



BridgeWave

COMMUNICATIONS

Making connections in a high-speed world

SLE100 Fast Ethernet Links



Installation Manual

P/N 590-00532
Revision A
June 2008

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This publication has been prepared for professional and properly trained personnel, and the customer assumes full responsibility when using the information herein.

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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.

- *These BridgeWave radios meet all applicable FCC safety requirements for general population exposure to radio frequency emissions; however, it is best to avoid prolonged, unnecessary exposure to the front of the radio while it is operating.*
- *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. The installer must also follow any additional local building and electrical code regulations.

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 FCC Part 15.255 and Industry Canada RSS-210.

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 - These BridgeWave radios are designed to withstand weather 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.

Avoid applying force to the antenna radome, since this may damage the internal feed horn. Never rest the unit on a surface with the radome facing down.

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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, WARNING and **NOTE** statements have been placed in various sections throughout this document to alert personnel of possible traffic affecting issues and to provide additional tips and helpful information. These statements should be closely observed.

Symbol	Description
	<p><i>Indicates that personal injury can result if the user does not comply with the given instruction.</i></p> <p><i>A DANGER statement will describe the potential hazard, its possible consequences, and the steps to perform to avoid personal injury.</i></p>
	<p><i>Indicates that equipment damage, process failure and/or loss of data can result if the user does not comply with the given instructions.</i></p> <p><i>A WARNING statement will describe the potential hazard, its possible consequences, and the steps to perform to avoid serious equipment damage.</i></p>
	<p><i>Provides supplementary information to emphasize a point or procedure, or provides a tip for easier operation.</i></p>



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.

BridgeWave Sales

E-mail: sales@bridgewave.com
Inside Sales: +1.866.577.6908

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 BridgeWave radio system.

2.2 Equipment Checklist

The survey team will need the following equipment:

- Tape Measure
- Site Survey Report Form

2.3 Line of Sight (LOS)

BridgeWave Wireless links require 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

Table 2-1: Minimum Mid Path Clearance Requirements

2.4 Link Distance

The Minimum Link Distance is 65 feet (20 meters)

The SLE100 provides highly reliable all-weather operation at half-mile distances anywhere in the USA and Canada.

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 CAT5 cable wiring will enter/exit the building
- Length of cable runs (not to exceed 100 meters, 328 feet)
- Grounding connection points
- Obstructions
- Accessibility

2.6 Cabling

The installation site should be inspected to determine the run paths for the Cat5 copper cable from the radio equipment to the surge arrestor and PoE Injector termination points. 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.

Each SLE100 radio includes a 100-240 VAC power adaptor suitable for indoor operation that converts the AC voltage from the standard electrical outlet in the wall to 48 volts DC.

The Cat5 cable that is used outside the building must be outdoor (plenum) rated (i.e., weather-protected) or installed in applicable conduit.

The maximum end-to-end Cat5 cable run from network equipment through the PoE Injector and to the SLE100 radio unit is 100 meters.

Figure 2-1 provides a diagram detailing the equipment and cabling found on a typical installation of BridgeWave's SLE100 60GHz radio equipment:

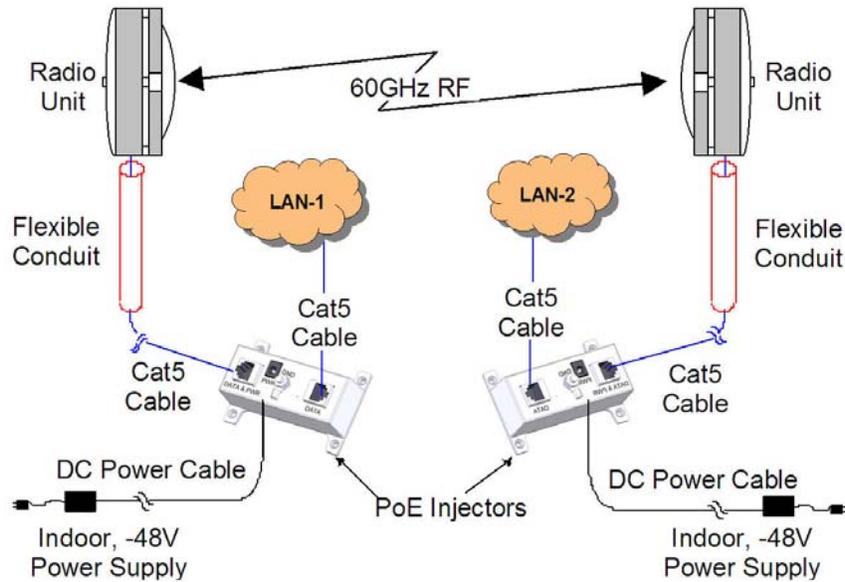


Figure 2-1 Cabling Diagram

2.7 Grounding & Lightning

	<p><i>Proper grounding of the outdoor equipment reduces electromagnetic interference, provides lightning protection, and protects against electrical discharge.</i></p> <p><i>Using improper techniques in lightning prone geographic areas may pose a danger to local personnel.</i></p> <p><i>The source and connection points for the building-to-earth ground in the vicinity of the antenna location should be determined.</i></p>
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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, that the Cat 5 cable be protected from lightning strikes by the use of an additional surge suppressor.

The surge suppressor must be installed at the point where the Cat 5 cable exits/enters the building, however use of a surge suppressor at the radio unit is optional since power cable surge suppression is built into the unit.

The BridgeWave SLE100 includes surge suppressors **at both ends** of the Cat 5 cable.



 Note	<i>For more information on recommended accessory devices and kits, contact BridgeWave Sales</i>
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2.8 Environmental

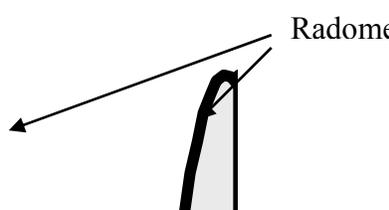
The structure to which the equipment will be mounted must be adequate to bear all wind and other weather conditions. The environmental conditions at the location must conform to the operating environment specified for the equipment.

3 Installation

3.1 Equipment Unpacking

The radio system equipment will arrive in two boxes: one box for the low-band radio and one box for the high-band radio. Locate the desired box (low-band or high-band) before beginning installation by checking the label on the outside of the box or on the radio itself. It is recommended that the shipping cartons and packing materials be retained in the event that it is necessary to return any equipment.

 <p>Note</p>	<p><i>Unpacked radios can be identified by the color of their labels found on their front faces or inside the unit after removing the plastic back weather cover. The blue color label indicates a high band radio and the red color label indicates a low band radio. See Figure 3-8 for further details.</i></p>
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 <p>Warning</p>	<p><i>Avoid applying force to the antenna radome, since this may damage the internal feed horn. Never rest the unit on a surface with the radome facing down.</i></p> 
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3.2 Equipment Inventory

Each carton is accompanied by a packing list. Verify the contents of the carton against the packing list. The following are inventory lists for a typical system.

Qty Description

- 2 ea. SLE100 radios (1 low-band & 1 high-band)
- 2 ea. Wall Mount Kits
- 2 ea. Pole Mount Kits (required only when mounting the radio onto a pole)
- 2 ea. Visual Alignment Tool (VAT)
- 2 ea. Standard Power Supply (Indoor rated, 100-240VAC input to 48VDC output)

- 1 ea. CD-ROM containing Installation Manual (1 provided per pair of radios)
- 1 ea. Hard reset box
- 1 ea. 9/16-inch wrench

BridgeWave 10-inch Antenna Wall Mount Kit Parts List

Item	Description	Qty.
1	Mount Bracket	1
2	Radio Yoke	1
3	Teflon Shim	1
4	3/8 Split Lock Washer	4
5	3/8 Flat Washer	4
6	3/8-16 x 3/4 bolts	4



BridgeWave Pole Mount Kit Parts List

Item	Description	Qty.
1	Pole Clamp	4
2	3/8-16x9in Threaded Rod	4
3	3/8 Split Lock Washer	14 (2 spare)
4	3/8 Flat Washer	14 (2 spare)
5	3/8-16 Hex Nut	13 (1 spare)
6	3/8-16 x 3/4 bolts	6 (2 spare)



 <p>Warning</p>	<p><i>The radio is sealed at the factory with warranty stickers on the inner (metal) cover of the radio. There is no need to open this cover in the field. Tampering with these seals will void the warranty.</i></p>
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3.3 Installation Tools

The following tools, should be used for installing the radio:

- Screwdriver, slotted 0.1 inch (2.5mm) wide
- Open-end wrench 11/32 (9mm)
- Open-end wrench 9/16 (14mm), 2 ea. (Supplied by BridgeWave)
- Ratchet with 6 inch (15cm) extension and 9/16 inch (14mm) deep socket
- Electrical tape
- Fish tape for pulling cable
- Cable tie wraps
- Hand-held DVM (digital voltmeter) with standard banana plug receptacles
- RJ45 connectors
- RJ45 crimp tool

3.4 Radio Mount Installation

The SLE100 radio unit can be mounted to a wall or attached to a pole. Instructions for assembling the mounting brackets for wall and pole mount applications are described in the sections below.

Wall Mounting Instructions

The diagram in *Figure 3-1* shows the required parts and assembly for mounting the bracket to a wall followed by detail instructions.

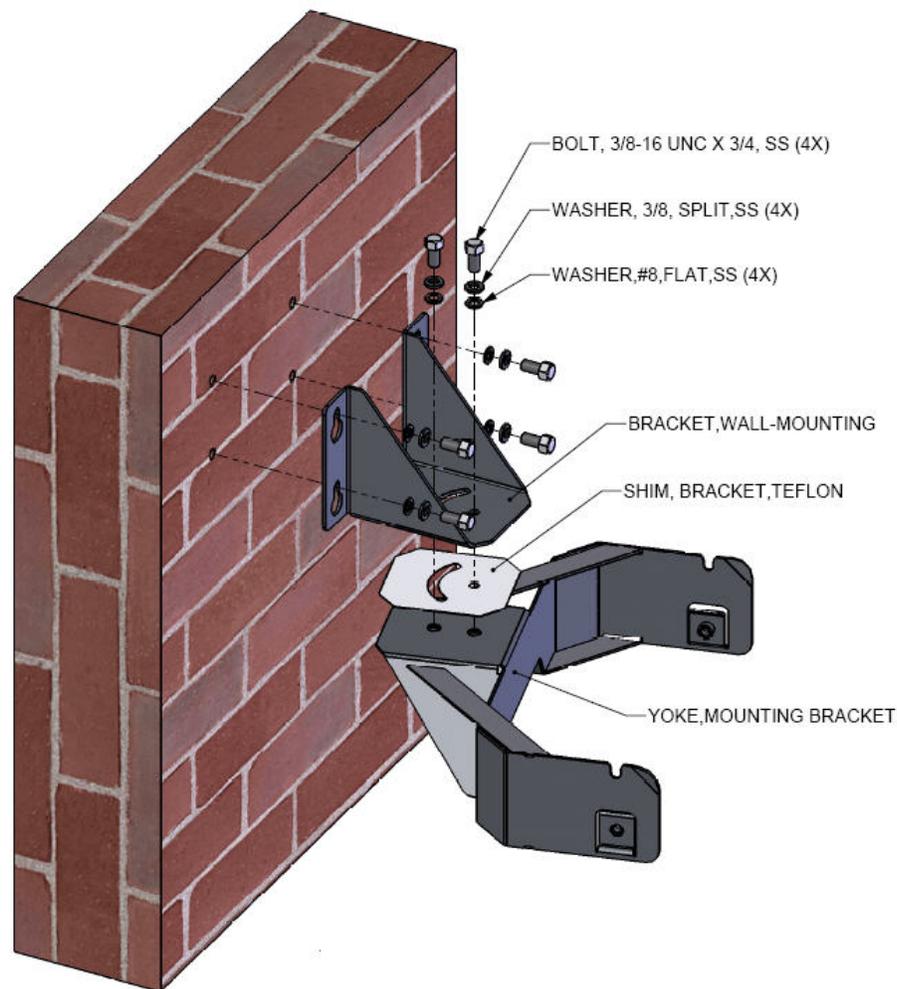


Figure 3-1 Wall Mount Assembly Diagram

1. Install 4 mounting bolts in the wall at the desired location. The template provided in Figure 3-3 can be used to establish the hole pattern on the wall. The bolts (normally $\frac{3}{8}$ -16) should extend 0.8 to 3.0 inches (2cm to 7.5cm) from the wall and be strong enough to secure the radio to the wall under foreseeable environmental conditions. The environmental conditions may include, but not limited to, wind, rain, ice, etc. Depending on the wall material the mount is being attached to, a different size bolt may be appropriate. In this case, bolts up to $\frac{3}{4}$ inch in diameter may be used.
1. Secure the ‘Wall-Mounting Bracket’ to the wall using the appropriate sized nuts, lock washers, and flat washers for the bolts used.
2. Attach the Yoke Mounting Bracket to the mount, with Teflon shim in-between, using 2 each of the supplied $\frac{3}{8}$ -16 x $\frac{3}{4}$ bolts, $\frac{3}{8}$ lock washers, and $\frac{3}{8}$ flat washers. Tighten the bolts just enough to allow the yoke to move back and forth without binding.

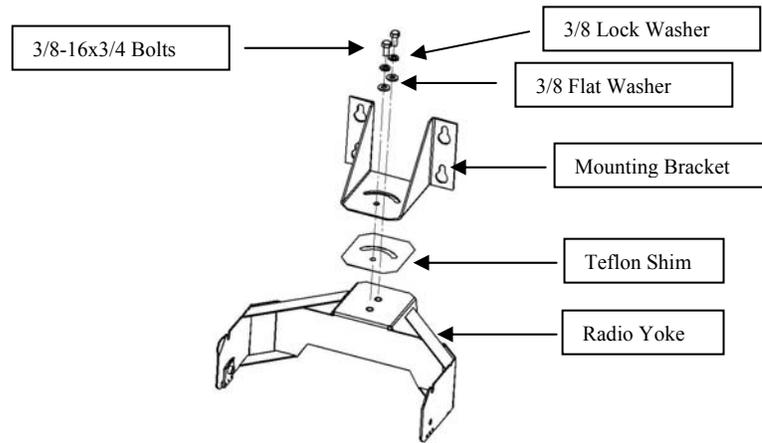


Figure 3-2 Attaching the Yoke to the Mounting Bracket

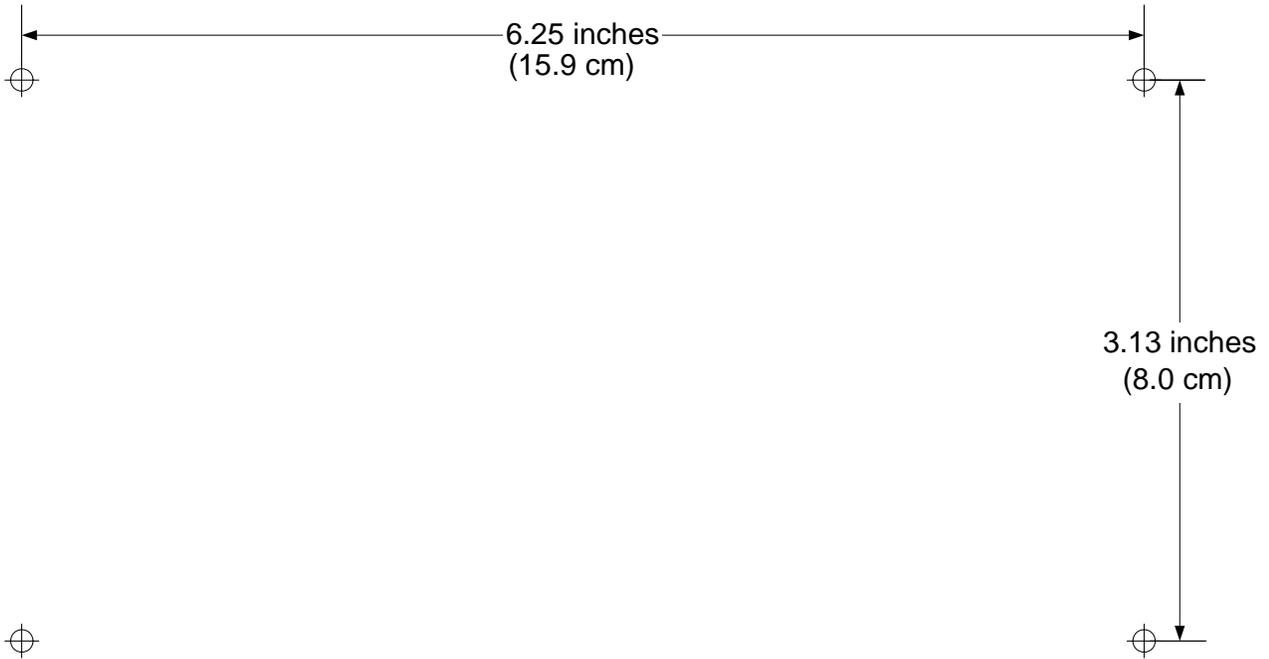


Figure 3-3: Wall Mount Hole Drilling Template

Pole Mounting Instructions

The pole mount kit can be used to secure the mount to a pole with diameter from 2.0 to 4.5 inches (50 to 115 mm). Listed below are the steps required to assemble the bracket for a pole mount application:

1. Pre-assemble the pole mount brackets by attaching the 4 All-Thread rods to two of the pole mount brackets using eight $\frac{3}{8}$ -16 x $\frac{3}{4}$ hex nuts and four each $\frac{3}{8}$ split lock washers, and $\frac{3}{8}$ # 8 flat washers, as shown in *Figure 3-4*. This creates a U-Bolt type arrangement.

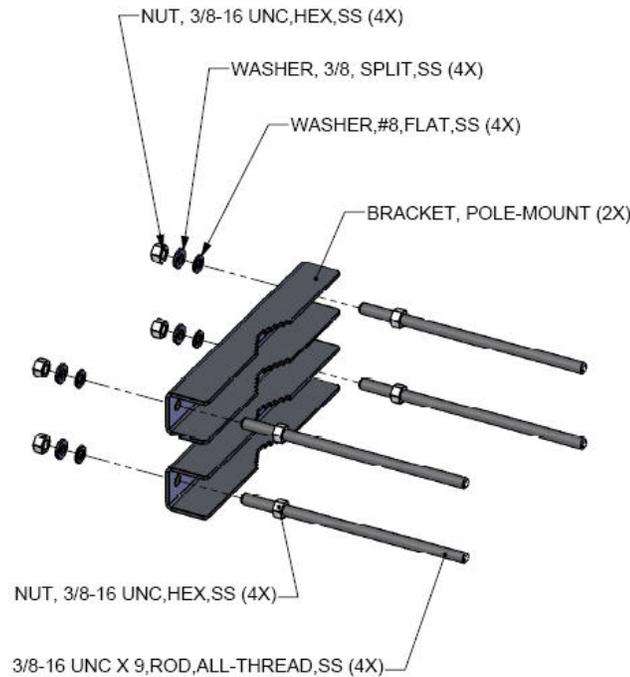


Figure 3-4 Pole-Mount Bracket Assembly

 <p>Note</p>	<p><i>The $\frac{3}{8}$-16 x $\frac{3}{4}$ hex nuts on the inside of the pole clamps do not require any washers since they are only holding the threaded rods in place and do not bear any load. These hex nuts secure the All Thread rods to the pole clamps making it easier to align the clamps on each side of the pole.</i></p>
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2. Attach two pole mount brackets to the wall-mounting bracket using 4 each $\frac{3}{8}$ -16 x $\frac{3}{4}$ bolts, $\frac{3}{8}$ Split lock washers, and $\frac{3}{8}$ # 8 flat washers.

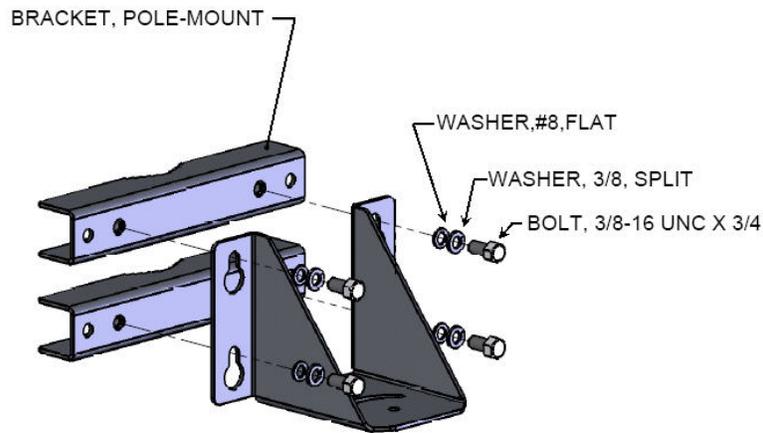


Figure 3-5 Attaching Pole Mount Brackets to Wall Mount Bracket

3. Attach the Yoke Mounting Bracket to the mount, with Teflon shim in-between, using 2 each of the supplied $\frac{3}{8}$ -16 x $\frac{3}{4}$ bolts, $\frac{3}{8}$ lock washers, and $\frac{3}{8}$ flat washers. Tighten the bolts just enough to allow the yoke to move back and forth without binding.

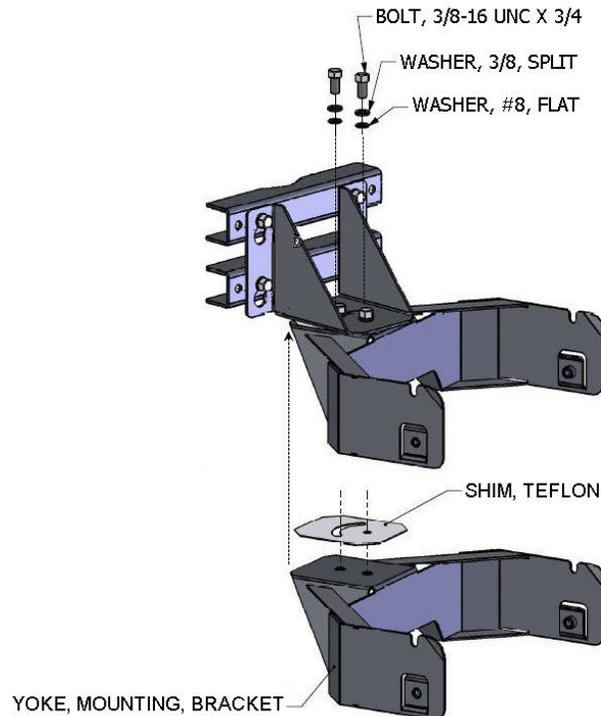


Figure 3-6 Attaching the Yoke to the Mounting Bracket



4. Secure the assembled Yoke Mount to the pole using the preassembled pole mount brackets from Step 13, and 4 each $\frac{3}{8}$ -16 nuts, $\frac{3}{8}$ lock washers, and $\frac{3}{8}$ flat washers.

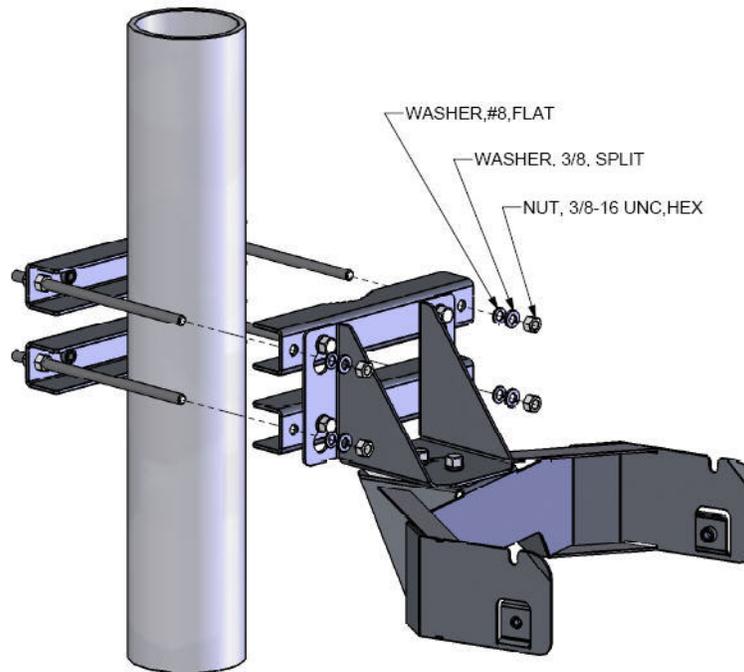


Figure 3-7 Attaching Pole Mount Brackets and Yoke to Pole

3.5 Radio Installation

Perform the following steps to attach the radio to the Yoke Mounting Bracket:

1. Determine desired polarization of the link, vertical or horizontal, and orient the radio accordingly using the diamond shaped polarity indication stickers shown in Figure 3-8.

 Note	<p><i>When the radio comes from the factory, the mounting plates are in the vertical polarization position, that is, the diamond marking on the front of the radio housing is to the right when viewed from the front. For horizontal polarization, the mounting plates should be moved so that the diamond is at the top when viewed from the front. Verify that the flexible conduit entrance is on one of the lower sides of the radio.</i></p>
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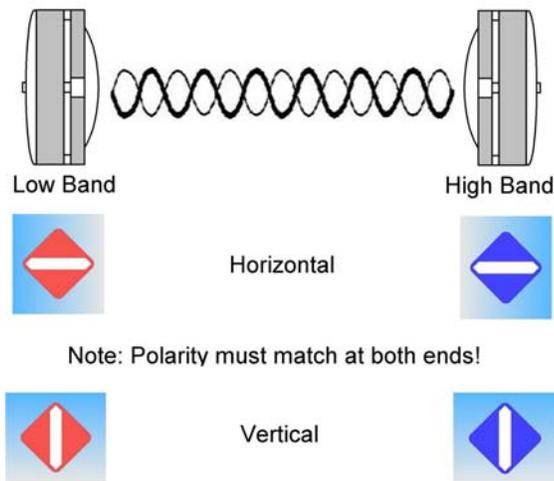


Figure 3-8: Polarization Diamond Orientations

 Note	<p><i>The blue color label indicates a high band radio and the red color label indicates a low band radio</i></p>
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 <p>Warning</p>	<p><i>It is critically important during installation to ensure the radios on each side of the link are in the same polarization (horizontal-horizontal or vertical-vertical). A link that has a radio on one side of the link set in the horizontal polarization and the other side of the link set in the vertical polarization will not operate properly.</i></p> <p><i>It is also critically important that a high-band radio is paired with a low-band radio to ensure the system will operate properly. Prior to installation check each radio to verify one is a high-band and the other is a low-band version. The label on the radio will indicate the band (blue for high or red for low).</i></p>
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2. Place the radio in the yoke; the two up/down pivot bolts should rest in the U's cut in the yoke as shown in Figure 3-9. The drain hole and conduit fitting should be pointed down.

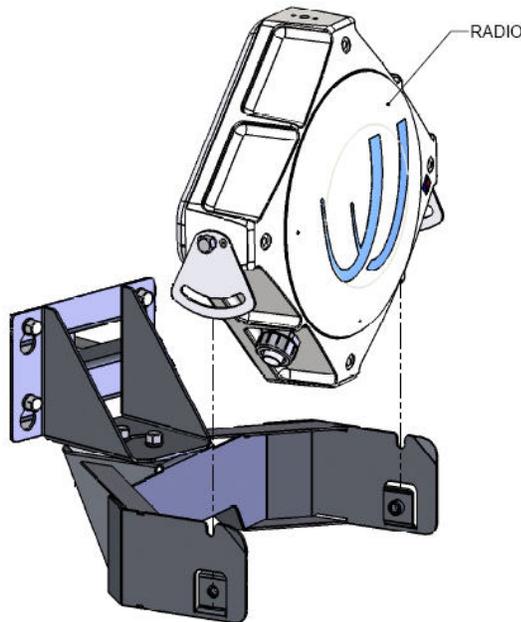


Figure 3-9 Attaching the Radio to the Yoke

3. Once the radio has been placed in the yoke mount, insert the bolt in the lower portion of the yoke to secure the radio. Tighten both the upper and lower elevation lock bolts enough such that the radio is secured in the mount but is still able to be easily tilted up and down.

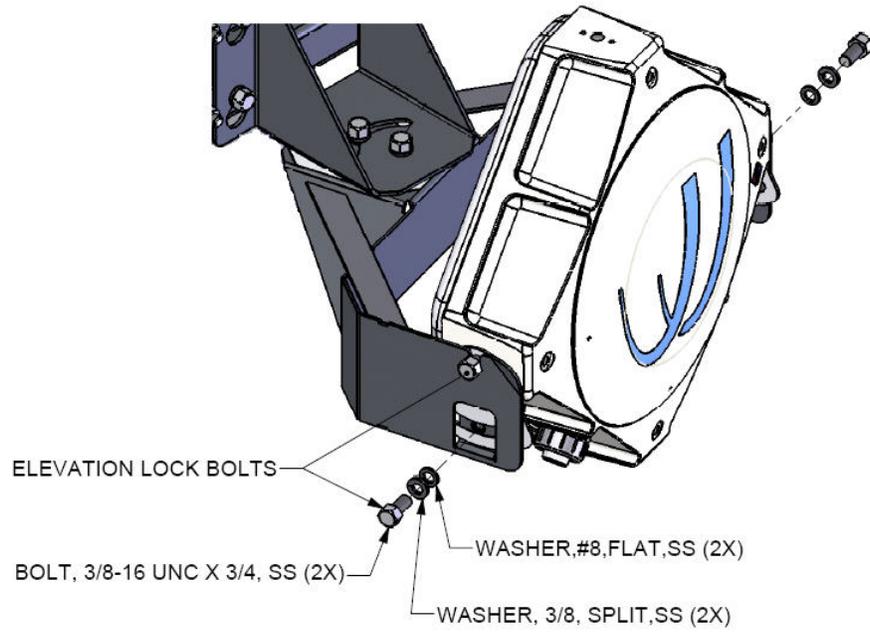
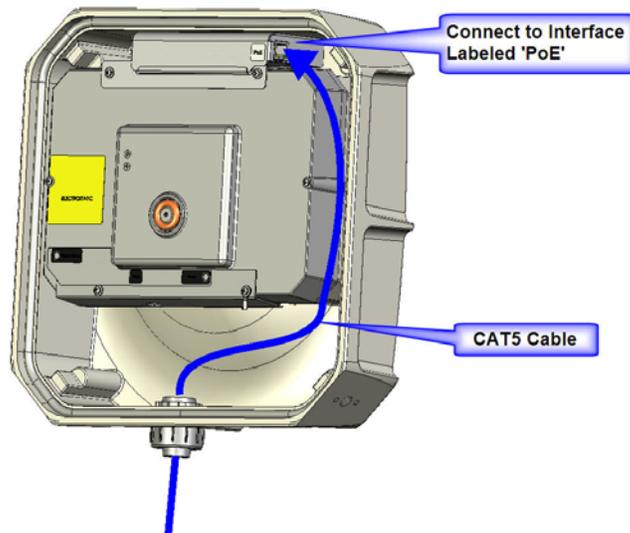


Figure 3-10: Attaching Radio to Yoke Mount Bracket

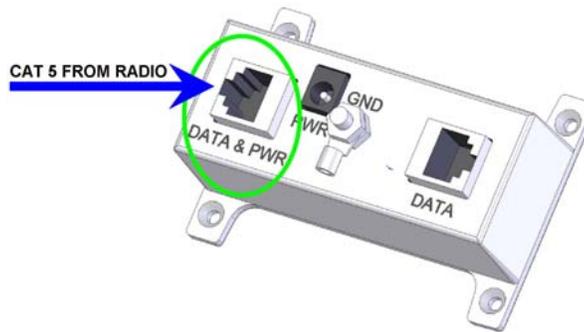
4. Perform steps 1 –3 on both ends of the link.

3.6 Cable Installation

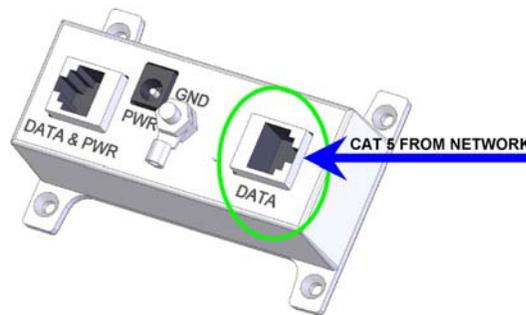
1. Install grounding for the radio unit. The preferred method for grounding the radio unit is to ground the mast (or wall-mount bracket) to a ground source, since this provides the largest grounding surface contact possible. If this is not possible, then use the following procedure:
 - A. Attach the lug of a 10 AWG ground cable to the radio at one of the two #8 holes at the bottom of the enclosure using a #8-32 bolt, #8 lock washer and #8 flat washers (not provided).
 - B. Connect other end of the ground cable to a nearby building exterior ground location.
2. Run a Cat 5 cable from the SLE100 radio unit to the indoor location where the PoE Injector will be installed.
3. Connect the Cat 5 cable to the interface labeled “PoE” on the radio unit.



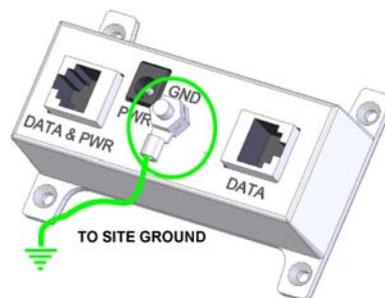
4. Install the PoE Injector in the desired indoor location and connect the Cat 5 cable coming from the radio unit to the interface labeled “Data & PWR”.



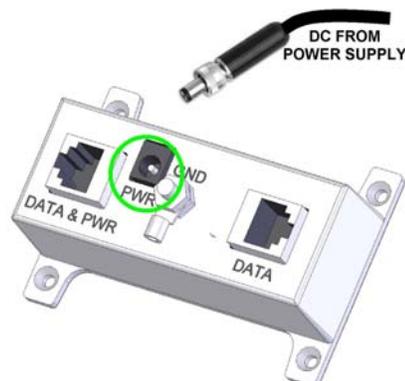
5. Next, connect the interface labeled “Data” on the PoE Injector to the network device that will interface with the SLE100.



6. Connect the site ground to the terminal labeled “GND” on the PoE Injector.

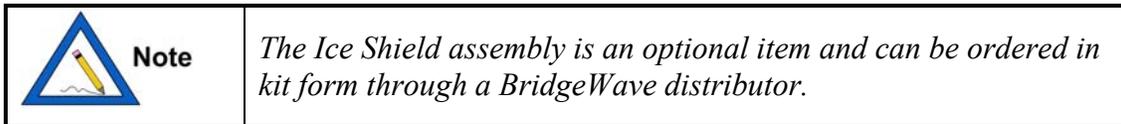


7. Connect the DC plug end of the Power Supply to the receptacle labeled “PWR” on PoE Injector.



8. Plug the AC cord into the power supply and connect to the local AC power. The radio will turn on.
9. Check the radio 'Power' LED status for a green indication. If green the radio is powered on and is ready for alignment.

3.7 Optional Ice Shield Canopy Installation



3.7.1 Introduction

In northern climates, the buildup of ice or snow on antennas can be a problem for millimeter wave radio installations. These problems are twofold: the electrical effect of snow and ice built up on the antenna's radome; and the mechanical impact of the additional weight of the snow or ice on the antenna and supporting structure.

The formation of ice or snow on the antennas radome can cause attenuation of the signal to the point where the link may become severely degraded or unusable. Uneven ice buildup can cause scattering of the signal, which in turn results in standing waves.

Ice layers are not likely to exist for extended periods, as ice tends to melt. In cold climates when the radome is below freezing temperature, ice does not stick to it, thus there is no issue. However in mixed rain-snow-ice storms, ice can stick to the radome, causing the link to operate at less than its optimal design.

Once the ice has hardened and freezes, the added weight of the ice on the antenna increases the wind load on the tower or mast, which may cause premature failure of the mounting structure. As ice breaks apart due to melting, or via its own weight, these large and heavy sheets falling down a tower or mast can cause damage to antennas or other objects mounted below.

BridgeWave provides an ice shield kit, designed to combat the buildup of ice on BridgeWave's wireless bridges. These inexpensive ice shields are easily fitted on the radios during the installation process.

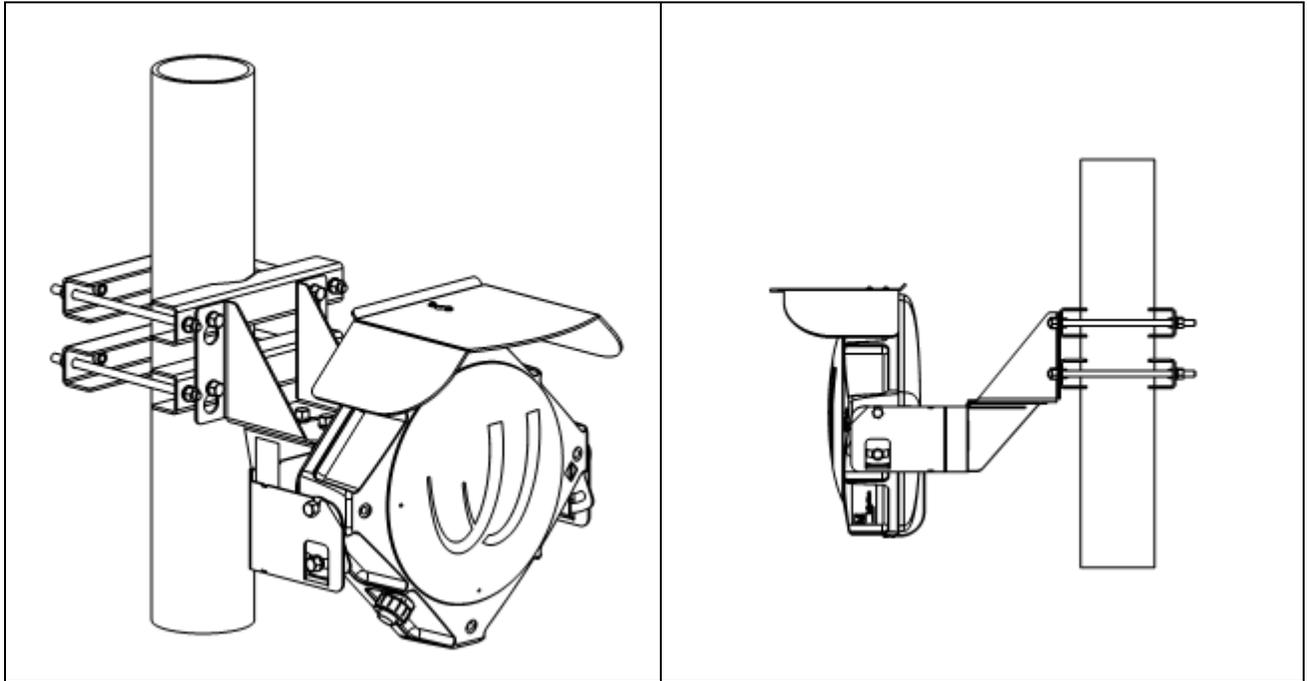


Figure 3.7.1-1: 60 Ice Shield

3.7.2 Optional Kit

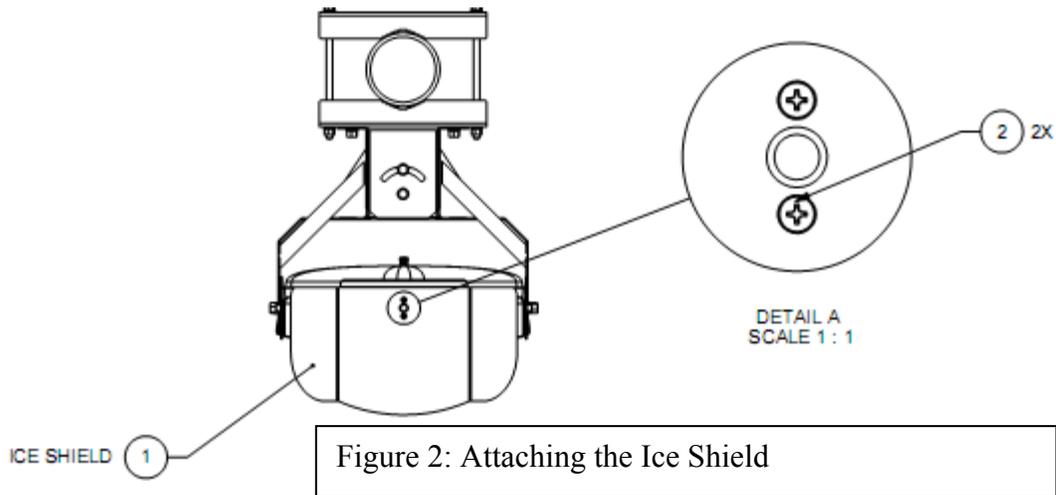
The part number for this kit is 515-00913

Refer to the table below for the kit required for your particular application. Each kit contains the necessary materials for the installation of the ice shield on one radio. Two kits are required per link.

Qty:	Description:
1 ea.	Ice Shield Canopy
2 ea.	8-32 x 1/2" Screw

3.7.3 Installation Instructions

1. Remove the protective liner from the canopy (if desired)
2. Remove the "O" bolt if equipped
3. Use the supplied screws to attach the Ice Shield to the radio

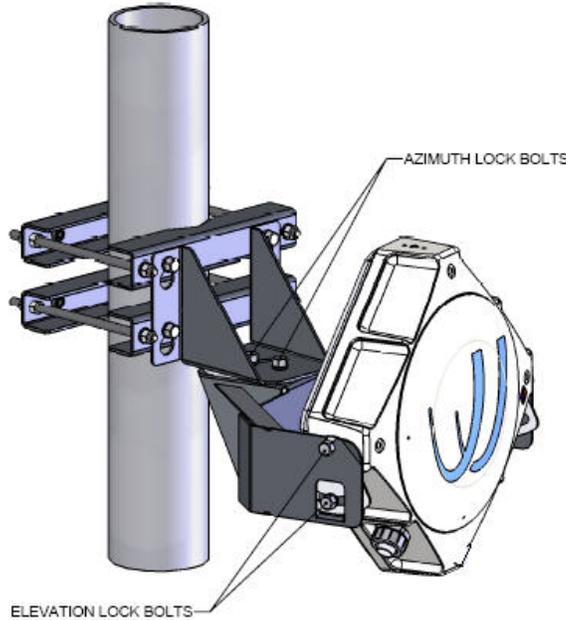


4. Re-install the “O” bolt.

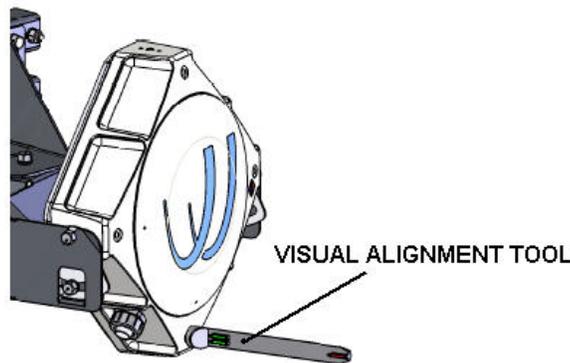
 Note	<i>Remove canopy when its not snowing to reduce antenna wind loading</i>
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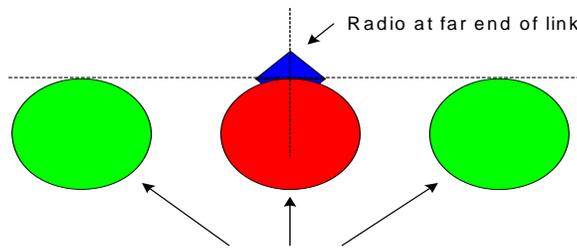
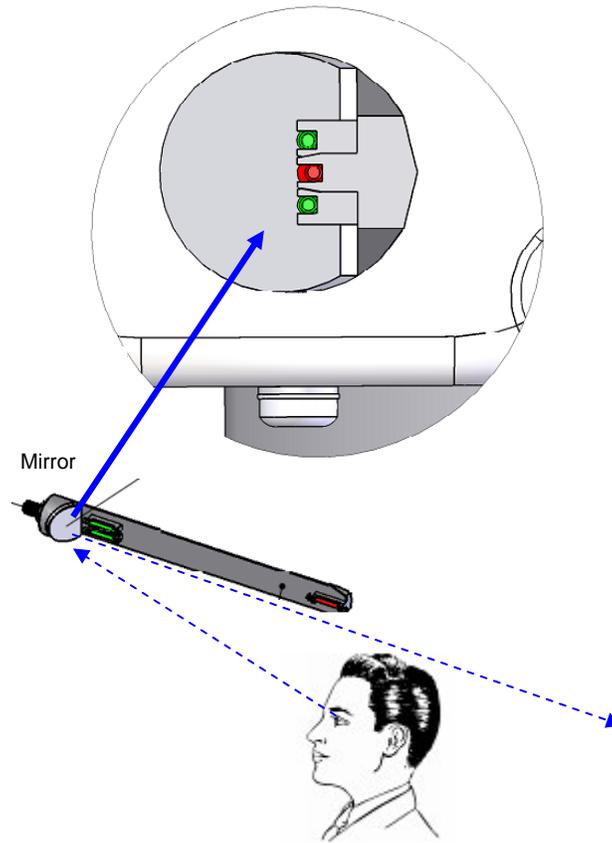
3.8 Antenna Alignment

1. Tighten the mounting bracket azimuth and elevation lock bolts just enough to allow the radio to pivot up/down and right/left with minimal effort. Tilt the radio so that it roughly points towards the other end of the link.



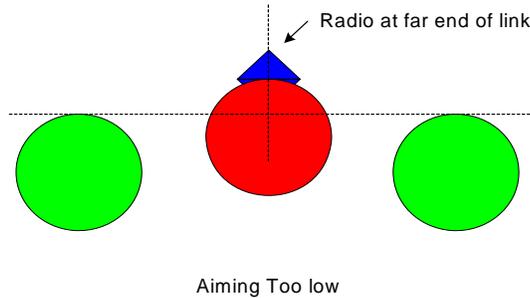
2. Thread the Visual Alignment Tool (VAT) into one of the four holes in the front (antenna) face of the radio **so that the o-ring just touches the radio face**. The VAT is used to roughly orient (align) the radio in the correct direction. Select the hole that allows the most convenient viewing of the other end of the link. The best viewing is achieved with your eye about 13 inches (33cm) from the VAT mirror. Move the radio such that it is aimed at the point tangent to the top of the red indicator when all three indicators (green/red/green) are in a line with equal gaps between the indicators.





The alignment aids need to be in a straight line.
Target, other radio, is placed at top of middle aid.

Right



Wrong

6. Verify Link Up LED's are lit solid on both radios.
7. Slightly rotate each radio up/down and left/right to find the maximum RSL voltage reading. [Note that the width of the center beam is only 1.4 degrees and the first side-lobe beam is only 2.5 degrees off from center.] Set the radio in the position that results in the highest RSL voltage reading. *See Section 3.9 to determine the proper use of the supplied test cable in order to read the RSL voltage.*

 <p>Note</p>	<p><i>Verify that the RSL voltage falls within the expected range based on the graph in Appendix B.</i></p>
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8. Begin to tighten the mounting bolts. It is important to tighten the bolts in the following order. First start with the bolts that control the left/right movement of the radio. These are the bolts on the yoke portion of the mount behind the radio. Start by tightening the bolt closest to the pole or wall. Once this is tightened, move to the bolt directly in front of the bolt you just tightened and slowly tighten this bolt. While tightening the bolts be careful that the radio does not move during the process. As these bolts are tightened up/down movement of the radio may occur due to the seating of the mounting bracket and radio yoke. Check the RSL voltage reading to ensure it is still at its maximum level, and adjust vertical tilt if required. Next, tighten the bolts that allow the up/down movement of the radio. First tighten the lower bolts on both sides of the yoke bracket. Once the lower bolts are tightened on both sides of the radio, tighten the upper bolts.
9. Repeat steps 1 to 8 for the peer radio.
10. Connect to the web management interface of each unit and perform an Auto-Calibration from the 'Maintenance' page on one end of the link at a time.
11. After both ends of the link are calibrated check the quality voltage using the test cable and a voltmeter and confirm it indicates 3.3V on each end of the link (i.e., error free).
12. Remove the VAT from the radio, replace the back plastic cover and hand tighten the back cover nut to the point where the back cover stops (i.e., when it hits the metal ring on the back metal plate). The installation is now complete.

 Note	<i>These instructions can also be found on the radio's back cover.</i>
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3.9 QUAL & RSL Test Cable

The alignment procedure is optimized through the use of the provided test cable. The test cable is designed for use with a digital voltmeter (not provided) to read the Link Quality and Receive Signal Level (RSL) voltage generated by the radio's receiver.

The Test Cable contains three banana plugs on one end that provides one common lead, one RSL, and one Qual lead. This is depicted in Figure 3-11.

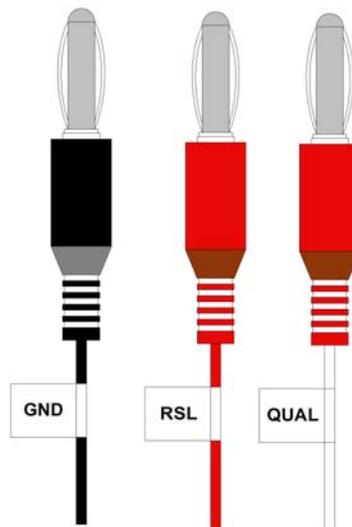


Figure 3-11 RSL & Qual Test Leads

A single plug is provided on the other end of the test cable. The single plug connects to the port labeled 'Test' on the radio unit. This test point is shown in Figure 3-12.

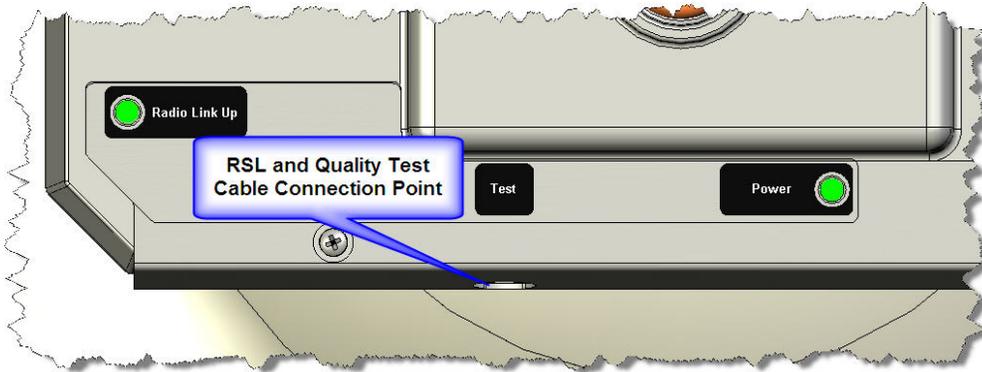


Figure 3-12: RSL and Quality Test Cable Connection Point

The voltmeter should be set to DC voltage and the x 20 setting. The expected RSL level is dependent on the distance between the two radio terminals. A chart is provided in Appendix B.

The quality voltage provides an indication of how well the link is performing and is described in the graph and detailed description below.

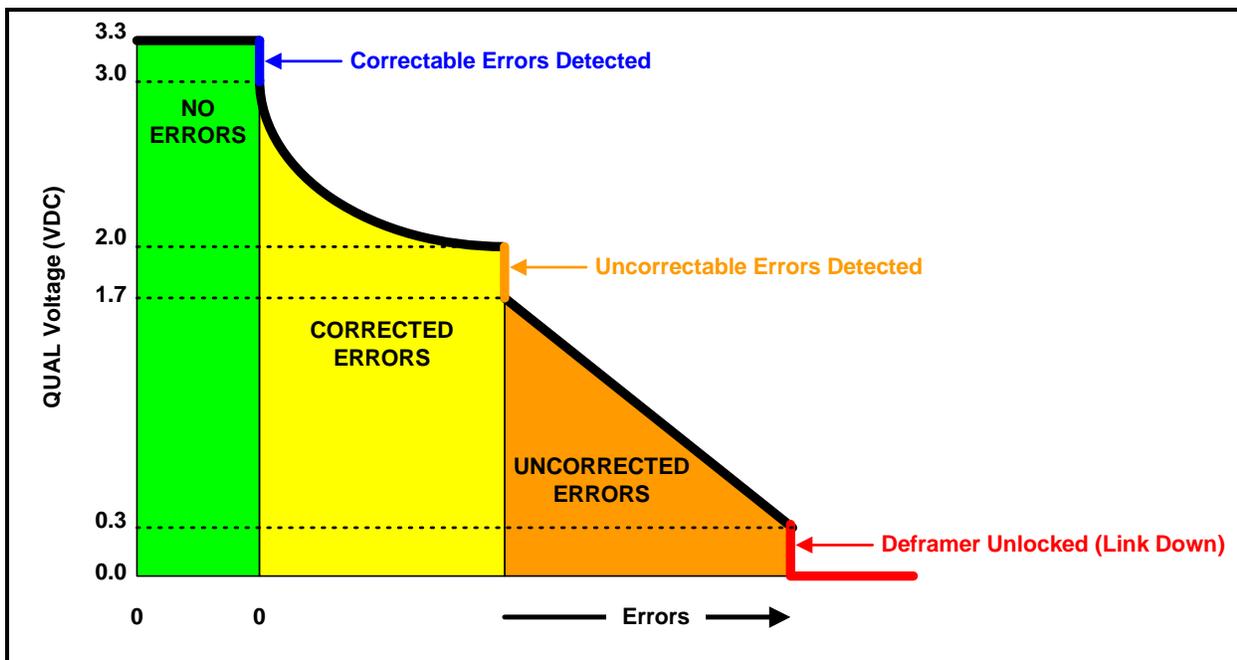


Figure 3-13 Quality Voltage Graph

- Quality Voltages between 3.0V and 3.3V indicate an error-free wireless link.
- Quality Voltages between 1.5V and 3.0V indicate a low rate of errors that the forward error correction will correct. The lower the voltage, the more errors are being corrected.

- Quality Voltages between 0.5V and 1.0V indicate excessive errors in the wireless link that can not be corrected by the FEC. To indicate this change in error performance, the quality voltage will drop from 1.5V to 1.0V in a single step.
- Quality Voltages below 0.5V indicate an unlocked deframer condition. This will be recognized as a link-down condition.

The following procedure can be used to check the RSL and quality voltages:

1. To read the RSL value (between 0 and 3.3V), insert GND (ground) and RSL banana plugs into the voltmeter. Note the RSL voltage. The voltage may be fluctuating; in this case, note the maximum value seen.
2. To read the Link Quality value of the radio, insert GND (ground) and QUAL banana plugs into the voltmeter. Note the Link Quality voltage. After an Auto-Calibration has been performed from the 'Maintenance' page of the web interface the quality voltage should read 3.3V if the link is aligned on the main antenna beam and there are no obstructions (i.e., trees, buildings, etc...) in the path, the link distance is within the operating parameters of the radio, and it is not raining heavily.

The SLE100 has been designed to require only minimal user configuration. To perform the configuration of the Network Management System follow the instructions in the Network Management manual.

During normal operation, the following conditions should exist at the radio:

- The power LED should be lit—solid green;
- The Link Up LED should be lit—solid green;
- The Link Quality BER voltage should be 3.3v, although dips in voltage are acceptable during periods of significant rain.
- Observe the 10/100Base-T LEDs on the interface labeled PoE at each side next to socket opening. The left one should be green if connected (link up) and the right will be flashing yellow when there is data traffic. [The picture does not show the 10/100Base-T connector or LEDs]

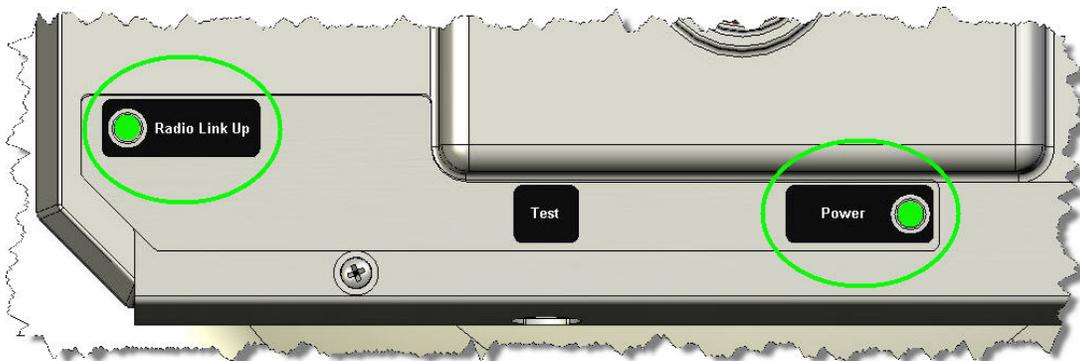


Figure 3-14: Radio Link Up and Power LED's

4 Configuring Network Equipment

The networking equipment that is connected to the SLE100 should first be checked to ensure it operates properly over a wired connection.

We recommend the network equipment on both sides of the link be configured as follows:

- Port auto-negotiation turned on
- Port configured to not enter *error-disable* state due to multiple link up/down transitions (since these may occur during periods of heavy rainfall)

 Note	<i>The radio's 10/100Base-T port is permanently set to auto-negotiate.</i>
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4.1 Network Port Statistics

Verify, if possible, the following on the user's network equipment (connected to the radios), in addition to verifying these values using the radio's Network Management System:

- Link integrity
- There are no receive errors on the link
- Network traffic is flowing in both directions.

 Note	<i>The radios support all standard Ethernet frame sizes, up to 1632 bytes for un-tagged or 802.1q VLAN-tagged frames.</i>
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Appendix A: Troubleshooting

The following table provides a summary of possible problems you might encounter while installing a BridgeWave SLE100 link, along with possible causes and their solutions.

 <p>Note</p>	<p><i>Extensive troubleshooting support and knowledgebase articles are available at the BridgeWave eSupport knowledgebase online at: http://bridgewave.com/support/kbrma.htm</i></p> <p><i>Contact BridgeWave support to obtain a login account by sending an email to support@bridgewave.com</i></p>
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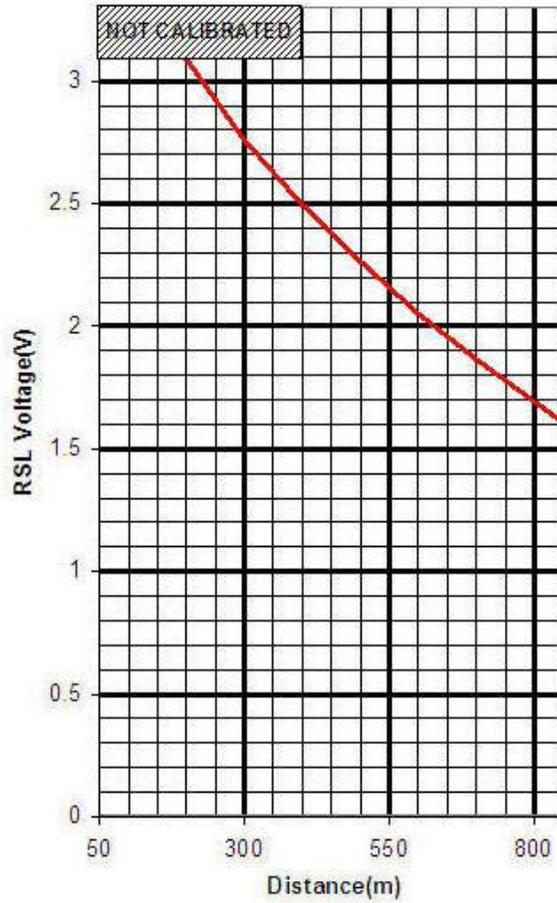
Problem	Possible Cause	Resolution
No power to radio	Wrong polarity of supply voltage	Use a DVM to determine the polarity and voltage on the DC cable at the PoE Injector.
	AC to DC adapter FUBAR	Check input and output voltages to/from the AC-DC power supply
	Incorrect wiring of CAT5 Cable	Check wiring pinouts
Copper interface light not lit at radio and/or network equipment.	Error in the configuration of the networking equipment	Verify the configuration of the network equipment is consistent with radio unit's copper port settings. The radio unit is set for auto-negotiation only.
	Incorrect wiring of CAT5 cabling	Check wiring pinouts
RSL voltage lower than expected	Incorrect calculation of link distance	Verify that the calculation tool used and the GPS used both use the same annotation system (degree hours minutes seconds or degree with a decimal value)
	Antennas aligned on side lobes	Use Visual Alignment Tool to verify direction of antennas.
	Radios set to different polarizations	Verify that both radios are set to the same polarization. (See section 3.4)
	Installed two high or low band radios in one link	Verify that one end of the link is high and the other end is a low band radio (See Section 3.5)
	Link exceeds maximum specified range	Verify path distance is no longer than ½ mile (800 meters)



Low link quality voltage Wireless link established but no data transfer over the link	Antennas are not aligned for maximum RSL	Use the Visual Alignment Tool and voltmeter to verify antenna alignment.
	Auto-calibration not completed	Force an Auto-calibration from the 'Maintenance' page.
	Interference	Check for possible interference by turning off the radio at the other end of the link or muting its transmitter and verify the RSL voltage on the local site drops below 0.2V.

Appendix B: RSL Voltage vs. Distance

Align Antenna to Max voltage and confirm RSL is above the Min value shown based on the link distance.



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