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The MP1100E operates in the 2.4 GHz band, complies with the IEEE 802.1D MAC bridging standard and supports SNMP monitoring if IP routing is enabled.

Federal Communications Commission (FCC) Radio Frequency Interference Statement

This device complies with Part 15 of FCC Rules. Operation of this device is subject to the following two conditions:

- It may not cause harmful interference.
- It must accept any interference that may cause undesired operation.

Information to the user

FCC RF exposure regulations require that a minimum of 30 inches of separation exist between an operating antenna and any person. When installing the antenna, ensure that this clearance is maintained while the product is in operation.

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Steps for minimizing or eliminating radio and television interference:

- Change the channel
- Reorient the radio or TV receiving antenna.
- Relocate the computer and bridge unit with respect to the receiver.
- Plug the computer and bridge into a different outlet so the computer and bridge are on different branch circuits.

If necessary, you should consult the dealer or an experienced radio/TV technician for additional suggestions. You may find the booklet called "How to

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Identify and Resolve Radio-TV Interference Problems” prepared by the Federal Communications Commission helpful. The booklet is available from the U.S. Government Printing Office, Washington, D.C., 20402, as stock number 004-000-00345-4.

This product was FCC certified under test conditions that included the use of shielded I/O cables and connectors between system components. To be in compliance with FCC regulations, the user must use shielded cables and connectors and install them properly.

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The manufacturer shall not be responsible for any operation of this product which is in violation of local law, creates interference harmful to other local devices, or results in a malfunction of this product caused by outside interference.

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- If warranty or return service is needed, you will receive a Return Material Authorization (RMA) number. At no time should Solecetek products or software be sent back without a valid RMA number. Solecetek accepts no responsibility for unauthorized returns.

You agree to pay for shipping to Solecetek. Solecetek will pay for shipping the repaired or replacement products to you. All Solecetek-paid shipments to customers will be by ground transportation. Any other freight arrangements will be at customer expense.

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6370 Nancy Ridge Drive, suite 109
San Diego, CA. 92121-3212
ATTN: RMA # _____

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- Enclose a copy of the original purchaser's proof of purchase, if needed to support warranty claim. (See details in LIMITATIONS section below.)

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- If warranty or return service is needed, you will receive a Return Material Authorization (RMA) number. At no time should Solecetek products or software be sent back without a valid RMA number. Solecetek accepts no responsibility for unauthorized returns.

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Solecetek Corporation
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San Diego, CA. 92121-3212
ATTN: RMA # _____

- Pack products securely, to prevent damage in transit. Be sure the RMA number is clearly visible on the outside of the return shipping carton.
- Returned Solecetek products must include all other components from the original package, including the hardware, any cables, connectors, software diskettes, and user manual(s).

Enclose a copy of the original purchaser's proof of purchase, if needed to After inspecting the failed unit, Solecetek will repair or replace defective parts or components. Solecetek will pay for delivery to the continental United States address of customer's freight forwarder via ground transportation. Other freight arrangements will be made at the customer's expense. If upon inspection by Solecetek, a unit returned under warranty is deemed to be damaged or out of warranty for any reason, (see LIMITATIONS section below), Solecetek will contact the customer with a price for the repair or replacement unit. Upon receipt of payment (wire transfer, certified check, credit card, etc.) for the replacement unit plus outbound shipping fees, Solecetek will send a new or refurbished unit to the customer. Customers who do not accept the repair offer may receive their failed equipment back by prepaying the return freight cost.

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Solecetek warrants that your Solecetek products will be free from defects in material and workmanship and will perform in substantial compliance with the operator's guide(s) accompanying the products for a period of one year.

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Table of Contents

Volume I

Federal Communications Commission (FCC) Radio Frequency Interference Statement	ii
Information to the user	ii
Radio Transmission Notice	iii
End User License Agreement	iii
U.S. Government restricted rights legend	iv
One Year Limited Warranty in the United States	v
Limitations	vi
Disclaimer of Warrantees	vi
Waiver of Consequential Damages	vi
One Year Limited Warranty outside of the United States	vii
Limitations	viii
Disclaimer of Warrantees	viii
Waiver of Consequential Damages	viii
 Table of Contents	 ix
 PREFACE	 1
 Protect Your Warranty	 1
 CHAPTER 1 INTRODUCTION	 3
 Sample Configuration	 5
 Features of the MP1100E	 6
Support for standard protocols	6
MAC Layer Bridge Support	6
Routing Protocols	6
IP and IPX	6
SNMP	7
Spanning Tree Protocol	6
Spread Spectrum	7
Channel Selection	7
Remote management support	7
Other features	8
 Operating Modes	 8
Bench Test (CSMA) mode	8
Base/sub mode	8
Base/sub advantages	9
 System Components	 9
Chassis (Console)	1
Cabling system	1
Outdoor unit	1
Equipment you provide	2
 Outdoor Antenna Options	 2

Preface

This Guide is designed to help you locate the information you need with a minimum of reading.

- To learn about the components and functions of your system, read Chapter One.
- For instructions on how to install and configure your system, read Chapter Two.
- For help in troubleshooting problems, see Chapter Three.

Consult Volume II for the following additional information:

- Detailed reference information concerning fields found on screens accessed from the main menu.
- Help in understanding basic RF concepts, such as signal gain, Fresnel zones, and RF line of sight.
- Information about setting up a standalone workstation.
- A list of Ethernet Protocols to use in your Bridge Setup.

Since the factory settings have been optimized for most applications, you should not change them without cause.

Protect Your Warranty

To protect your warranty:

- Do not remove or modify the external label or serial number.
- Do not open the bridge chassis. Repairs within the chassis must be done by an authorized Solectek service technician.
- Use only the original Solectek AC power supply components provided in the product package.
- Do not substitute or modify the cables or antennas. Use only the Solectek cables and antennas that are approved by the FCC.
- Observe Solectek's environmental specifications (temperature range, humidity, proximity to other devices, etc.).

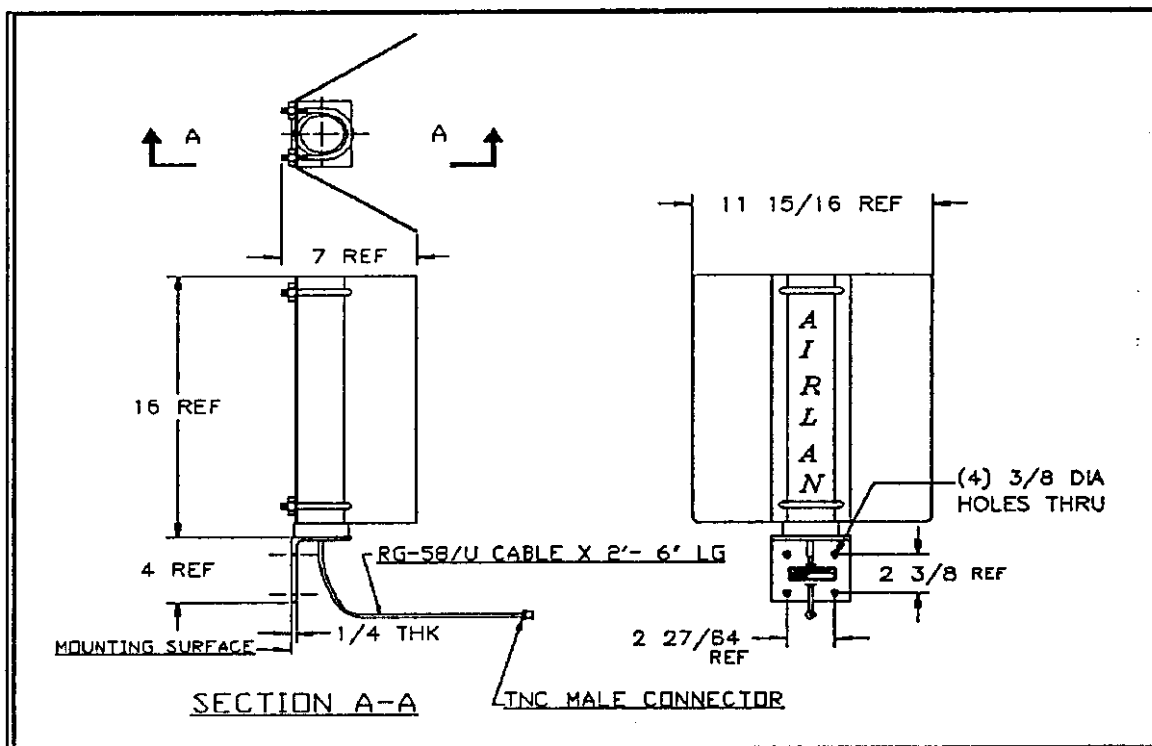
KA324WAN4
30 Degree Omni

WLAN BASE STATION 30° SECTORAL ANTENNA PART NUMBER 9529-830

SEAVEY ENGINEERING ASSOCIATES, INC.

ANTENNA DESIGN AND DEVELOPMENT

This Base Station Antenna is used with a 2.4 GHz Wireless Local Area Network System. The antenna is sealed within a white polycarbonate radome. Mounting is to a vertical pipe using customer-supplied U-Bolts.



Specifications for 9529-830 WLAN Base Station Sectoral Antenna

Frequency:	2,400 - 2,485 MHz
Gain:	15.0 dBi, Nominal
Polarization:	Vertical
Elevation Peak:	Horizon +/- 10 Degrees
Elevation Beamwidth:	22 Degrees, Nominal
VSWR:	2.5:1, Maximum
Impedance:	50 OHMS
Azimuth Beamwidth:	30°, Nominal
Construction:	Polycarbonate Radome, Sealed
RF Port:	With 10K OHM Shunt Resistor
Mounting:	Mast Mounting with U-Bolts
Size:	2-3/8 inch dia., 16 inches long
Environmental:	-50 Deg. to +70 Deg. C, Survive 125 MPH

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PAGE #	DESCRIPTION	FCC ID #
50	Certification of Transceiver Model MP1100	KA324WAN4

APPENDIX A (Raw Data Sheets)

This chapter describes components and features of the MP1100E. It contains the following sections:

- **Sample Configuration** - Describes the equipment and set up used to operate the MP1100E
- **Features of the MP1100E** - Provides an overview of what the MP1100E can do
- **Mode description** - Describes the difference between Bench Test (CSMA) mode and Base Station / Substation mode
- **System Components** - Describes the equipment that comes with the MP1100E
- **Outdoor Antenna Options** - Describes the antenna options available for point-to-point and multipoint connections
- **Prerequisites** - Describes the requirement for a clear path between your antennas
- **Hardware specifications** - Charts the physical specifications for the chassis and ODU

Introduction

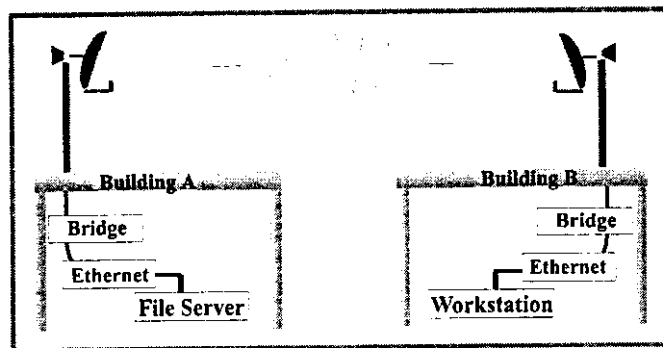
The 11 Mbps MP1100E is used to make wireless Local Area Network (LAN) connections between two or more locations. This radio link allows workstations in any of the connected buildings to communicate with workstations in the other buildings.

In many situations MP1100Es cost less to operate and can be easier to install and maintain than wired connections. Without the need for wiring, MP1100Es provide a cost-effective solution for crossing barriers, such as streets and highways. And with reflector (dish) antennas, you can link locations up to 25 miles apart.

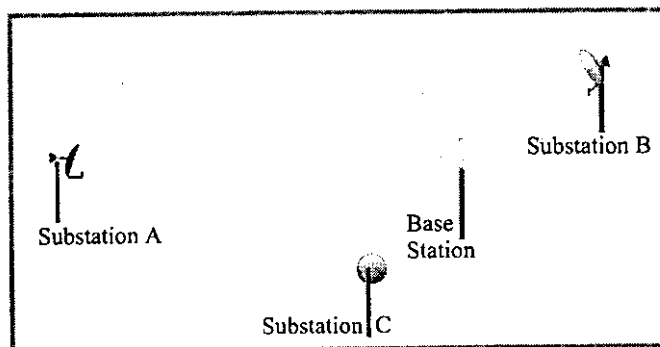
The MP1100E works with standard 10 Mbps IEEE 802.3 networks. It operates on any one of three selectable channels in the license-free 2.4 GHz Industrial, Scientific, and Medical (ISM) band, and it uses Direct Sequence Spread Spectrum (DSSS) technology to enhance data security and avoid interference.

Sample Configuration

The figure below shows a sample configuration for a link between two buildings.



In this configuration the LAN in Building A is connected to the LAN in Building B only by the wireless link, and the only packets sent between the two LAN systems are packets specifically destined from one LAN to the other. The MP1100E supports both point-to-point and multi-point wireless connections.



In this example, the base station communicates directly with each substation. The substations communicate with each other through the base station.

Features of the MP1100E

The following features allow the MP1100E to provide a seamless and reliable connection between LAN systems in separate buildings.

Support for standard protocols

The MP1100E handles both MAC layer bridging and limited (RIP and Static Route) network layer routing for IP and IPX protocols. These operations may be enabled individually or concurrently.

MAC Layer Bridge Support

The MP1100E relays messages between Ethernet systems so that the devices on either side of the RF link appear to be on the same logical Media Access Control (MAC) network.

A MAC layer bridge system functions like a single large LAN. The connections are transparent to the workstations they connect. The MAC Layer Bridge protocol (MLB) conforms to the IEEE (Institute of Electrical & Electronic Engineers) 802.1D standard and is compatible with any other standard Ethernet 802.1D MLB in the network.¹

Spanning Tree Protocol

802.1d Spanning Tree Protocol STP is used to avoid looping, broadcast storms, and duplication of frames.

Routing Protocols

IP and IPX

The IP and IPX protocols are supported for both local and remote LANs. Solecetek IPX is compatible with Novell's IPX protocol. Solecetek's IP implementation supports for RIP, Static Routing, ARP, UDP and ICMP. SNMP comply with standard bridge group specifications for GETS only specifications. The MP1100E supports RIP/SAP broadcast suppression. Broadcast suppression will transmit RIP/SAPs over the RF link only when a change occurs.

¹ The MAC layer is layer 2 of the divisions of the Open Systems Interconnection (OSI) reference model for LANs approved and promoted by the International Standards Organization (ISO).

As with other IP and IPX bridges, the bridge cannot have duplicate or conflicting network addresses.

SNMP

SNMP MIB I & MIB II Bridge Group monitoring (gets only) are supported when IP routing is enabled.

Spread Spectrum

The MP1100E uses 2.4 GHz Direct Sequence Spread Spectrum (DSSS) RF technology. DSSS spreads the transmission across the assigned radio band, thus reducing interference and increasing system security. Because the MP1100E operates in the ISM band, an FCC license is not required so long as the system is used in its FCC approved configuration.

Channel Selection

If another wireless bridge or router in your vicinity is operating in the same frequency range, you can switch your units to a different channel. You have three broadcast channels to choose from:

- channel 1 — 2.430 GHz (the default setting)
- channel 2 — 2.438 GHz
- channel 3 — 2.445 GHz

Remote management support

Each channel is approximately 44 MHz wide. Please note the significant overlap between channels 1 and 2 and 2 and 3.

All bridges can be controlled remotely from either an MP1100E console that is equipped with a monitor and keyboard or a dedicated PC workstation. See Volume II Appendix B for information on how to set up a standalone PC workstation.

The MP1100E supports two types of remote management:

- Via SNMP (MIB I or II gets only) when IP routing is enabled (monitor only)
- Via a remote management utility that is built into the software (full management)

Other features

- Password protection
- Built-in antenna alignment utility
- Heavy duty, rack-mountable chassis

Operating Modes

The MP1100E offers a choice of base station and substation modes or Bench Test (CSMA) mode. The characteristics of each mode are summarized as follows:

Bench Test (CSMA) mode

CSMA/CA (Carrier Sense Multiple Access with Collision Avoidance) is a modified version of the industry-standard Ethernet protocol CSMA/CD (CD for Collision Detection). The collisions CSMA/CA is designed to avoid can occur when two or more stations try to transmit at the same time. CSMA/CA avoids collisions by making stations that want to transmit listen first for other stations and try again later if the airway is busy. CSMA/CA is set as the default mode for bench testing because the bridges can communicate with no software changes.

But CSMA/CA can only be used in low-traffic environments where the airway is normally clear. It is not recommended for normal operation. The following problems can reduce system throughput as demand increases and stations need to send data at the same time:

- Collision Avoidance lock - Where a station waiting for an open airway gets stuck waiting for the channel to become free.
- Hidden substation effect - Where stations beyond each other's listening range transmit simultaneously, causing collisions.
- Capture effect - Where sites with strong signals overpower sites with weak signals.

Base/sub mode

Solectek has developed a base station/substation protocol mode to avoid these CSMA/CA limitations. This protocol assures fair network access, recovers timed-out connections, and provides constant throughput when traffic is high. It can support up to eight units operating on the same RF channel.

Base station / substation mode uses a star configuration with one centrally located unit configured as a base station. All other units are configured as substations that communicate through the base station. Each substation normally processes communications for one LAN, but the base station also manages internetwork communications. Although some substations may be beyond the RF reception range of some of the other substations, all users can communicate with each other through the base station.

The base station polls each substation in sequence and allocates time for that station to transmit. Recovery is initiated for any substation that does not respond within the limited time.

Since the base station manages transmissions so that no two sites can transmit at once, the substations do not need to listen to each other. If a

substation were to receive messages from another substation as well as the base station, the messages would be duplicates. The base station/substation protocol filters out duplicate messages.

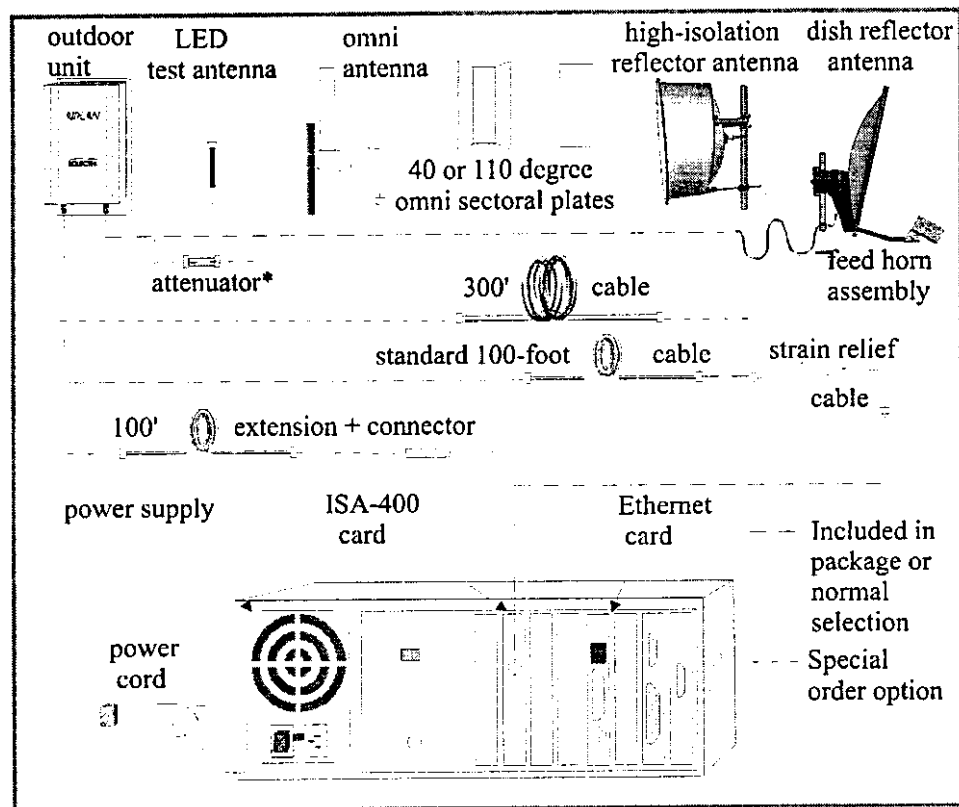
Base/sub advantages

Base station / Substation is the preferred mode for normal operation. It offers the following benefits:

- Higher throughput under heavy load than systems using CSMA/CA or other similar protocols
- Easier configuration of multipoint internetworks having large numbers of stations at varying distances.
- Substation-to-substation communication (via the base station)

System Components

The list of components you will need for installation depends on the distance you are spanning and the need to obtain an unobstructed line of sight between your antennas.



At least two bridge units are needed to create a wireless bridge system — one at each location you are linking. Each unit comes with the following components:

- An MP1100E chassis with a power cord
- A cable for linking the outdoor unit to a strain relief cable attached to the bridge
- An LED test antenna - has an effective range of 50 feet and is appropriate for test purposes only
- An Operator's Guide - describes installation and problem solving procedures and provides a reference of all console functions
- An outdoor unit (ODU) - Patented bi-directional amplifier

You will need a keyboard and monitor for setup, but they are not required for normal operation, and they are not furnished as part of the MP1100E package. You will also need an outdoor antenna. Solecetek antennas are available in four configurations, described later in this chapter.

To comply with requirements for unlicensed operation, the MP1100E must be used in the exact configuration approved by the FCC. Use of components other than those provided by Solecetek places you in violation of FCC regulations in the US or similar regulations in other nations and will void your warranty.

Chassis (Console)

The chassis houses the hardware and software used to control and manage the MP1100E and provides the interface between your LAN and the RF system. It is generally used with a monitor and keyboard that are not furnished as part of the MP1100E package.

Cabling system

The MP1100E comes standard with a 100-foot cable. An additional 100 foot cable is available from Solecetek so you can extend the cable length to 200 feet. You can also order a 300-foot cable that is used in place of the standard 100-foot cable. The ODU automatically compensates for cable attenuation based on the use of Solecetek cable in standard lengths. Solecetek requires that only unspliced FCC-approved Solecetek cable be used with the MP1100E.

Outdoor unit

The outdoor unit processes the received or transmitted signals. It filters and adjusts the signal levels. Circuitry in the outdoor unit allows the MP1100E to determine the length of cabling linked to the input port. It then boosts power appropriately for the length of cabling.

Equipment you provide

During setup and problem solving activities, you will need to attach a color VGA monitor and keyboard to the MP1100E. A color VGA monitor provides a visual display of runtime statistics, giving you packet counter measurements and RF link measurements. It also provides a visual display during antenna alignment. The keyboard allows you to select different screens to monitor performance and make adjustments. The MP1100E does **NOT** come with a keyboard and monitor, and the use of this equipment is optional after system setup is complete.

If the distance between your antennas is less than approximately 400 yards, you will need a Solecetek attenuator which is not part of the MP1100E package.

Outdoor Antenna Options

AIRLAN antennas are designed to meet the requirements of different environments. While the outdoor unit and cabling comes standard with the MP1100E, you must choose the best antenna for your application from a list of Solecetek antennas approved by the FCC for use with the MP1100E.

Always use the antenna with the narrowest beam width possible (highest gain) that still allows coverage of the target station(s). For example, it usually is best to use dish (reflector) antennas for short, point-to-point links. A narrow beam width minimizes interference from other sources.

Directional Antennas

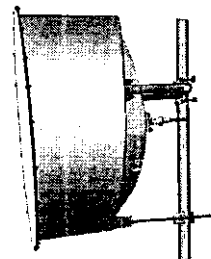
The ANT-DIR-21 reflector (dish) antenna has a gain of 21 dBi. Combined with the signal-boosting capabilities of the outdoor unit, this antenna allows the MP1100E to send and receive over a 25-mile distance. Specifications on bandwidth as well as vertical and horizontal size of the radiation beam are as follows:

- 3 dB elevation or azimuth beam width: 17.5° maximum
- 1 dB azimuth beam width: 8° minimum
- polarization: vertical or horizontal
- maximum gain: 21 dBi at 2.4 GHz

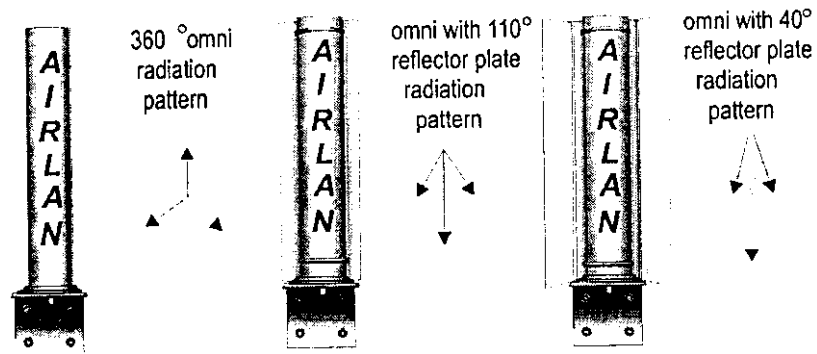


The ANT-DIR-22 is a reflector antenna for use where two or more 2.4 GHz antennas are mounted in close proximity. Specifications on bandwidth as well as vertical and horizontal size of the radiation beam are:

- gain: 22.0 dBi @ 2.40 GHz
- polarization: vertical or horizontal
- 3 dB beam width: 11.6° maximum
- 1 dB azimuth beam width: 8° minimum



Multi-directional antennas



The ANT-MULTI is an omni-directional antenna that ships with two user installable reflector plates (sectorals). The sectorals limit the 360° antenna signal to either 40° or 110°. Each of these configurations has different characteristics and is discussed separately below. (See Volume II Appendix A for help in understanding these specifications.)

40° Directional Antenna - You can use this antenna in multi-point links with other Solectek 2.4 GHz antennas. When used in the standard configuration with the dish (ANT-DIR-21) or high density (ANT-DIR-22) antennas, the combination can span links up to 14.1 miles.

Having a gain of 13.8 dBi and receiving 21 dBms of power from the outdoor unit, the 40-degree ANT-MULTI broadcasts about 34.5 EIRP.

Specifications on bandwidth as well as on vertical and horizontal size of the radiation beam are as follows:

- 3 dB elevation beam width: 22° nominal
- 3 dB azimuth beam width: 40° maximum
- 1 dB azimuth beam width: 23°

110° Directional Antenna - You can use the 110° antenna in multi-point links with other Solectek 2.4 GHz antennas. It is normally used in combination with the dish (ANT-DIR-21) or high density (ANT-DIR-22) antennas for multi-point links up to 10.6 miles. Having a gain of 10.5 dBi and receiving 21 dBms from the outdoor unit, the 110-degree ANT-MULTI antenna broadcasts about 31.5 EIRP.

Specifications on bandwidth as well as on vertical and horizontal size of the radiation beam are as follows:

- 3 dB elevation beam width: 26° nominal
- 3 dB azimuth beam width: 110° maximum
- 1 dB azimuth beam width: 56°

360° Antenna - This configuration is for use in short distance multi-point links up to 6.9 miles when used in combination with the dish (ANT-DIR-21) or high density (ANT-DIR-22) antennas.

Specifications on bandwidth as well as on vertical and horizontal size of the radiation beam are as follows:

- elevation beam width: 26° nominal
- elevation peak: horizon +5°, -5°
- azimuth beam width: 360°

Antenna Combinations

To achieve the maximum spanning distance, align each antenna so that the pointing direction faces the center lobe of the signal from the other antenna. Optimum alignment is assumed with point-to-point links using dish or high density antennas and for 360 degree omni antennas which have no center lobe. But center lobe alignment cannot be assumed in multi-point links where a multi-directional antenna is used to exchange signals in more than one direction. The charts below show the ranges you can achieve with a probable 99% minimum link availability. It shows the spanning distance in miles with center lobe alignment listed first, and for the multidirectional antennas one dB alignment (80% signal strength) listed second, and three dB alignment (50% signal strength) listed third.

Rural Links (in miles)				
	360° 6 dBi	110° 10.5 dBi	40° 14 dBi	dish 21 dBi
360°	1.5	2.2/1.9/1.6	3.5/3/2.5	6.9
110°		6.0/5.1/4.1	8.2/7.1/5.8	10.6/9.3/7.2
40°			11.4/10.0/8.0	14.1/12.2/8.8
dish				25.0

Urban Links (in miles)				
	360° 6 dBi	110° 10.5 dBi	40° 14 dBi	dish 21 dBi
360°	0.5	1/.8/.7	1.4/1.2/.9	3.0
110°		2.4/2.1/1.4	3.8/3.0/2.3	4.9/3.8/3.0
40°			5.3/4.0/3.2	7.0/5.0/4.0
dish				13.0

Prerequisites

The success of an RF link depends on a clear line of sight between the antennas. For information on line of sight, see Volume II Appendix A. You may need technical assistance to determine your line of sight and operating environment requirements. In some cases a site survey should be completed before the system is installed. It is also important to keep the bridge units physically separate from other radio devices which are

operating in the same frequency range (Radio Bands; 2.4-2.48355 GHz) so they will not interfere with your signal.

Hardware specifications

Package and Options	
Standard	Bridge (chassis) with strain relief cable, LED bench test antenna, ODU, Operator's guide, and 100-foot cable
Special Order	Attenuator 100' extension cable 300' alternative cable
Antenna Options (Purchased separately)	Dish (21 dBi gain) or high-density (22 dBi gain, both with 8° concentrated signal path Omni 360° 6 dBi gain, Omni + 40° sectoral , 13.8 dBi, Omni + 110° sectoral 10.5 dBi

Protocols	
Bridging	MAC layer bridging 802.1D Spanning Tree support IEEE 802.3 Ethernet
Routing features	IP & IPX with RIP support
SNMP compliance	Standard MIB II bridge group (gets only)
Modes of operation	Bench Test (CSMA), Base station/substation
LAN Interface	802.3 Ethernet w/10BaseT BNC & AUI
LAN compatibility	all major network operating systems

Radio Specifications	
Frequency Range	2.4 - 2.48355 GHz
Channels	2.430, 2.438, 2.445 GHz
Frequency stability	+25 ppm
RF Power out	15.5 dBm
Modulation	DQPSK
Spectrum Spreading	11-bit direct sequence spread spectrum
Processing gain	10 dB nominal
Rx Sensitivity	-82 dBm (@ 10 ⁻⁸ bit error rate)
Data Rate	11 Mbps
Bit Error Rate (BER)	1x10 ⁻⁸
Certification & Licensing	FCC 15.247

*point-to-point, one direction, using WG DA-10 protocol analyzer

General	
Power	29.9 watts @ 115 VAC Switchable
Power Supply Certification	UL CSA TUV
Maximum range	25 miles
Remote control capability	Other MP1100E console PC workstation (see, Vol. II Appendix B)
Warranty	1 year limited warranty

Physical Characteristics - MP1100E Chassis	
height	7.00 inches
width	17.00 inches
length	17.00 inches
Chassis weight	18 lb.
operating temperature	room temperature (50° - 104° F 10° - 40° C)
MTBF	50,000 hours
certification for power supply	UL, CSA, TUV

Physical Characteristics - Outdoor Unit and Cables	
height	1.00 inches
width	5.50 inches
length	8.80 inches
weight	2.85 lbs.
operating temperature	ODU -22° F to 158° F -30° C to 70° C cables -40° F to 185° F -40° C to 85° C