



BridgeWave

COMMUNICATIONS

making connections in a high-speed world

**The BridgeWave E60 product line
Wireless Ethernet Links in the 60GHz Band
Model AR60, FE60, GE60 &
AR60X, FE60X, GE60X**



Installation Manual

P/N 580-00507
Revision 1
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In the event Buyer believes that Products do not conform to the limited warranty of this Section, Buyer shall pay for the shipping and insurance of such Product to BridgeWave. If BridgeWave determines in its sole opinion that such Products do not conform to the limited warranty, then BridgeWave shall pay for the shipping and insurance of repaired or replacement Products to Buyer. However, in the event that BridgeWave determines in its sole opinion that such Products conform to the limited warranty, Buyer shall pay for shipping and insurance of such Products back to Buyer.

All obligations of BridgeWave under this limited warranty shall cease in the event of abuse, accident, alteration, misuse or neglect of the Product. In-warranty repaired or replaced parts are warranted only for the remaining unexpired portion of the original warranty period applicable to the repaired or replaced parts.

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Product Compatibility

While every effort has been made to verify operation of this product with many different communications products and networks, BridgeWave makes no claim of compatibility between its products and other vendors' equipment. It is assumed that users have thoroughly evaluated this product's performance in the communications environment in which it will be used.

Safety

CAUTION, WARNING, and DANGER statements have been strategically placed in the text to alert personnel of possible hazards. These statements must be closely observed.

The following general safety precautions must be observed during all phases of operation and service of the products covered in this manual. Failure to comply with these precautions or with specific warnings elsewhere in this manual willfully violates standards of design, manufacture, and intended use of the product. BridgeWave assumes no liability for the customer's failure to comply with these requirements.

- *The BridgeWave 60GHz product line meets all applicable FCC safety requirements for radio equipment; however, it is best to avoid prolonged, unnecessary exposure to the front of the radio while it is operating. The exposure one would receive from aligning the radio is not harmful to humans.*
- *The outdoor equipment must be properly grounded to provide some protection against voltage surges and built-up static charges. In the event of a short circuit, grounding reduces the risk of electrical shock.*

For installations in the U.S.A., refer to Articles 810830 of the National Electrical Code, ANSI/NFPA No. 70, for information with respect to proper grounding and applicable lightning protection for DC cables.

For installations in all other countries, implement protection in accordance with the safety standards and regulatory requirements of the country where the equipment is to be installed.

- *Do not install or operate this equipment in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.*
- *Do not install substitute parts or perform any unauthorized modification to the equipment. Changes or modifications not expressly approved by BridgeWave can void the user's authority to operate the equipment.*

Regulatory Information

This device complies with part 15 of the FCC Rules.

Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and,
- (2) This device must accept any interference that may cause undesired operation.

Equipment Precautions

Water and Moisture - The E60 product line is designed to withstand moisture conditions typically encountered when installed outdoors.

Power Sources - This product should only be operated with the type of power source provided by BridgeWave Communications Inc.

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1 Introduction

1.1 Purpose of Manual

The information in this manual is directed to persons who must perform or coordinate the tasks associated with the process of installing wireless communication devices, and planning communication network applications.

1.2 Prior Knowledge

This manual assumes the operator has at least basic experience with and an understanding of wireless technology and some familiarity with configuring and operating networking equipment. Preferably, the person installing this equipment fully understands the information covered in this manual prior to attempting these procedures.

DANGER! Indicates that personal injury can result if the user does not comply with the given instruction. A DANGER statement will describe the potential hazard, its possible consequences, and the steps to perform to avoid personal injury.

WARNING! Indicates that serious damage to the equipment can result if the user does not comply with the given instruction. A WARNING statement will describe the potential hazard, its possible consequences, and the steps to perform to avoid serious equipment damage.

CAUTION! Indicates that equipment damage, process failure, and/or loss of data can result if the user does not comply with the given instruction. A CAUTION statement will describe the potential hazard, its possible consequences, and the steps to perform to avoid equipment damage, process failure, and/or loss of data.

NOTE: Provides supplementary information to emphasize a point or procedure, or provides a tip for easier operation.

1.3 Contact Information

Technical Assistance and Customer Service

BridgeWave distributors are authorized local service providers and are responsible for immediate customer support. If problems are not resolved, contact BridgeWave Customer Service for assistance:

Santa Clara, CA USA
Tel: 408.567.6906
Fax: 408.567.0775
Email: support@bridgewave.com

Return Material Authorization (RMA)

Should BridgeWave equipment have to be returned for repair or replacement, an RMA number must be obtained from BridgeWave or the local BridgeWave distributor. When returning equipment, be sure to write the RMA number on the outside of the shipping carton.

2 Site Planning

2.1 General

Before the start of an installation a survey should be conducted of the proposed area of the site(s). The survey personnel should be fully familiar with the details required to install the an E60 radio system.

- FE60 and FE60X radios transport Fast Ethernet over the wireless connection (100Mbps full duplex)
- GE60 and GE60X radios transport Gigabit Ethernet over the wireless connection (1000Mbps full duplex)
- AR60 and AR60X radios have an adaptive rate over the wireless connection, depending on the fade margin in the link the radio will transmit either Gigabit Ethernet or Fast Ethernet over the air

2.2 Equipment Checklist

The survey team will need the following equipment:

- Binoculars
- GPS Navigation Device
- Tape Measure
- Site Survey Report Form

2.3 Line of Sight (LOS)

The E60 Wireless Ethernet link requires Line-of-Sight for proper operation. Fortunately, the links are relatively short and obstructions in the path can easily be identified. Binoculars can ease viewing in poor light conditions.

The planning should include an investigation into future building plans that could block the LOS path, and other long-term incremental obstructions such as trees. Intermittent obstructions such as aircraft at a nearby airport should also be considered.

The following table details the minimum clearance needed from obstacles near the path in order to ensure the radios will operate properly.

Path Length (meters)	Minimum Clearance (meters)
250	0.56
500	0.79
750	0.97
1000	1.12
1500	1.37
2000	1.58

Table 2-1: Minimum Clearance at Link Midpoint for various Path Lengths

2.4 Link Distance

Measurement of the link distance is important in estimating the link availability and calculating expected Receive Signal Level (RSL). This measurement can be performed using the Latitude and Longitude readings from a Global Positioning System (GPS) device, which is placed near the proposed locations of the antennas, or using a range finder device.

Table 2-2 below lists the maximum link distance with respect to desired availability and ITU rain zone (ITU-R Recommendation PN.837). The map (Figure 2-1) following the chart shows where the rain zones fit across North America and Asia for various availabilities and most ITU rain zones. The availability for the AR systems is a combination of the FE and GE tables of the same type (FE60 and GE60 or FE60X and GE60X) depending on the current condition of the link.

FE60 Distance Table

(V1545)	Rain Zone								
Availability	A	B	C	D	E	F	K	M	N
99.9000%	1470	1440	1420	1350	1400	1350	1280	1140	980
99.9700%	1410	1370	1340	1300	1270	1220	1120	980	820
99.9900%	1360	1280	1230	1180	1140	1080	960	840	710
99.9950%	1310	1220	1170	1100	1050	990	880	770	660
99.9970%	1280	1180	1120	1050	1010	940	830	730	630
99.9990%	1220	1100	1030	960	910	850	750	660	580

FE60X Distance Table

(V1620)	Rain Zone								
Availability	A	B	C	D	E	F	K	M	N
99.9000%	2380	2340	2300	2170	2250	2170	2040	1790	1520
99.9700%	2280	2200	2150	2080	2030	1950	1760	1520	1250
99.9900%	2180	2050	1960	1870	1800	1690	1490	1280	1070
99.9950%	2100	1940	1840	1730	1660	1550	1360	1170	990
99.9970%	2050	1870	1760	1640	1570	1460	1270	1100	940
99.9990%	1940	1720	1600	1480	1410	1300	1140	1000	870

GE60 Distance Table

(V1435)	Rain Zone								
Availability	A	B	C	D	E	F	K	M	N
99.9000%	990	970	960	920	940	920	870	790	710
99.9700%	950	930	910	890	870	840	770	680	580
99.9900%	920	870	850	810	790	750	670	590	510
99.9950%	890	840	800	760	740	700	620	550	480
99.9970%	870	810	770	730	700	660	590	520	460
99.9990%	840	760	720	670	640	600	540	480	420

GE60X Distance Table

(V1620)	Rain Zone								
Availability	A	B	C	D	E	F	K	M	N
99.9000%	1820	1790	1760	1670	1730	1670	1580	1400	1190
99.9700%	1760	1690	1650	1610	1570	1510	1370	1190	990
99.9900%	1680	1580	1520	1450	1400	1320	1170	1010	850
99.9950%	1620	1510	1430	1350	1300	1210	1070	930	790
99.9970%	1580	1450	1370	1280	1230	1140	1010	880	750
99.9990%	1500	1340	1250	1160	1110	1030	910	800	690

Table 2-2: Maximum Link Distances (meters) for various Availabilities and Rain Zones

99.9000% availability equates to 526 minutes per year of outage due to heavy rains.
 99.9700% availability equates to 158 minutes per year of outage due to heavy rains.
 99.9900% availability equates to 53 minutes per year of outage due to heavy rains.
 99.9950% availability equates to 26 minutes per year of outage due to heavy rains.
 99.9970% availability equates to 15 minutes per year of outage due to heavy rains.
 99.9990% availability equates to 5 minutes per year of outage due to heavy rains.

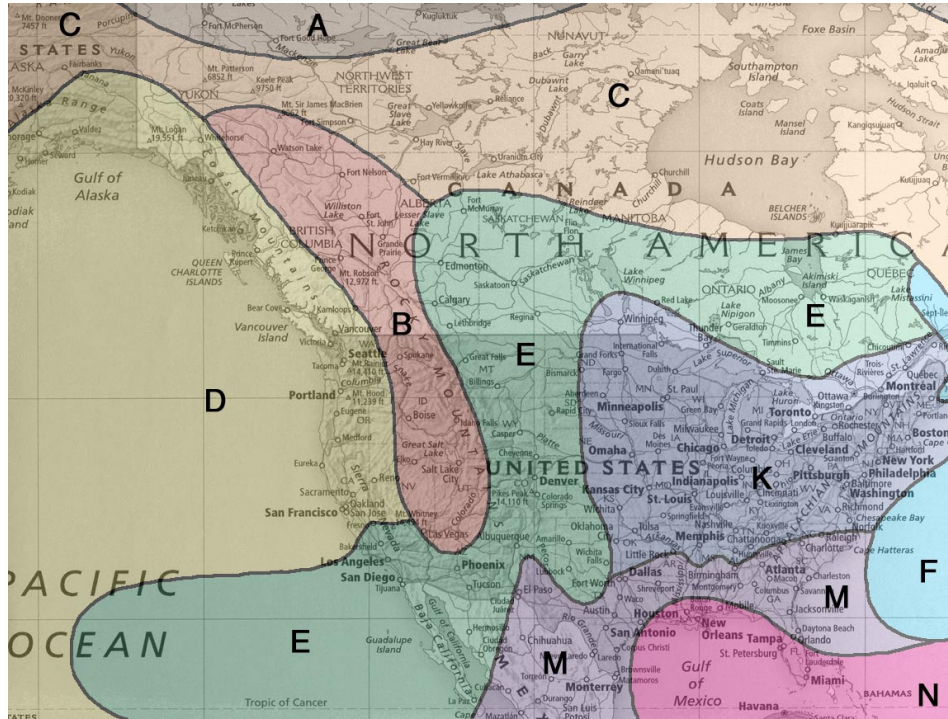


Figure 2-1: Rain Zone map for North America

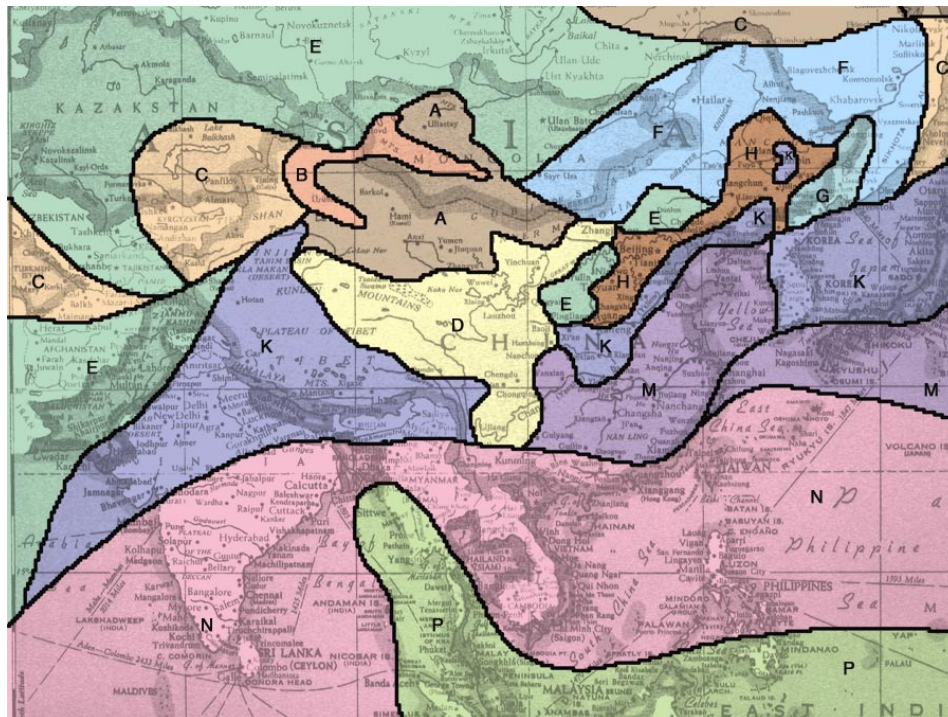


Figure 2-2: Rain Zone map for Asia

2.5 Antenna Location

The optimum location for the antennas must be determined. The ideal location should provide for ease of erecting and mounting the antenna, as well as unimpeded Line-Of-Site (LOS) to the other site. The following factors should be taken into account:

- Type of mounting—wall or pole
- Location where the fiber and DC power wiring will enter/exit the building
- Length of cable runs
- Grounding connection points
- Obstructions
- Accessibility

2.6 Cabling

The installation site should be inspected to determine the run paths for the fiber cable and power cable from the radio equipment to the termination point. Locations for roof penetration should be identified. The routing and securing of all cables should conform to all applicable codes and requirements. Depending on the likelihood of damage due to foot traffic or equipment movement, cabling conduit may be required. The maximum cable run length as specified for the equipment being installed must not be exceeded.

The radio requires an LC type connectors on a pair of simplex multi-mode fibers to properly connect to the radio and the users network equipment. Single-mode fiber is **not** a current option supported by the radio. The network equipment end of the fibers should be terminated with connectors that match the network equipment fiber interface.

Fiber Cable Length	Cable Type
Up to 270 meters	62.5/125 μ m
Up to 500 meters	50/125 μ m

Table 2-3: Fiber Cable Types

All radios in the E60 product line include a 100-240 VAC power adaptor suitable for indoor operation that converts the AC voltage from the standard electrical outlet in the wall to DC voltage. Our radio requires a minimum of 15.0 VDC (24.0 VDC maximum) up the power cable to the radio to function properly. When planning the cable run from the indoor mounted AC power adaptor to the radio unit, it is critical to use the cable gauge (AWG) indicated below to ensure adequate voltage at the radio. The electrical cable that is used outside the building must be outdoor rated (i.e., weather-protected) providing a single pair of wires necessary to power the equipment. The required DC power cable is 12 gauge, 2 wire (i.e., 12/2) rated for outdoor use.

DC Cable Length	Minimum Cable Size	
	Outside Diameter of DC Cable Jacket (min-max)*	Conductor size
Up to 250 meters	0.17 – 0.45 inches (4.3 – 11.9 mm)	12 AWG (4mm ²)

Table 2-4: Minimum DC Cable Size

**Note: Specification is for the outdoor weather-protected portion of the DC cable entering the radio enclosure. The indoor portion of the DC cable must comply with local building and/or electrical codes in your area.*

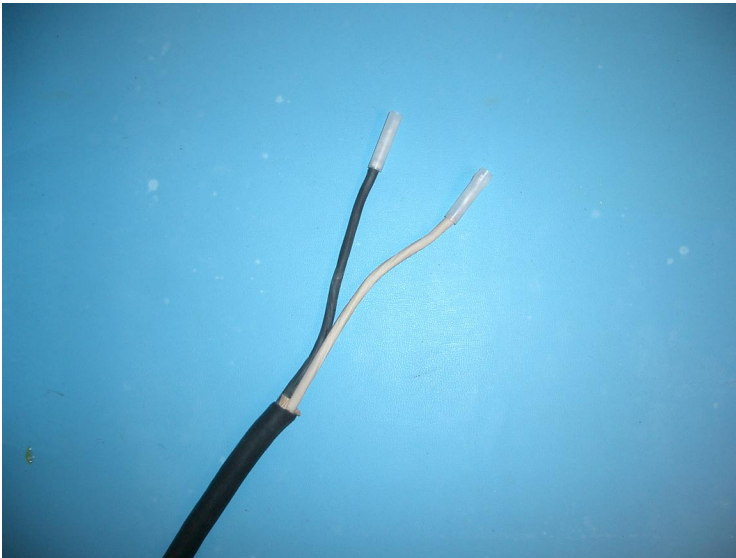


Figure 2-3 (left) details a standard 12-gauge wire that has been fitted with the power connectors (provided) for the radio's internal power supply necessary to mate with the provided power cord. A standard crimping/splicing tool (not provided) is required to terminate the power connectors onto the 12-gauge cable required for use with the E60 products.

Figure 2-3: 12-gauge DC power cable with crimp connectors

2.7 Grounding & Lightning Protection

WARNING!

Proper grounding of the outdoor equipment reduces electromagnetic interference, provides lightning protection, and protects against electrical discharge. The source and connection points for the building-to-earth ground in the vicinity of the antenna location should be determined.

It is recommended to integrate the radio ground into the building ground utilizing the pole mount hardware. For wall or ungrounded pole mounts connect a grounding wire to the grounding point on the radio. Select the size of the ground wire based on the National Electrical Code.

In addition to grounding the equipment, **BridgeWave strongly recommends**, and local building codes may require, the DC electrical cable to be protected from lightning strikes. You may use a Polyphaser surge suppressor, model # IS-PSP-24 (or equivalent model from another manufacturer). The surge suppressor must be installed at the point where the DC electrical cable exits/enters the building.

The Polyphaser device is available from the following companies:

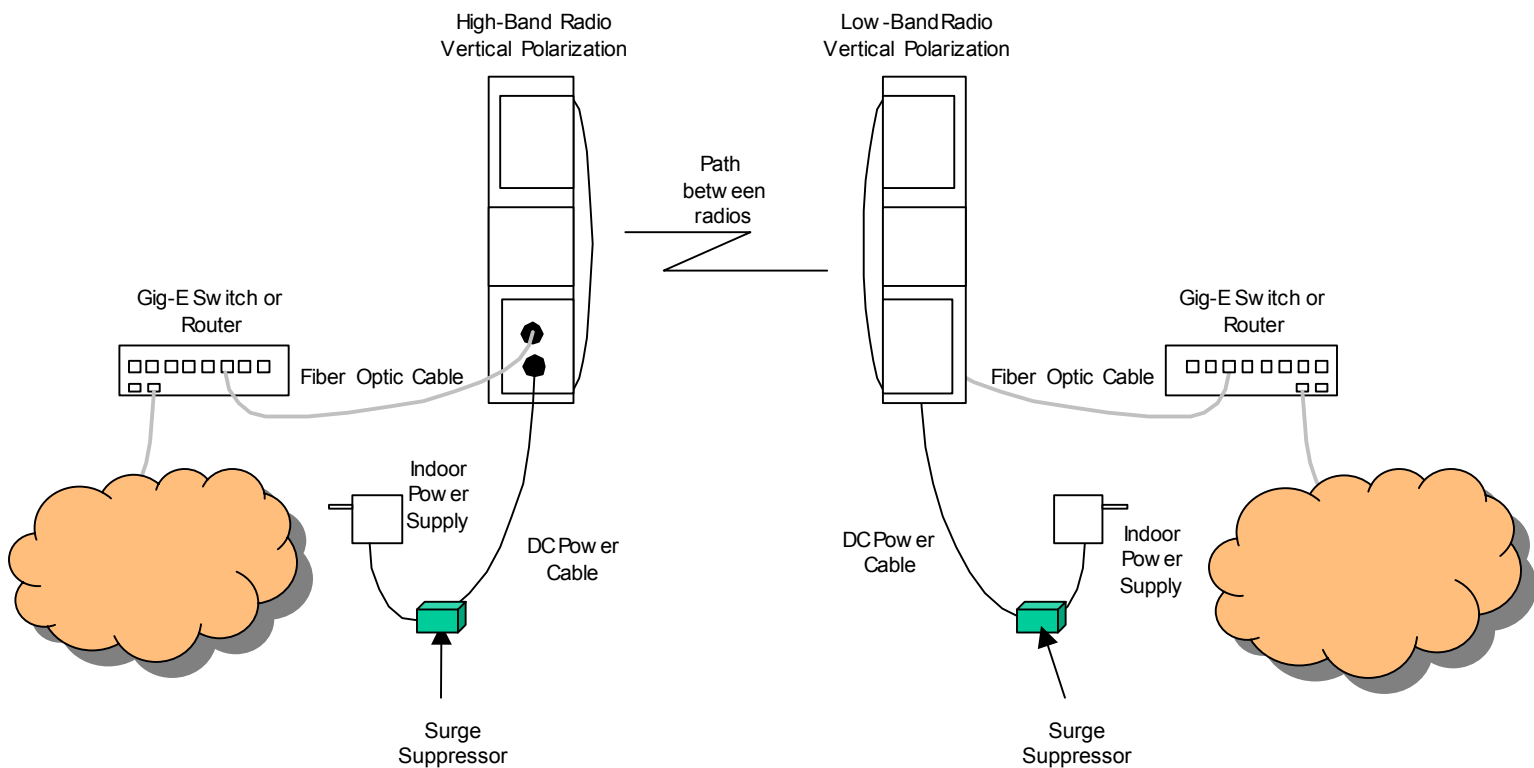
Hutton Communications	877-648-8866	www.huttoncom.com
TESSCO Technologies	800-472-7373	www.tessco.com
Winncom Technologies Corp.	888-946-6266	www.winncom.com

2.8 Environmental

The structure to which the equipment will be mounted should be adequate to bear all wind and other weather conditions. The environmental conditions at the location must conform to the operating environment specified for the equipment.

2.9 Simple Network Diagram

Following is a diagram detailing the equipment and cabling found on a typical installation of BridgeWave's 60GHz radio equipment.



Note: The ports on all switches or routers must be configured for: 1000Mbps, full-duplex and auto-negotiation disabled.