8 GHz Aeras WaveLink-ITU E3 and 10/100 versions can operate at up to +16.0 dBm average transmit power, and are intended for use over longer distances. ¶

0-0.1 Applications

The Aeras WaveLink product line is designed to serve the following communications markets:

- Internet Access and Backhaul Systems: Used by Internet Service Providers (ISPs).
- Private Networks: Wireless Bridged LANs and WANs.
- PCS/PCN and Cellular Networks: High speed links between base stations.
- Wireless Local Loop Networks: Fixed wireless, used by Local Exchange Carriers (LECs).
- Business Bypass or Local Exchange Bypass: Provided by Competitive Access Providers (CAPs) and Competitive Local Exchange Carriers (CLECs).
- When used with Aeras Networks WaveStream Switches, the Aeras WaveLink can provide the radio links in a self-healing wireless mesh backhaul network to support broadband communications, including DSL (Digital Subscriber Line) and Cellular over ATM (Asynchronous Transfer Mode).

0-1 System Overview

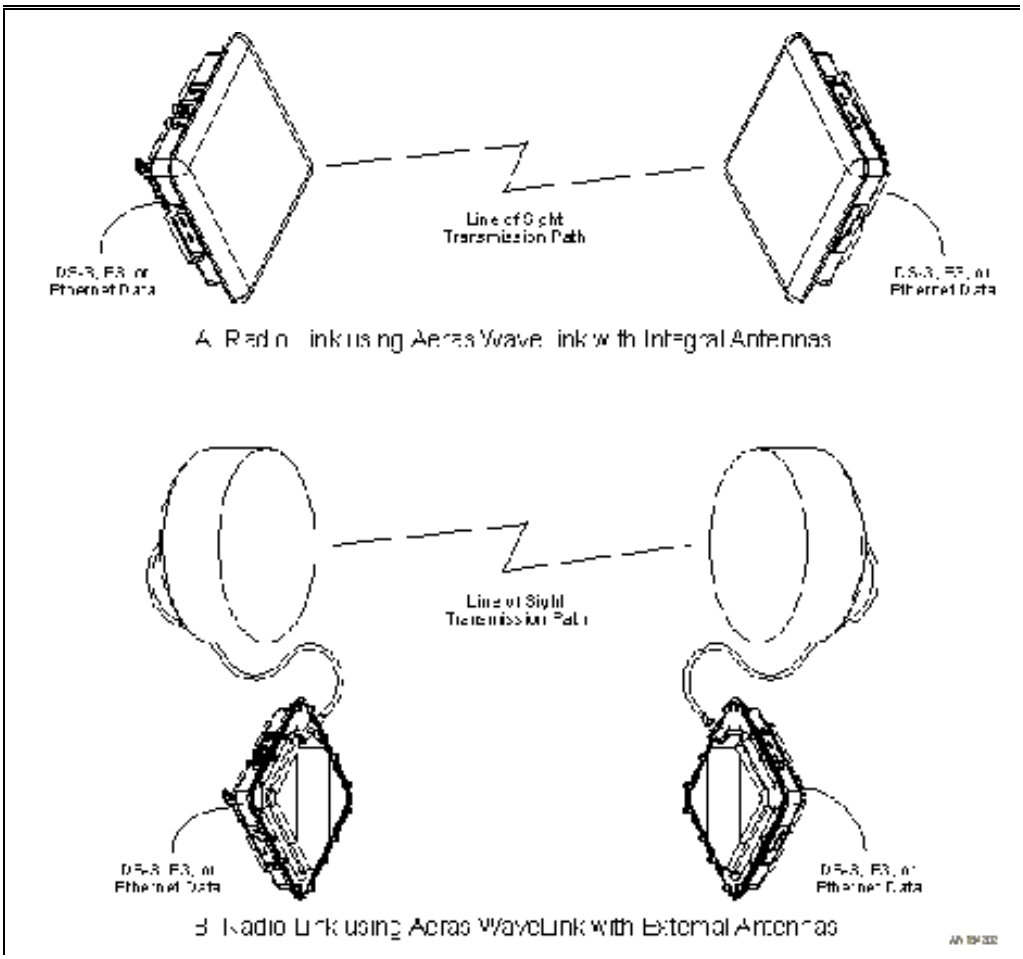
Each Aeras WaveLink consists of a Aeras WaveLink radio, with integral antenna or an optional external antenna, as shown in Figure , along with external power and data cabling. In a typical installation, the Aeras WaveLink radio and antenna are mounted

outdoors, usually on a tower or building. If so equipped, the external antenna connects to the Aeras WaveLink radio through a factory-supplied coaxial cable.

See Figure . A radio system, or link, contains two Aeras WaveLink radios each equipped with either an integral or external antenna, installed at each end of the link, separated by a line of sight transmission path. Frequency band, terrain, actual line-of-sight and environmental conditions influence the range of operation and path performance.

The Aeras WaveLink carries one full-duplex DS-3, E3, or Ethernet channel, and is powered by a 30-watt external ±21 to ±60 VDC power supply.

Figure 0-1 Typical Radio Link Configurations



Because the Aeras WaveLink can be ordered in two different bands, with high and low channels, and can be installed with horizontal or vertical polarization, up to eight Aeras WaveLinks can be mounted at a each hub, or node, to form part of a star or mesh network. See Figure .

Figure 0-1 Aeras WaveLink 5.3 and 5.8 Star Network

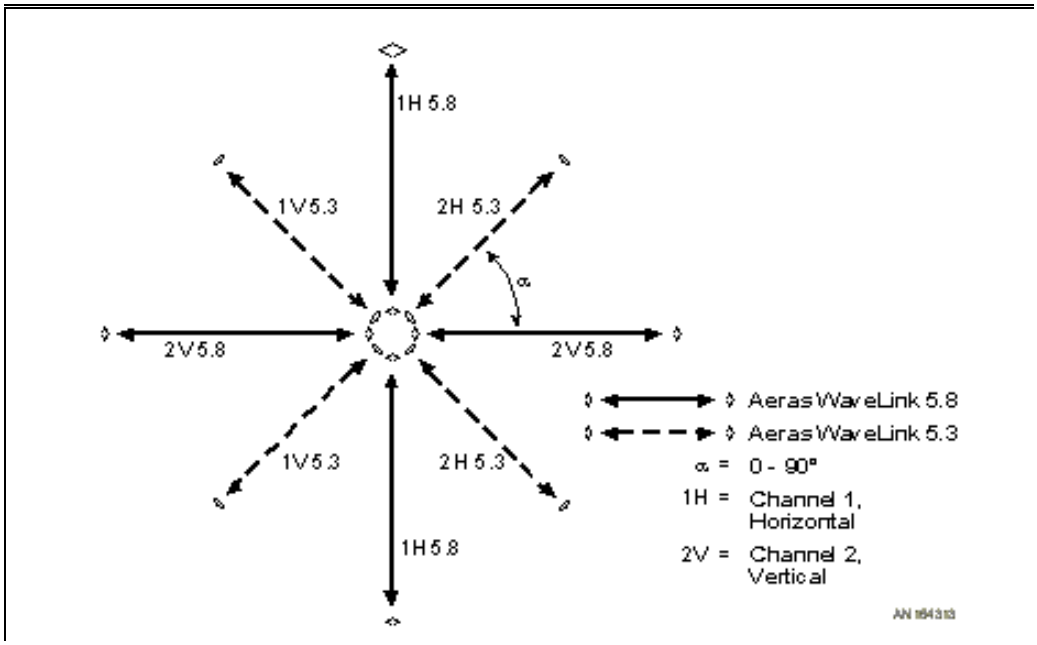


Figure 0-1

Features

The Aeras WaveLink offers the following features:

- Robust outdoor all-outdoor enclosure.
- Integral or external antenna.
- Sturdy radio mounting systems for quick, accurate and reliable integral antenna alignment.
- Operates in the license-exempt 5.25-5.35 GHz (5.3 GHz) band.
- Full-duplex transmission:
  - DS-3 (DSX-3, per Bellcore GR-499-CORE)
  - E3 (per ITU G.703)
  - Ethernet 10/100Base-T (per IEEE 802.3)
- Easy configuration, installation, operation, and maintenance.
- Integral web server for configuring, operating, and monitoring using an HTML-based web browser GUI.
- Ethernet interface used with NMSs (Network Management Systems) or EMSs (Element Management Systems) using SNMP (Simple Network Management Protocol) traps. Supports MIB-II (Management Information Base II) and Aeras Networks enterprise MIB.
- ATPC (Automatic Transmit Power Control).
- Self Test, BER test mode, RF and digital loopbacks.
- Reed Salomon Forward Error Correction (FEC).
- Operating and backup software versions contained in Aeras WaveLink memory, operator-selectable.

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Aeras WaveLink Basic Structure

0-0.1 Radio Links

Each radio link includes two Aeras WaveLink terminals. Each terminal consists of a Aeras WaveLink radio with an integral flat-panel antenna, or a Aeras WaveLink radio with an external antenna (see Figure). Generally, the Aeras WaveLink terminals are mounted outdoors on a tower or building.

0-0.1 Data Stream

The DS-3, E3, or Ethernet data signals enter the Aeras WaveLink, and are modulated into the RF data stream. The RF radio signal radiates from the local antenna and propagates to the remote antenna. At the remote terminal, the received signal is demodulated and demultiplexed, separating the payload data and the overhead management data.

0-0.1 Aeras WaveLink Models

The Aeras WaveLink is manufactured in many configurations:

- Versions with DS-3 or Ethernet carried over 5.3 GHz links.
- Versions with E3 or Ethernet carried over 5.3 GHz links.
- Each version available with an N-type connector for a factory-supplied 61 cm (2 ft.) external antenna, or with an N-type connector for a customer-supplied external antenna.

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Deleted: either an integral 30 x 30 cm (12 x 12 in.) antenna, or with or 122 cm (4 ft.) ... [1]

Aeras WaveLink models are described in Table .

Table 0-1 Aeras WaveLink Models (continued)

Model	Transmi t Band	Frequency Band	Link Carries	Antenna
M100746-102 M100747-102	Low High	5.25-5.35 GHz	DS-3	External, 61 (2 ft.), or External, customer-supplied
M100746-202 M100747-202	Low High	5.25-5.35 GHz	Ethernet (45 Mbps)	External, 61 (2 ft.), or External, customer-supplied

Deleted: M100746-101 M100747-101 ... [2]

Deleted: or 122 cm ...or 4 ... [3]

Deleted: M100748-101 M100749-101 ... [4]

Deleted: M100748-102 M100749-102 ... [5]

Deleted: M100746-201 M100747-201 ... [6]

Deleted: or 122 cm ...or 4 ... [7]

Deleted: M100748-201 M100749-201 ... [8]

Deleted: M100748-202 M100749-202 ... [9]

Deleted: M100746-301 M100747-301 ... [10]

Deleted: M100746-302 M100747-302 ... [11]

Notes:

1. These models are the only versions FCC certified for 0063 watts transmit

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Deleted: M100748-301 M100749-301

Deleted: Low High

Deleted: 5.725-5.825 GHz

Deleted: E3

Deleted: Integral

Deleted: M100748-302 M100749-302

Deleted: Low High

Deleted: 5.725-5.825 GHz

Deleted: E3

Deleted: External, 61 or 122 cm (2 or 4 ft.), or External, customer-supplied

Deleted: M100746-401 M100747-401

Deleted: Low ... [12]

Deleted: 5.25-5.35 GHz

Deleted: Ethernet (35 Mbps)

Deleted: Integral

Deleted: M100746-402 ... [13]

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Deleted: 5.25-5.35 GHz

Deleted: Ethernet (35 Mbps)

Deleted: External, 61 or 122 ... [15]

Deleted: M100748-401 ... [16]

Deleted: Low ... [17]

Deleted: 5.725-5.825 GHz

Deleted: Ethernet (35 Mbps)

Deleted: Integral

Deleted: M100748-402 ... [18]

Deleted: Low ... [19]

Deleted: 5.725-5.825 GHz

Deleted: Ethernet (35 Mbps)

Deleted: External, 61 or 122 ... [20]

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Deleted: Low ... [22]

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Deleted: E3

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Deleted: (TBD) ... [24]

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Deleted: Ethernet (35 Mbps)

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Mounting and Antenna Alignment

To ensure proper mounting and antenna alignment Aeras Networks sells mounting brackets designed for use with the Aeras WaveLink. The single bracket mounts one Aeras WaveLink, while the dual bracket mounts two Aeras WaveLinks back-to-back. Both brackets are designed to provide rugged mounting for the Aeras WaveLink, while allowing fine adjustment for antenna alignment.

0-0.1 Interface Connectors and Indicators

See Figure for a view of the Aeras WaveLink external connectors and indicators. The Aeras WaveLink connectors and indicators are described in Table .

0-0.1 Aeras WaveLink Interface Connectors and Indicators

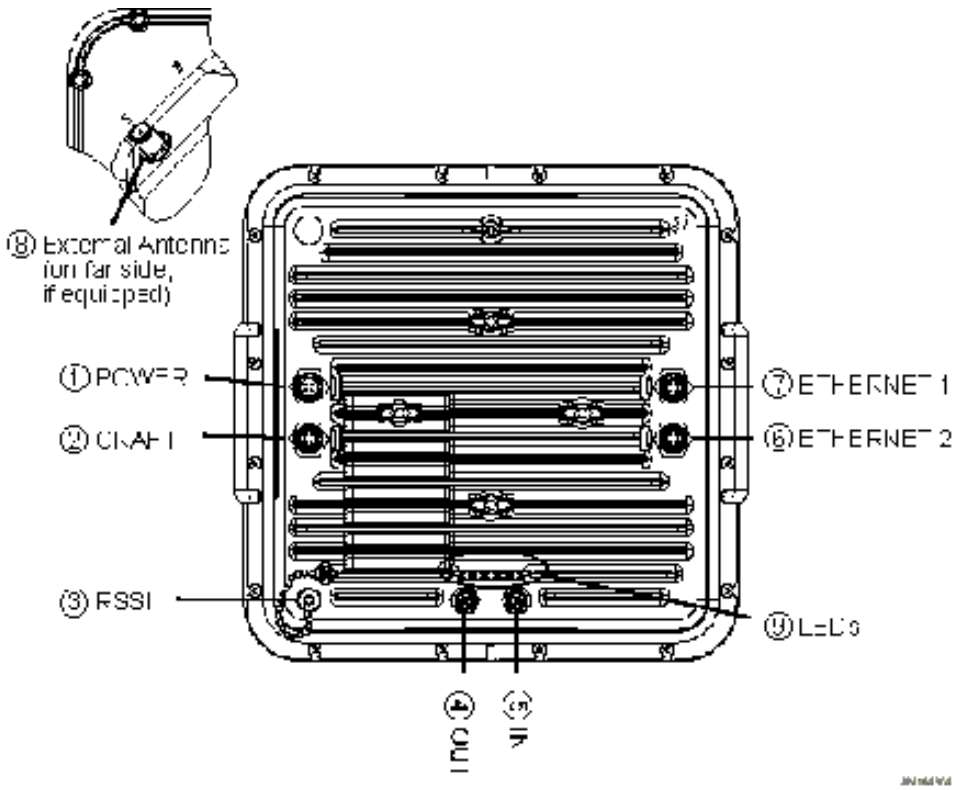


Table 0-2 Aeras WaveLink Interface Connectors and Indicators (continued)

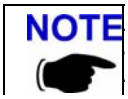
No.	Name	Component	Description	From	Note
1	POWER	Male 4-Pin Circular Connector	Power input plug	Power Supply	Accepts ±21 to ±60 VDC
2	CRAFT	Female 4-Pin Circular Connector	RS-232 receptacle	Asynchronou s laptop port	1200 to 115,200 baud, used only for tech support troubleshooting
3	RSSI	Female BNC Connector	Receive Signal Level Indicator	Voltmeter	Verifies RF signal strength, used to align antenna
4	OUT	Female TNC Connector	DS-3 or E3 data from the radio link	DS-3 or E3 data equipment	--
5	IN	Female TNC Connector	DS-3 or E3 data to the radio link	DS-3 or E3 data equipment	--
6	ETHERNET 2	Female 4-Pin Circular Connector	10/100Base-T transmit and receive receptacle	Ethernet equipment	For Ethernet data or link to SNMP or Web manager, or use to daisy-chain Ethernet port to next Aeras WaveLink in cascade
7	ETHERNET 1	Female 4-Pin Circular Connector	10/100Base-T transmit and receive receptacle	Ethernet equipment	(Same as ETHERNET 2)
8	ANTENNA PORT (Opt.)	Female N-type Connector	50 Ohm RF receptacle	External antenna	Only equipped on external-antenna models, on far side of chassis
9	PWR/LCL ALM	Green LED	Power/Local Alarm Status	--	ON = Power OK, no alarm, Flashing = Local alarm, OFF = Power off.
	RF LINK	Green LED	Radio Link Status		ON = Rcv. OK, OFF = Link Alarm.
	DATA	Green LED	DS-3/E3 Status		ON = OK (no LOS), OFF = LOS.
	ENET 2	Green LED	Ethernet Status		ON = OK, Flashing = data, OFF = No conn.
	ENET 1	Green LED	Ethernet Status		ON = OK, Flashing = data, OFF = No conn.
Note: For connector pinouts, refer to **Error! Reference source not found.**.					

Table 0-2

Cables

To ensure longevity in a outdoor environment, Aeras Networks sells various cables designed for use with the Aeras WaveLink. Aeras Networks offers the following weather-resistant cables:

- DS-3, E3, and Ethernet data cables and the power cables are offered in 25 m (82 ft.), 50 m (164 ft.), and 100 m (328 ft.) lengths.
- A 6 m (19.7 ft.) Ethernet cable is available to route the Ethernet signal between two Aeras WaveLinks in the same location, or when you are configuring the Aeras WaveLink from a Craft PC.
- For models to be used with external antennas, a 2 m (6.6 ft.) N-to-N RF cable is available to connect the external antenna to the Aeras WaveLink.
- A 6 m (19.7 ft.) RS-232 4-pin Circular-to-DB9 Craft cable is available to connect a Craft PC to a Aeras WaveLink for future CLI applications.
- When the Aeras WaveLink is to be used with a Aeras WaveStream Switch for a mesh backhaul network, a 6 m (19.7 ft.) dual TNC-to-TNC cable is available to connect each Aeras WaveStream Switch to a Aeras WaveLink.



Deleted: Integral Antenna¶
The integral antenna is a 30 cm x 30 cm (12 in. x 12 in.) flat-panel antenna mounted directly on the Aeras WaveLink radio chassis, as shown in Figure . All RF connections between the integral antenna and the Aeras WaveLink radio are made internally, eliminating the need for external coaxial cabling. Because the integral antenna is sealed onto the Aeras WaveLink chassis, the Aeras WaveLink and integral antenna are mounted as a unit, and share the same environmental protection. An arrow on the connector side of the Aeras WaveLink chassis indicates the antenna polarization (either vertical or horizontal).¶
¶
Section Break (Continuous)
<#>Integral Antenna and Aeras WaveLink Radio¶
¶

External Antenna

Some Aeras WaveLink models use an external antenna to radiate and receive RF signals. The antenna attaches to the Aeras WaveLink via a factory-supplied cable. The following sections describe factory- and customer-supplied external antennas.

Factory-Supplied

The following external antennas are offered for use with the Aeras WaveLink:

- 61 cm (2 ft.) parabolic type
- 122 cm (4 ft.) parabolic type

Figure shows a typical 61 cm external antenna with N-type connector cabled to the Aeras WaveLink radio.

The antenna type should be selected according to local regulatory rules and system gain requirements.

For the available antenna models refer to Table . Complete antenna specifications are provided in **Error! Reference source not found.**.

Table 0-2 Antenna Models

Model	Description
091-455524	Parabolic antenna, 5.3 or 5.8 GHz, 61 cm (2 feet)

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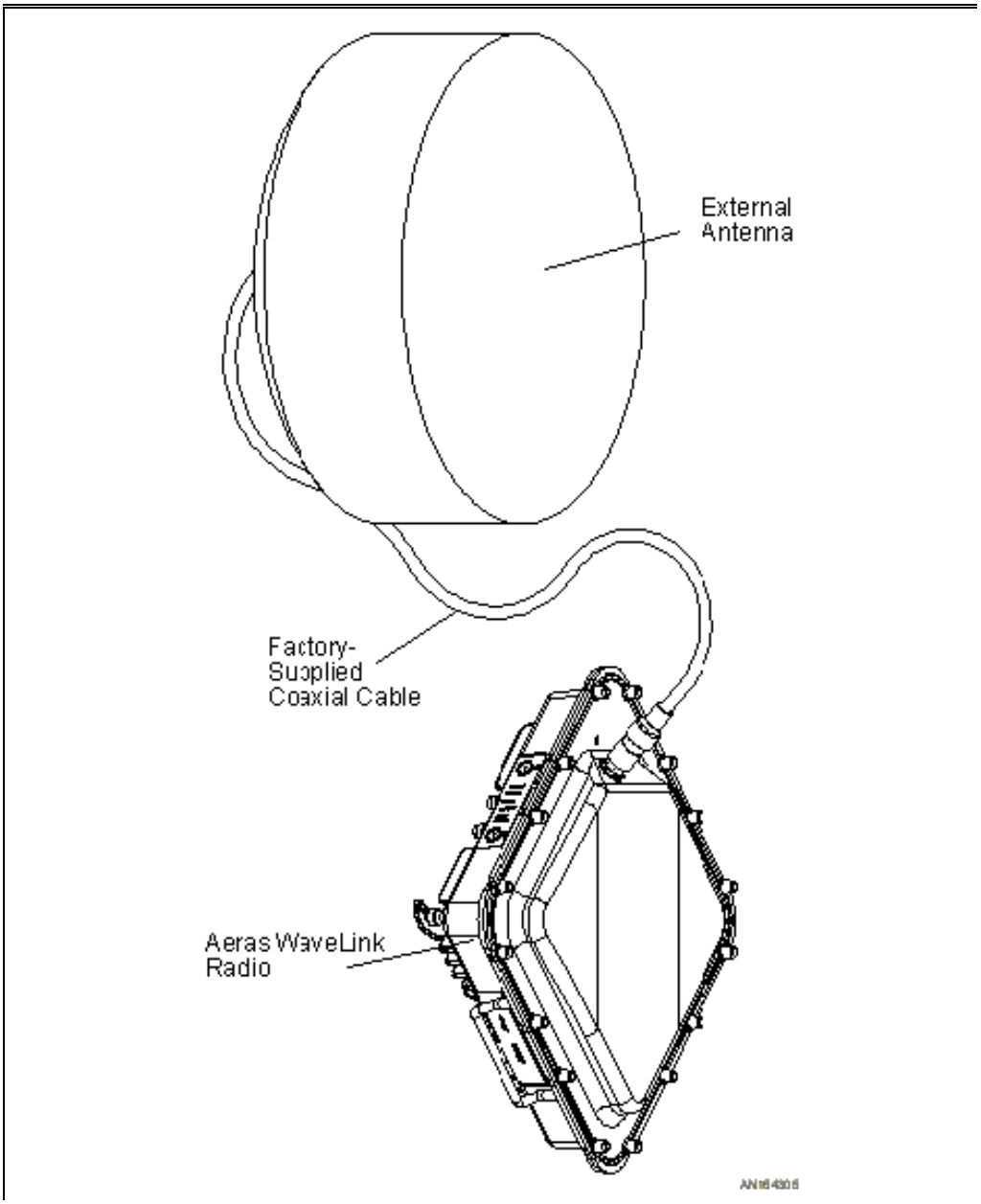
Deleted: Parabolic antenna, 5.3 or 5.8 GHz, 122 cm (4 feet)

Customer-Supplied

The Aeras WaveLink can be ordered with a coaxial cable to be connected to a customer-supplied external antenna. In this case, refer to the external antenna user documentation for specifications and model numbers.

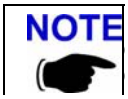
Figure 0-1 Typical Factory-Supplied External Antenna and Aeras WaveLink Radio



Configuration, Operation, and Monitoring

The Aeras WaveLink and radio link are configured, operated and monitored through one of five user interfaces. The five interfaces are:

- A built-in web server GUI hosted by the Aeras WaveLink, which can be accessed by any local or remote computer equipped with a web browser. This is the interface most operators will use to interact with the Aeras WaveLink. The web browser can access the Aeras WaveLink built-in web server through either the ETHERNET 1 or ETHERNET 2 port.



- SNMP traps, which communicate with MIB-II compliant NMSs (Network Management Systems) and EMSs (Element Management Systems). This interface is used by operators who want real-time notification of radio problems. The Aeras WaveLink sends SNMP traps to NMSs and EMSs over Ethernet links through either the ETHERNET 1 or ETHERNET 2 port.
- An ASCII command line interface, accessible through the RS-232 CRAFT port, or through the ETHERNET 1 or ETHERNET 2 port using telnet. This interface is primarily used by Aeras Networks technical support personnel when performing detailed troubleshooting.
- The RSSI port, providing a DC voltage level proportionate to the received RF signal level, and allowing installers to use a DC voltmeter to fine-tune antenna alignment. This interface is primarily used during installation, but the current RSSI measurement is also available via the Aeras WaveLink built-in web server or via SNMP polls.
- Five LEDs that provide visual alarm status. They verify proper operation of the Ethernet ports, DS-3/E3 ports, and radio link, and indicate proper power input and radio operation. These LEDs are usually used during installation to provide a quick product verification.

0-0.1 SNMP

The Aeras WaveLink radio supports SNMP network management. SNMP is a protocol that defines the method of communicating with and controlling network devices.

Devices that support the SNMP protocol can be queried for their status and other device information. Some devices allow changing device settings or configurations using SNMP commands. The device settings and other device data are available as variables. They are defined in the standard Management Information Base (MIB) file, provided by the device manufacturer. The SNMP manager uses a database to hold lists of variables that can be accessed for each device on the network. The device data can be displayed in tables, graphs, or saved in a file.

Aeras WaveLink Network Management Architecture

Aeras WaveLink software network management is comprised of two main items:

- SNMP based Network Management System (NMS) application in the network management workstation.
- SNMP agent in the Aeras WaveLink.

The workstation manages all Aeras WaveLinks assigned unique IP addresses. The workstation also provides a graphical display of the network objects showing the status, performance, and configuration parameters of each Aeras WaveLink radio.

The SNMP local agent is a standard MIB-II compliant software module that resides in each Aeras WaveLink. The agent collects information from different Aeras WaveLink components as defined in the Management Information Base (MIB) structure. The Aeras WaveLink incorporates both standard and private MIBs.

Different Aeras WaveLinks are distinguished by their customer-assigned IP addresses. The Web browser communicates with the Aeras WaveLink using TCP/IP (Transmission Control Protocol/Internet Protocol) and HTTP (Hyper Text Transfer Protocol).

The NMS data transfer between the manager and the agents is accomplished using either polling or trapping techniques.

Polling

The NMS polls each Aeras WaveLink SNMP agent at specific intervals. These are set according to user requirements during SNMP NMS configuration.

Traps

The Aeras WaveLink agent sends an SNMP trap to the manager whenever a predefined event occurs. Groups of traps can be defined according to their level of severity. The operator can choose to enable or disable any traps or group of traps according to their level of severity (and his or her own security level). Traps can be logged using any standard SNMP manager.

0-0.1 NMS Connectivity

The NMS workstation can access any Aeras WaveLink using its IP address. The NMS workstation can connect to each Aeras WaveLink using any of the following methods:

- 10/100 Base-T Ethernet - accessing Aeras WaveLinks via a LAN through hubs, switches or routers.
- Cascading Ethernet links transport NMS information between colocated Aeras WaveLinks. This is done by daisy-chaining the ETHERNET 1 and ETHERNET 2 ports between Aeras WaveLink radios using straight-pinned or crossover Ethernet cables.

Web-Based GUI Access Security

Access to the Web-based GUI (graphical user interface) is limited by username and password, which is available at different levels of security as follows:

- User - Read only privilege.
- Administrator - Read/partial write privilege. The administrator cannot cause a radio link to reset by changing critical parameters.
- Supervisor - Full read/write privilege.

0-0.1 GUI Functions

The Web-based GUI monitors and controls the main functions of the Aeras WaveLink. These functions are listed below and detailed in the following sections:

- Configuration management
- Status and fault management
- Test activation and monitoring
- Software downloading
- Performance monitoring

Refer to **Error! Reference source not found.** for Aeras WaveLink GUI operating instructions.

Configuration Management

The NMS software can be used to configure the parameters of the Aeras WaveLink radio, although this is normally done using a web browser GUI. This includes the setup of templates with predetermined default values, relating to both the parameters of common element types and the validation of parameter values. It also includes saving and loading configuration files for individual Aeras WaveLink radios. The NMS also controls the uploading and downloading of individual parameter values, and complete configuration setups.

Parameter configuration is terminal-oriented. Every configuration session deals with the Aeras WaveLink as accessed by its particular IP address. Some of the parameters, such as RF channel number, link ID, etc. affect the Aeras WaveLinks on both ends of the radio link. Special care should be taken to activate the new parameter values consistently on both ends of the radio link.

Status and Fault Management

Status and fault management involve a selective display of failures alerting the user to take actions according to a decision making tree.

Some status indications and alarms may report conditions that pertain to both ends of the radio link. These ends are commonly referred to as local and remote.

Test Activation and Monitoring

Following is a brief description of the tests that can be invoked and monitored by the Web based NMS.

Loopbacks

The loopbacks are incorporated into the radio to assist in detecting equipment/component/ cable failure during both installation and normal operations. Loopbacks are user initiated. The Aeras WaveLink DS-3 and E3 versions support RF and various interface loopbacks. (Note that loopbacks are not supported on the Aeras WaveLink Ethernet versions, as any loopback could result in an immediate data storm. Instead, Aeras Networks that customers use external equipment to Ping (use Packet Internet Groper) to test their Ethernet paths.)

BER Test

The following Bit Error Rate (BER) test is provided by the DS-3 and E3 Aeras WaveLink versions:

- Pseudo random signal generator - capable of inserting a standard test signal for BER measurements, and local- and remote-end loopback functions.
- BER measurements of radio link performance under normal operating conditions.

Software Downloading

The Web-based user interface enables off-line operation and SNMP updates of files. Alternatively, when on-line, configuration can be updated from the NMS to the Aeras WaveLink agent. Another way to upgrade multiple Aeras WaveLinks is to use FTP (File Transfer Protocol).

Note that the Aeras WaveLink can hold two software loads in memory, which facilitates upgrading and reverting to a previous software version.

Some factory default software settings are always retained at the Aeras WaveLink to safeguard against complete failure of communications caused by equipment restart.

Performance Monitoring

Each Aeras WaveLink gathers various statistics regarding radio link performance. The Web based user interface can retrieve and analyze these statistics upon demand. In addition, the Web based user interface manager processes its own general statistical data, based on the information that is received. Current BER, Receive Signal Strength Indicator (RSSI), and other performance monitors are available for the radio link.

The Web-based user interface is designed to easily interface with optional graph management software packages for sophisticated performance presentation.

0-1 Typical Applications

Aeras WaveLink gives the user great flexibility in setting up point-to-point radio links on a very cost effective basis, because it avoids unnecessary outlays in expensive leased lines or fiber optic land-based lines. Low cost of ownership makes return on investment (ROI) attractive compared to leased lines.

Aeras WaveLink advantages over copper/fiber alternatives include: short installation time, easy maintenance using NMS software, independence of competing PTTs, avoiding the need to secure normal right-of-way and/or physical installation permits, and redeployability to meet changing needs.

The simplicity of the Aeras WaveLink installation makes it easy for the user to implement Aeras WaveLink in a variety of applications. It also means that the user can conveniently move a previously installed Aeras WaveLink to a new location to meet the requirements of a changing system. Aeras WaveLink enables seamless future software upgradability, protecting customer investment, reducing logistics, spare parts and product stocking. The following sections briefly describe typical applications.

0-0.1 Internet (ISP)

The appetite for higher Internet access speeds require faster ISP access and backhaul and ISP connections to businesses. The Aeras WaveLink radio is perfectly suitable for both backbone and direct end-user connectivity.

0-0.1 Private Network Wireless Bridged LANs and WANs

Aeras WaveLink radios are also used to provide communications links for private networks. For companies requiring frequent communications into areas without extensive telecommunications infrastructure or in areas where the cost of local access is high, installing and maintaining a Aeras WaveLink radio network can be very cost effective. Typical users of private networks include: government agencies such as land management, municipal agencies, and universities; large utilities such as oil, gas, and electric concerns; and companies with widely deployed assets such as railroads and timber resource managers.

0-0.1 PCS/PCN and Cellular Networks

Cellular operators mainly use Aeras WaveLink radio links for Base Transceiver Station (BTS) interconnections, BTS to Base Station Controller (BSC), and BSC to BSC interconnections.

0-0.1

Wireless Local Loop Networks and Local Exchange Bypass

Wireless systems in emerging markets were originally deployed to provide premium services to a mobile subscriber base. However, middle and lower income countries have driven mobile network providers into a new business - the substitution of wireless service for fixed service, so-called fixed wireless networks, providing a cost-effective solution in situations where no wireless infrastructure exists. Wireless local loop (last mile) networks are implemented mostly by Local Exchange Carriers (LECs).

Alternative carriers, such as Competitive Access Providers (CAPs) and Competitive Local Exchange Carriers (CLECs) use radio links to establish standard telecommunications links between their customers' sites and their own backbone networks. This way CAPs and CLECs provide their customers with cost-effective local area telephone service and cheaper long distance services.

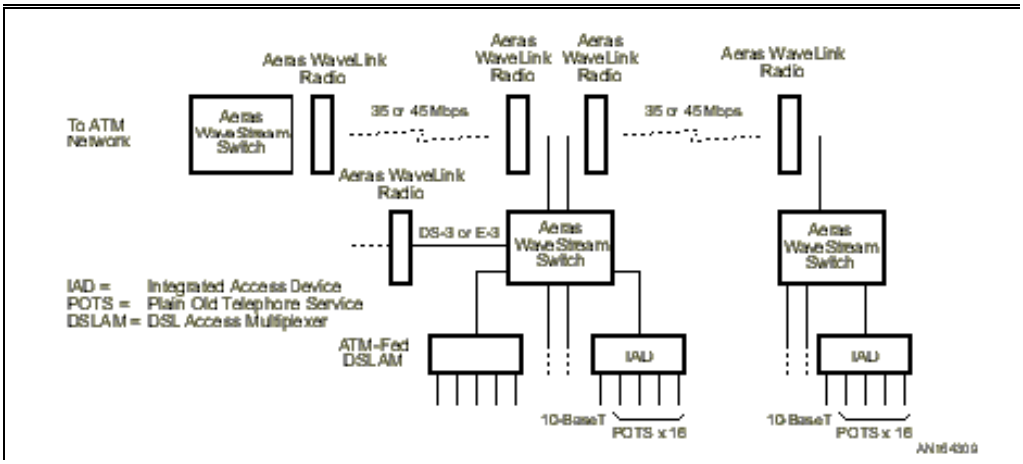
0-0.1 Business Bypass and Local Exchange Bypass

The Aeras WaveLink radio is a perfect solution for Business Bypass and Local Exchange Bypass applications.

0-0.1 Backhaul for Wireless MTU and MDU Access

The Aeras WaveLink radio can be used as an infrastructure element in wireless Multiple Tenant Unit (MTU) and Multiple Dwelling Unit (MDU) applications, when used with Aeras Networks WaveStream Switch products. Figure shows a typical wireless MTU/MDU access configuration.

0-0.1 Typical Wireless MTU/MDU Access Configuration



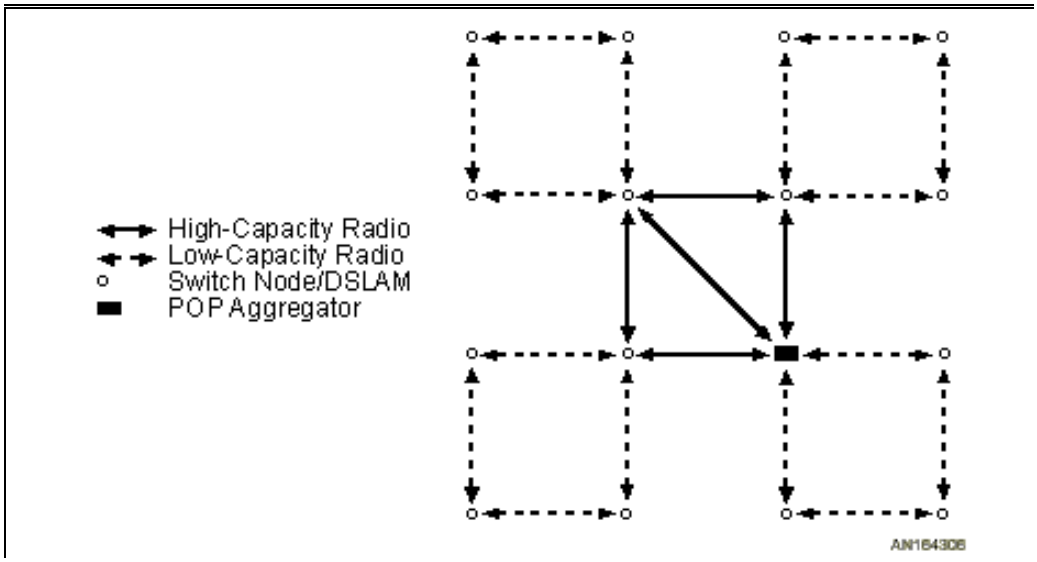
0-0.1

Wireless Mesh Backhaul Networks

2.5G and 3G cellular systems, which integrate voice and data, require higher-capacity backhaul, QoS (Quality of Service), BoD (Bandwidth on Demand), ability to dynamically load balance bursty traffic, and provide support for legacy 1G and 2G systems. When used with Aeras Networks WaveStream Switches, the Aeras WaveLink can provide the radio links for a self-healing wireless mesh backhaul network to support broadband ATM communications to support this application. These networks feature high reliability, lower maintenance costs, improved scalability, and enhanced interference mitigation.

DSL providers are typically limited by the quality of existing copper lines to a short distance from the CO (Central Office). To serve customers farther from the CO, DSLAMs (DSL Access Modules) must be used closer to the customer site. The backhaul from DSLAMs to the CO has to be robust to reduce or eliminate downtime, and must have sufficient bandwidth to support DSL traffic. When used with Aeras WaveStream Switches, the Aeras WaveLink can provide the radio links for a self-healing wireless DSLAM mesh backhaul network to support these requirements. See Figure for a typical wireless mesh backhaul network.

0-0.1 Typical Wireless DSLAM Mesh Backhaul Network

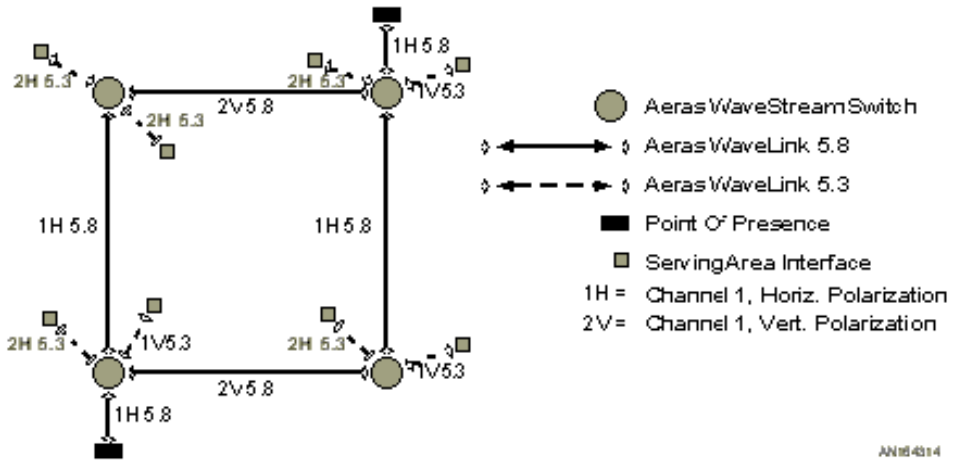


0-0.1

Wireless ATM Mesh Distribution with Aeras WaveStream Switch

When used with Aeras Networks WaveStream Switches, the Aeras WaveLink can provide the radio links for a self-healing wireless ATM mesh backhaul network to support broadband communications. These networks feature high reliability, lower maintenance costs, improved scalability, and enhanced interference mitigation. See Figure for a typical wireless ATM mesh backhaul network.

0-0.1 Typical Wireless ATM Mesh Backhaul Network



0-1 Specifications

Refer to **Error! Reference source not found.** for Aeras WaveLink specifications.

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either an integral 30 x 30 cm (12 x 12 in.) antenna, or with

Page 1: [1] Deleted Unknown

or 122 cm (4 ft.)

Page 1: [2] Deleted Unknown

M100746-101
M100747-101

Page 1: [2] Deleted Unknown

Low
High

Page 1: [2] Deleted Unknown

5.25-5.35 GHz

Page 1: [2] Deleted Unknown

DS-3

Page 1: [2] Deleted Unknown

Integral (Note 1)

Page 1: [3] Deleted Unknown

or 122 cm

Page 1: [3] Deleted Unknown

or 4

Page 1: [4] Deleted Unknown

M100748-101
M100749-101

Page 1: [4] Deleted Unknown

Low
High

Page 1: [4] Deleted Unknown

5.725-5.825 GHz

Page 1: [4] Deleted Unknown

DS-3

Page 1: [4] Deleted Unknown

Integral (Note 2)

Page 1: [5] Deleted Unknown

M100748-102
M100749-102

Page 1: [5] Deleted **Unknown**

Low
High

Page 1: [5] Deleted **Unknown**

5.725-5.825 GHz

Page 1: [5] Deleted **Unknown**

DS-3

Page 1: [5] Deleted **Unknown**

External, 61 or 122 cm
(2 or 4 ft.), or
External, customer-supplied (Note 2)

Page 1: [6] Deleted **Unknown**

M100746-201
M100747-201

Page 1: [6] Deleted **Unknown**

Low
High

Page 1: [6] Deleted **Unknown**

5.25-5.35 GHz

Page 1: [6] Deleted **Unknown**

Ethernet (45 Mbps)

Page 1: [6] Deleted **Unknown**

Integral (Note 1)

Page 1: [7] Deleted **Unknown**

or 122 cm

Page 1: [7] Deleted **Unknown**

or 4

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M100748-201
M100749-201

Page 1: [8] Deleted **Unknown**

Low
High

Page 1: [8] Deleted **Unknown**

5.725-5.825 GHz

Page 1: [8] Deleted **Unknown**

Ethernet (45 Mbps)

Page 1: [8] Deleted **Unknown**

Integral (Note 2)

Page 1: [9] Deleted **Unknown**

M100748-202
M100749-202

Page 1: [9] Deleted **Unknown**

Low
High

Page 1: [9] Deleted **Unknown**

5.725-5.825 GHz

Page 1: [9] Deleted **Unknown**

Ethernet (45 Mbps)

Page 1: [9] Deleted **Unknown**

External, 61 or 122 cm
(2 or 4 ft.), or
External, customer-supplied (Note 2)

Page 1: [10] Deleted **Unknown**

M100746-301
M100747-301

Page 1: [10] Deleted **Unknown**

Low
High

Page 1: [10] Deleted **Unknown**

5.25-5.35 GHz

Page 1: [10] Deleted **Unknown**

E3

Page 1: [10] Deleted **Unknown**

Integral

Page 1: [11] Deleted **Unknown**

M100746-302
M100747-302

Page 1: [11] Deleted **Unknown**

Low
High

Page 1: [11] Deleted **Unknown**

5.25-5.35 GHz

Page 1: [11] Deleted **Unknown**

E3

Page 1: [11] Deleted **Unknown**

External, 61 or 122 cm
(2 or 4 ft.), or
External, customer-supplied

Page 2: [12] Deleted **Unknown**

Low
High

Page 2: [13] Deleted **Unknown**

M100746-402
M100747-402

Page 2: [14] Deleted **Unknown**

Low
High

Page 2: [15] Deleted **Unknown**

External, 61 or 122 cm
(2 or 4 ft.), or
External, customer-supplied

Page 2: [16] Deleted **Unknown**

M100748-401
M100749-401

Page 2: [17] Deleted **Unknown**

Low
High

Page 2: [18] Deleted **Unknown**

M100748-402
M100749-402

Page 2: [19] Deleted **Unknown**

Low
High

Page 2: [20] Deleted **Unknown**

External, 61 or 122 cm
(2 or 4 ft.), or
External, customer-supplied

Page 2: [21] Deleted **Unknown**

(TBD)
(TBD)

Page 2: [22] Deleted **Unknown**

Low
High

Page 2: [23] Deleted **Unknown**

5.725-5.825 GHz, ETSI Version

Page 2: [24] Deleted **Unknown**

(TBD)
(TBD)

Page 2: [25] Deleted **Unknown**

Low
High

Page 2: [26] Deleted **Unknown**

5.25-5.35 GHz,
ETSI Version

Page 2: [27] Deleted **Unknown**

-1.0 dBm average transmit power.

Page 2: [28] Deleted **Unknown**

2. The integral antenna and 61 or 122 cm (2 or 4 ft.) external antenna models are the only versions FCC certified for +16.0 dBm average transmit power.
3. These models are the only versions ETSI certified for 25 milliwatts EIRP.

Two

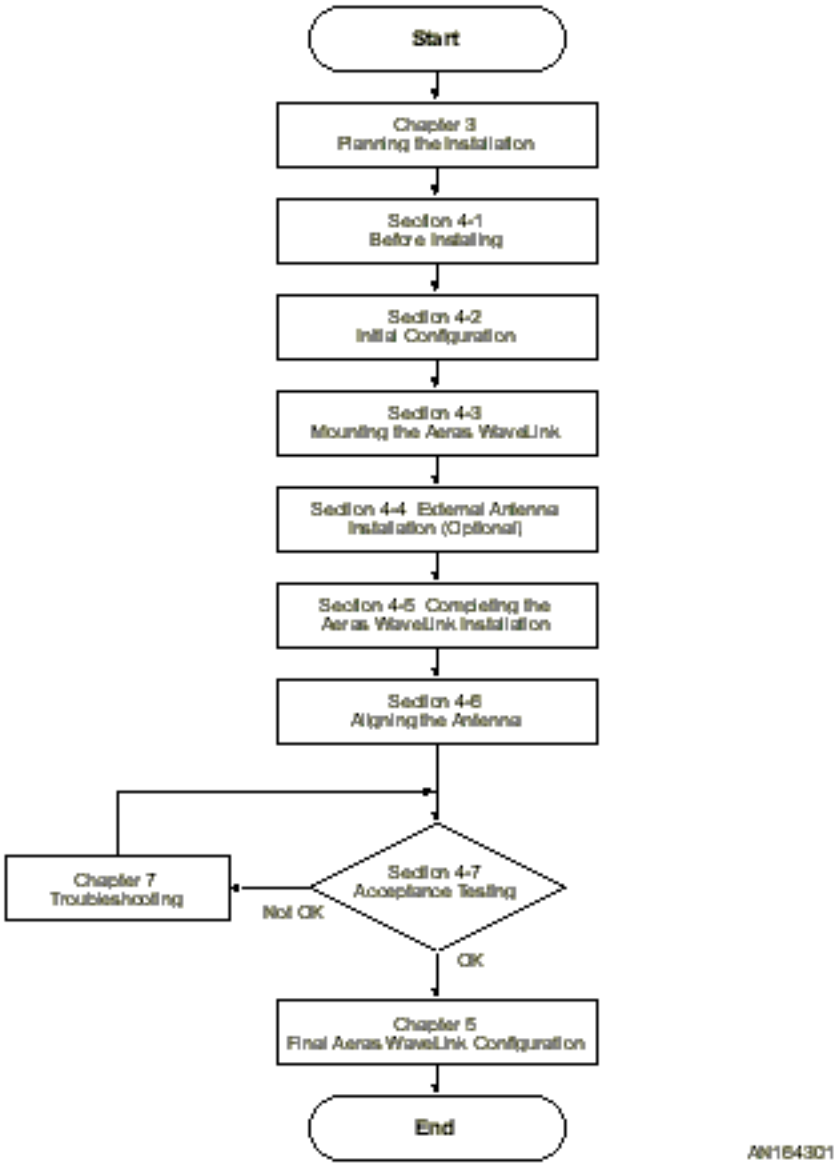
Installation Steering Guide

This chapter briefly outlines the complete installation and configuration procedure for the Aeras WaveLink, and a flowchart of this process is given. The topics discussed here are presented in detail in subsequent chapters of this manual.

0-1 Installation Flow Chart

The flow chart in Figure includes references to the installation and troubleshooting sections in this manual.

Figure 0-1 Installation Flowchart



Three

Installation Planning

This chapter provides a comprehensive planning guide for Aeras WaveLink installations, and includes a Radio Link Planning Worksheet that should be filled out for each radio link. Fill out a copy of the Radio Link Planning Worksheet before continuing with Chapter **Error! Reference source not found.**.

In addition, this chapter provides an introduction to Network Management System (NMS) software and configuration issues.

This chapter contains the following sections:

- Section , Planning a Aeras WaveLink Network

Section ,

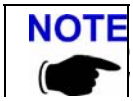
- Site Planning

Section ,

- Planning Element and Network Management Ethernet Links

Section ,

- Planning DS-3 or E3 Links
- Section , Power Planning
- Section , Transmit Power Planning
- Section ,



0-1 Planning a Aeras WaveLink Network

As described in Section , the Aeras WaveLink can be used to support a number of applications. However, the two most common configurations are point-to-point and mesh network. Point-to-point configurations (Figure) are easiest to plan and implement, as the radio links merely transmit industry-standard formatted data from one location to another. Mesh network configurations (Figure) use Aeras Networks WaveStream Switches to create networks that feature high reliability, low maintenance cost, improved scalability, and enhanced interference mitigation.

Both configurations use common point-to-point radio links, so the point-to-point radio link planning can also be applied to mesh network configurations. Generally, the common points to consider when planning a Aeras WaveLink network are:

- **Line of Sight:** Unlike some frequency bands, the Aeras WaveLink radios must be within line of sight of each other. That is, the far-end antenna must be visible from

the near-end antenna. If there are trees, buildings, mountains, or other obstructions between the two antennas, the Aeras WaveLinks on each end of the radio link will be unable to communicate with each other. Make sure the Aeras WaveLink radios used in each radio link are within line of sight of each other. Refer also to the Fresnel Zone Clearance section that follows.

- **Fresnel Zone Clearance:** There must be sufficient open space around the direct line of sight to minimize interference with the radio beam. At a minimum, 60% of the first Fresnel zone of the path should be clear.

  Even with clear line-of-sight, objects still may be near enough to the transmission path to cause problems. Obviously, objects that stand directly in the transmission path obstruct the beam, causing a drop in signal strength at the receiving end; in addition, objects and reflective surfaces that are in near proximity to the path can cause signal interference and attenuation of the received signal.

  Fresnel zones define the amount of clearance required for obstacles. These zones are series of concentric ellipsoid surfaces that surround the straight-line path between the two antennas. The first Fresnel zone is defined as the surface containing every point for which the distance from the transmitter to any reflection point on the surface and then on to the receiver is one-half wavelength longer than the direct signal path.

  The following equation shows that Fresnel zones are a function of the transmission frequency, path length, and location along the path:

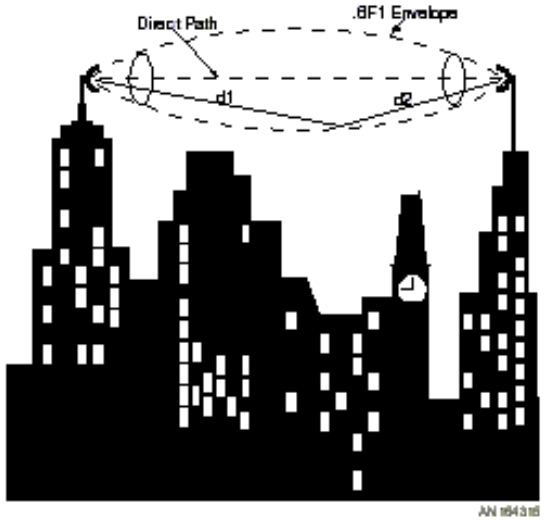
  $$F1 = 17.3\sqrt{\frac{d1d2}{fD}}$$ Fresnel Zones formula

  Where:

  Fl = First Fresnel zone radius in meters
  d1= Distance from transmitter to reflection point in kilometers
  d2 = Distance from reflection point to receiver in kilometers
  D = Length of direct signal path in kilometers
  f = Transmission frequency in GHz.

  An envelope at six-tenths of the first Fresnel zone (referred to simply as the Fresnel Zone Clearance) defines the minimum acceptable clearance of an obstacle (see Figure). The formula for the Fresnel Zone Clearance is shown after Figure .

Figure 0-1 Fresnel Zone Clearance



$$0.6F1 = 10.4\sqrt{\frac{d1d2}{fD}}$$ Fresnel Zone Clearance formula

Where:

Fl = First Fresnel zone radius in meters
d1= Distance from transmitter to reflection point in kilometers
D = Length of direct signal path in kilometers
d2 = D - d1
f = Transmission frequency in GHz.

Figure shows that the Fresnel zone radius is greatest at midpath. It is at this point that the required obstacle clearance is greatest. The equation given previously yields the 0.6F1 minimum beam clearance envelope values at midpath as shown in Table . Also use the equation to calculate the necessary minimum beam clearance envelope for other obstacles along the path, especially near both endpoints of the path.

Figure 0-1 Beam Clearance Envelope at Midpath

Path Distance	Midpath Minimum Beam Clearance Envelope (Note)
2 km	7 m
5 km	11 m
10 km	15 m
20 km	21
32 km	27 m
1 mile	20 ft
3 miles	34 ft
6 miles	48 ft
12 miles	69 ft
20 miles	88 ft
Note: The minimum beam clearance envelope is defined by the radius around the direct path shown in Figure , within which there must be no obstacles.	

Figure 0**Multipath Fading:** See Figure . Because a Aeras WaveLink terminal typically transmits its strongest signals in a cone-shaped pattern, some of the signal may be reflected from a nearby building, from water under the signal path, or from other RF reflectors. This reflected signal can then be received by the far-end Aeras WaveLink and superimposed on the main signal, usually degrading the signal strength. To avoid multipath fading, Aeras Networks recommends that you install the Aeras WaveLink antenna on the back, rather than the front, of buildings to avoid multipath fading from water or other ground-level surfaces, and that you plan radio links away from nearby buildings.

Figure 0-1 Preventing Multipath Fading from Ground-Level Surfaces

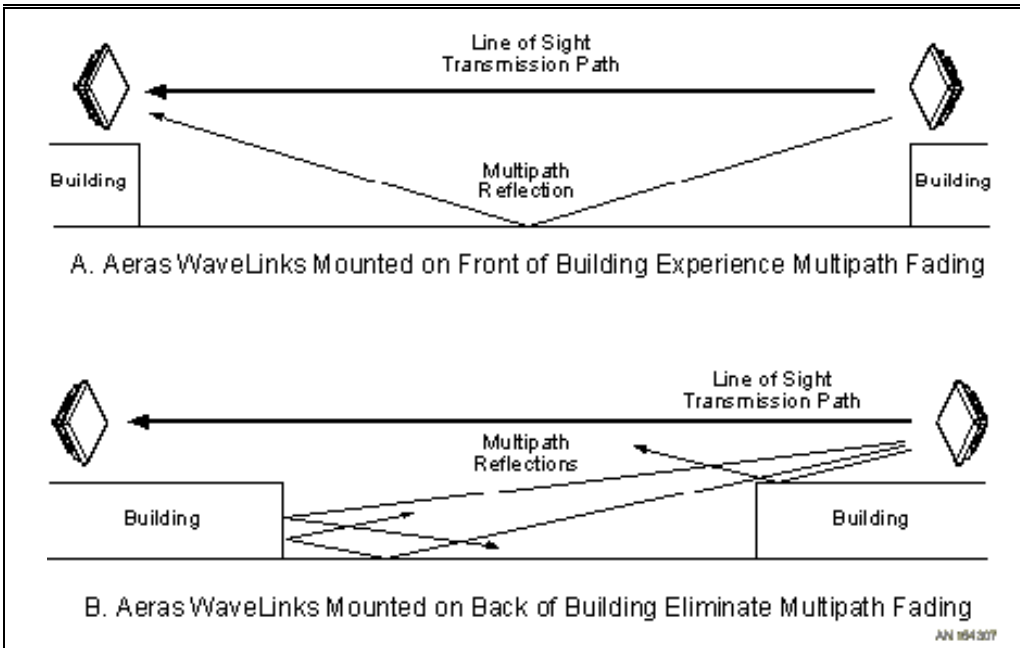


Figure 0**External Interference:** Because the Aeras WaveLink operates in an unlicensed band, Aeras Networks strongly recommends that you use a spectrum analyzer at both ends of planned radio links, with the receiving antenna as close to the proposed Aeras WaveLink antenna mounting spot as possible. Use a polarized antenna, and scan for both horizontally- and vertically-polarized interfering radiation. If you find external interference in either of the two (High or Low) bands, configure the Aeras WaveLink for the least-impacted band. Refer to Table for the High and Low bands for the Aeras WaveLink radio.

Site Planning

Each proposed Aeras WaveLink terminal site requires a site survey and plan for the following:

- **Power:** The Aeras WaveLink radio requires a +/-21 to +/-60 VDC power source. Make sure required power supply is available before installing the Aeras WaveLink.
- **Mounting Point:** The Aeras WaveLink is usually mounted on a vertical mast or pole mounted on a building or a tower. The Aeras WaveLink mounting bracket can accommodate a 4.5- to 11.5-cm (1.75- to 4.5-in.) diameter mast or pole.

  When the Aeras WaveLink is equipped with an external antenna, the antenna and the Aeras WaveLink radio should be mounted so the factory-supplied 2 m (79 in.) can be used to connect the antenna to the Aeras WaveLink.
- **Grounding and Lightning Protection:** The Aeras WaveLink radio requires adequate grounding and lightning protection. If the mounting point described above provides adequate lightning protection, the Aeras WaveLink radio will still need a good earth ground to a bare-metal earth ground. Refer to **Error! Reference source not found.** for detailed grounding and lightning protection recommendations.
- **Cable Routing:** The Aeras WaveLink DS-3, E3 and/or Ethernet data cables connect associated external equipment to the Aeras WaveLink radio. Before installation, procure cable ties and/or standoffs to route and to create service loops for these cables.
- **Physical Security:** The Aeras WaveLink radio is typically mounted high enough to prevent casual tampering. The Aeras WaveLink radio is further protected by anti-tampering chassis screws that prevent most casual attempts to open the chassis.

Planning Element and Network Management Ethernet Links

0-0.1 Links From the EMS or NMS to the Aeras WaveLink

The Aeras WaveLink communicates with SNMP-based Element Management Systems and Network Management Systems over Ethernet communication links. Because the Aeras WaveLink contains two independent switched Ethernet ports, one Aeras WaveLink can be connected directly to an Ethernet switch or router, and colocated Aeras WaveLinks can be cascaded. Figure shows some common arrangements for the EMS and/or NMS Ethernet links.

The cable run from the Ethernet switch or router to the Aeras WaveLink must be 100 m (328 ft.) or less, and can be straight-through or crossover, because the Aeras WaveLink Ethernet ports automatically detect the transmit and receive pairs and switch them if necessary. Aeras Networks sells 25 m (82 ft.), 50 m (14 ft.), and 100 m (328 ft.) Ethernet cables with the correct connectors for these links, as described in Section .

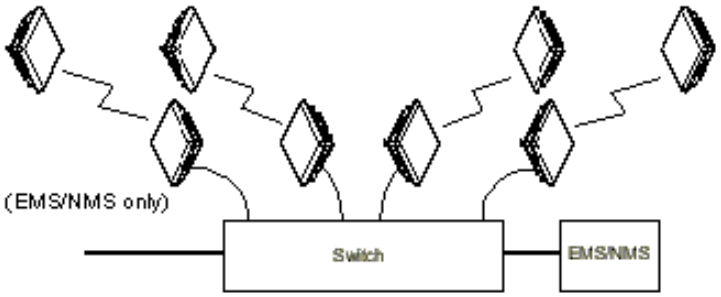
Alternatively, when Aeras WaveLinks are to be cascaded as shown in Figure (B), Aeras Networks sells a 6 m (20 ft.) Ethernet cable with the correct connectors for the Aeras WaveLink- to-Aeras WaveLink links, as described in Section .

Note that the EMS or NMS must be within eight or fewer Ethernet hops of the Aeras WaveLink for proper communications.

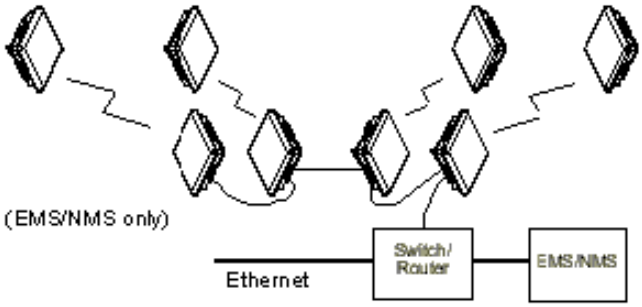
0-0.1 Links Between Aeras WaveLinks

As shown in Figure , the near end Aeras WaveLink automatically sets up an ethernet connection to the Aeras WaveLink at the far end of each radio system, or link. In ethernet models, the inband ethernet connection uses the payload data ethernet link, while in DS-3 and E3 models, the ethernet connection is out-of-band, and does not interfere with the DS-3 or E3 payload data.

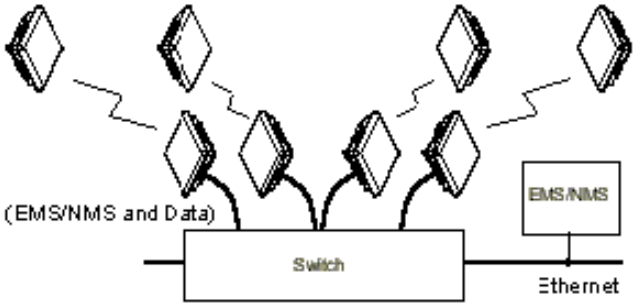
0-0.1 Typical EMS/NMS Ethernet Connections



A. E3 and/or DS-3 Aeras WaveLinks at Different Locations



B. Colocated E3 and/or DS-3 Aeras WaveLinks



C. Colocated Ethernet Aeras WaveLinks

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0-1

Planning DS-3 or E3 Links

The Aeras WaveLink DS-3 and E3 versions use paired 75 Ohm cables with male TNC connectors for the transmit and receive data from external DS-3 or E3 equipment. Aeras Networks sells 25 m (82 ft.), 50 m (14 ft.), and 100 m (328 ft.) DS-3 or E3 cables with the correct connectors for these links, as described in Section .

Alternatively, when a Aeras WaveStream Switch is connected to the Aeras WaveLink, Aeras Networks sells a 6 m (20 ft.) DS-3 cable with the correct connectors for this link, as described in Section .

0-1 Power Planning

Aeras Networks sells 25 m (82 ft.), 50 m (14 ft.), and 100 m (328 ft.) power cables with the correct connectors for Aeras WaveLink power, as described in Section .

0-1 Transmit Power Planning

The Aeras WaveLink normally uses a manually-set output power level. When Automatic Transmit Power Control (ATPC) is enabled, the far-end Aeras WaveLink terminal provides feedback to the near-end Aeras WaveLink to set the transmit power to the lowest level required for clear data transmission.

Transmit power can be attenuated by 40 dB for initial configuration and interference isolation. Also, a maximum transmit power level can be set (whether or not ATPC is enabled) to prevent interference with other RF receivers.

Deleted: <#>Maximum Aeras WaveLink Power Output¶
Since the Aeras WaveLink can be ordered in a number of configurations, with different gains for each of the associated antennas, use the Table to determine the maximum power output. Note that the factory-supplied external antenna cable attenuates the maximum power output by approximately 0.5 dB.¶
¶
Page Break
Section Break (Continuous)
¶
Section Break (Continuous)
<#>Maximum Power Output by Model Configuration (continued)¶
¶
Model
... [1]

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Maximum Aeras WaveLink Power Output

Since the Aeras WaveLink can be ordered in a number of configurations, with different gains for each of the associated antennas, use the Table to determine the maximum power output. Note that the factory-supplied external antenna cable attenuates the maximum power output by approximately 0.5 dB.

Page Break

Section Break (Continuous)

Maximum Power Output by Model Configuration (continued)

Model	Frequency Band	Link Carries	Antenna	Max Tx Power
M100746-101 M100747-101 M100746-201 M100747-201	5.25-5.35 GHz -- Per FCC Regulations	DS-3 or Ethernet (45 Mbps)	Integral	-1 dBm +21 dBi = +20 dBm Average EIRP
M100748-101 M100749-101 M100748-201 M100749-201	5.725-5.825 GHz -- Per FCC Regulations	DS-3 or Ethernet (45 Mbps)	Integral	+16 dBm +21 dBi = 37 dBm EIRP
M100748-102 M100749-102 M100748-202 M100749-202			External, 61 cm (2 ft.)	+16 dBm +28 dBi - 0.5 dB = 43.5 dBm EIRP
M100748-102 M100749-102 M100748-202 M100749-202			External, 122 cm (4 ft.)	+16 dBm +34.6 dBi - 0.5 dB = 50.1 dBm EIRP
M100746-101 M100747-101 M100746-201 M100747-201	5.25-5.35 GHz -- non-FCC	DS-3 or Ethernet (45 Mbps)	Integral	+10 dBm +21 dBi = 31 dBm EIRP
M100746-102 M100747-102 M100746-202 M100747-202			External, 61 cm (2 ft.)	+10 dBm +28 dBi - 0.5 dB = 37.5 dBm EIRP
M100746-102 M100747-102 M100746-202 M100747-202			External, 122 cm (4 ft.)	+10 dBm +34.6 dBi - 0.5 dB = 44.1 dBm EIRP
M100746-102 M100747-102 M100746-202 M100747-202			External, customer-supplied	+10 dBm +___ dBi - 0.5 dB = _____ dBm EIRP (Note)
M100748-101 M100749-101 M100748-201 M100749-201	5.725-5.825 GHz -- non-FCC	DS-3 or Ethernet (45 Mbps)	Integral	+16 dBm +21 dBi = 37 dBm EIRP
M100748-102 M100749-102 M100748-202 M100749-202			External, 61 cm (2 ft.)	+16 dBm +28 dBi - 0.5 dB = 43.5 dBm EIRP
M100748-102 M100749-102 M100748-202			External, 122 cm (4 ft.)	+16 dBm +34.6 dBi - 0.5 dB = 50.1 dBm EIRP

M100749-202				
M100748-102 M100749-102 M100748-202 M100749-202			External, customer-supplied	+16 dBm +___ dBi - 0.5 dB = _____ dBm EIRP (Note)
(TBD) (TBD) (TBD) (TBD)	5.725-5.825 GHz -- Per ETSI Regulations	E3 or Ethernet (35 Mbps)	Integral	-2 dBm +21 dBi = +24 dBm Average EIRP, +28 dBm Peak EIRP
M100746-301 M100747-301M 100746-201 M100747-201	5.25-5.35 GHz -- non ETSI	E3 or Ethernet (35 Mbps)	Integral	+10 dBm +21 dBi = 31 dBm EIRP
M100746-302 M100747-302 M100746-202 M100747-202			External, 61 cm (2 ft.)	+10 dBm +28 dBi - 0.5 dB = 37.5 dBm EIRP
M100746-302 M100747-302 M100746-202 M100747-202			External, 122 cm (4 ft.)	+10 dBm +34.6 dBi - 0.5 dB = 44.1 dBm EIRP
M100746-302 M100747-302 M100746-202 M100747-202			External, customer-supplied	+10 dBm +___ dBi - 0.5 dB = _____ dBm EIRP (Note)
M100748-301 M100749-301 M100746-401 M100747-401	5.725-5.825 GHz -- non ETSI	E3 or Ethernet (35 Mbps)	Integral	+16 dBm +21 dBi = 37 dBm EIRP
M100748-302 M100749-302 M100746-402 M100747-402			External, 61 cm (2 ft.)	+16 dBm +28 dBi - 0.5 dB = 43.5 dBm EIRP
M100748-302 M100749-302 M100746-402 M100747-402			External, 122 cm (4 ft.)	+16 dBm +34.6 dBi - 0.5 dB = 50.1 dBm EIRP
M100748-302 M100749-302 M100746-402 M100747-402			External, customer-supplied	+16 dBm +___ dBi - 0.5 dB = _____ dBm EIRP (Note)
Note: External, customer-supplied antenna gain to be provided by manufacturer.				

Calculating the Required Transmit Power

The Aeras WaveLink will normally use the maximum transmit power listed in Table , but may need to be attenuated when there are other receivers beyond the remote Aeras WaveLink terminal (for instance, in a mesh network). In this case, the professional installer must use the free-space calculation to determine the actual Maximum Transmit Power to prevent interference.

Radio Link Planning

As described in Section , each radio link requires one Aeras WaveLink at each end of the link. Before you start installing your Aeras WaveLinks, fill in the following information for both ends of the radio link:

Radio Link Planning Worksheet (continued)

	Aeras WaveLink 1 - High Band	Aeras WaveLink 2 - Low Band
Information Common to Both Aeras WaveLink Radios		
Radio Link Name:		
Radio Link Information:		
Radio Link Polarization (pick one, must be the same for both):HORIZONTALVERTICAL		
Radio Link Payload (as ordered, must be the same for both):DS-3E3Ethernet		
Information Unique to Each Aeras WaveLink Radio		
Model Number (see Aeras WaveLink Label & Table)	M1007 _ _ - _ 0 _ (high band)	M1007 _ _ - _ 0 _ (low band)
Antenna Type (pick one)	Integral 61cm (2ft.) 122cm (4ft.) other:_____	Integral 61cm (2ft.) 122cm (4ft.) other:_____
Radio Link Channel and Band Center Frequency (pick one pair, each end of the radio link must be different)	Channel 1 High Band, 5.3GHz: Tx--5.322GHz/ Rx--5.262GHz (default)	Channel 1 Low Band, 5.3GHz: Tx--5.262GHz/ Rx--5.322GHz
	Channel 2 High Band, 5.3GHz: Tx--5.338GHz/ Rx--5.278GHz	Channel 2 Low Band, 5.3GHz: Tx--5.278GHz/ Rx--5.338GHz
	Channel 1 High Band, 5.8GHz: Tx--5.797GHz/ Rx--5.737GHz (default)	Channel 1 Low Band, 5.8GHz: Tx--5.737GHz/ Rx--5.797GHz
	Channel 2 High Band, 5.8GHz: Tx--5.813GHz/ Rx--5.753GHz	Channel 2 Low Band, 5.8GHz: Tx--5.753GHz/ Rx--5.813GHz
Transmit Attenuation (default = Disable)	EnableDisable	EnabledDisable
Maximum Transmit Power (refer to Section)	__ dBm	__ dBm
Automatic Tx Power Control (refer to Section)	EnableDisable	EnabledDisable
IP Address (must be different, obtain from IP network planner)	_ _ _. _ _ _. _ _ _. _ _ _	_ _ _. _ _ _. _ _ _. _ _ _
Subnet Mask (obtain from IP network planner)	_ _ _. _ _ _. _ _ _. _ _ _	_ _ _. _ _ _. _ _ _. _ _ _
Default Gateway (obtain from IP network planner)	_ _ _. _ _ _. _ _ _. _ _ _	_ _ _. _ _ _. _ _ _. _ _ _
RSSI Alarm Level (default = -70dBm)	- __ dBm	- __ dBm
Alarm on Loss of DS-3, E3 or Ethernet Input Signal	EnabledDisable	EnabledDisable
Login Name (up to 19 printable ASCII characters) Note that the login name is case-sensitive.		
Login Password (8 - 19		

printable ASCII characters) Note that the password is case-sensitive.		
Allow Login From IP Addresses (don't forget CraftPC)	Any (default) -OR- _ _ _. _ _ _. _ _ _. _ _ _ _ _ _. _ _ _. _ _ _. _ _ _	Any (default) -OR- _ _ _. _ _ _. _ _ _. _ _ _ _ _ _. _ _ _. _ _ _. _ _ _
SNMP Trap Community (default = public, up to 19 ASCII characters starting with an alpha character, including numbers and-_.)		
Send SNMP Traps to	_ _ _. _ _ _. _ _ _. _ _ _ _ _ _. _ _ _. _ _ _. _ _ _ _ _ _. _ _ _. _ _ _. _ _ _	_ _ _. _ _ _. _ _ _. _ _ _ _ _ _. _ _ _. _ _ _. _ _ _ _ _ _. _ _ _. _ _ _. _ _ _
Read/Write Community (default = public, up to 19 ASCII characters starting with an alpha character, including numbers and-_.)		
Allow Read/Write Access From	Any (default) -OR- _ _ _. _ _ _. _ _ _. _ _ _ _ _ _. _ _ _. _ _ _. _ _ _ _ _ _. _ _ _. _ _ _. _ _ _	Any (default) -OR- _ _ _. _ _ _. _ _ _. _ _ _ _ _ _. _ _ _. _ _ _. _ _ _ _ _ _. _ _ _. _ _ _. _ _ _
Read-Only Community (default = public, up to 19 ASCII characters starting with an alpha character, including numbers and - _.)		
Allow Read-Only Access From	Any (default) -OR- _ _ _. _ _ _. _ _ _. _ _ _	Any (default) -OR- _ _ _. _ _ _. _ _ _. _ _ _
System Name (optional, up to 255 ASCII characters)		
System Contact Information (optional, up to 255 ASCII characters)		
System Location (optional, up to 255 ASCII characters)		