WS-410AD Metro Access Point Installation Guide

June 2007

Copyright Notice

FCC Notice to Users and Operators

This equipment has been tested and found to comply with the limits for a digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense. (If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to correct the interference by using one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.

Contents

CHAPTER 1

About This Guide

Preface

This guide details the Wavion WS-410 installation procedures. The intended audience of this document is trained technical professionals.

Conventions

The exclamation point within a triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the product.

The lightning flash with an arrowhead symbol within a triangle is intended to alert the user to the presence of uninsulated dangerous voltage within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.

The notebook is intended to alert the user of a note containing further information.

Contacting Technical Support

For technical support, contact Wavion using these methods:

Address:	Wavion Technical Support Wavion Inc. 1190 Saratoga Avenue San Jose, California 95129 USA
Telephone:	+1-408-261-7000
Fax:	+1-408-261-7001
Email:	support@wavion.net
Web:	www.wavion.net

CHAPTER 2

Introduction

The WS410 is a new category of Wi-Fi Access Point designed from the ground up for metro-Wi-Fi deployments. It is based on six antennas and radios and custom-built ASICs, utilizes Wavion's powerful multi-antenna signal processing technologies, and provides significant performance gains to off-the-shelf 802.11 standards-based Wi-Fi clients.

The WS410 may be mounted on streetlights or rooftops and may be easily interfaced with either wired internet connections, wireless mesh or backhaul equipment. Multiple power options are provided for maximum flexibility.

Complete management of the WS410 is provided through SNMP, a graphical user interface, and SYSLOG services.

The WS-410 Wi-Fi Access Point uses six omni-directional antennas and beam-forming technology in order to provide significant performance gains to off-the-shelf 802.11 standards-based Wi-Fi clients.

CHAPTER 3

Installing the Wavion WS-410 Metro Access Point

This guide explains how to safely install the Wavion WS-410 Metro Access Point. The following topics are covered in this chapter:

Important Safety Instructions

WARNING: It is illegal to modify the construction of this product. Modifying the operating frequency or enhancing the transmit output power through the use of external amplifiers or other equipment is specifically disallowed by the "Telecommunications Act."

WARNING: This device is for outdoor or indoor use with conditions that no harmful interference to authorized radio stations results from the operation of this device. This device shall not influence aircraft security and/or interfere with legal communications as defined in the "Telecommunications Act." If this device is found to cause interference, the operator of this equipment shall cease operating this device immediately until no interference is achieved.

NOTE: This device must be installed by a trained professional, value added reseller or systems integrator who is familiar with RF planning issues and the regulatory limits in the United States of America.

CAUTION: Read and save these instructions. Heed all warnings. Follow all instructions.
CAUTION: Do not defeat the safety purpose of the grounding. Only use attachments/ accessories specified by the manufacturer.

CAUTION: Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way. For example, if the power-supply cord or plug is damaged, liquid has been spilled on the apparatus, objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, it does not operate normally, or has been dropped.

WARNING: Risk of personal injury or death when installing this device! There is a risk of personal injury or death if the WS-410 antennas come near electric power lines. Carefully read and follow all instructions in this manual. By nature of the installation, you may be exposed to hazardous environments and high voltage. Use caution when installing the outdoor system.

WARNING: This apparatus must be connected to earth ground.

WARNING: Do not open the unit. There is a risk of electric shock inside.

CAUTION: You are cautioned that any change or modification not expressly approved in this manual could void your authority to operate this equipment.

CAUTION: There are no user-serviceable parts inside. All service must be performed by qualified personnel.

CAUTION: The RJ45 connectors of your Wavion WS-410 may source DC power on pins 4,5 and 7,8. The IEE 802.3 standards allow for pins 4,5 and 7,8 to be used for Power Over Ethernet. Some products may be incompatible with the Wavion Power Over Ethernet capability.

CAUTION: Only UL listed parts and components will be used for installation. Use UL listed devices having an environmental rating equal to or better than the enclosure rating to close all unfilled openings.

CAUTION: To maintain Overvoltage (Installation) Category II, install a suitable surge suppressor device in the branch circuit to limit expected transients to Overvoltage Category II values. The limits are based on IEC60664 and are also located in Table 2H of UL60950 (for mains 110V, the transient rating is 1500V).

CAUTION: The WS-410 must be installed only with the equipped antennas.

CAUTION: A minimum distance of 40cm from the WS410's antenna should be kept when the system is operated.

CAUTION: Read and save these instructions. Heed all warnings. Follow all instructions.

Preparing for Installation

The Wavion WS-410 must be installed by a trained professional, or systems integrator who is familiar with RF planning issues and regulatory limits as defined by the governing body of the country in which the unit will be installed.

The following lists the equipment required for installation and explains how to prepare the installation site.

WARNING: Do not modify the construction of this product. Modifying the operating frequency or enhancing the transmit output power through the use of external amplifiers or other equipment is illegal.

WARNING: This device is for use outdoors or indoors on the condition that operation of this device causes no harmful interference to authorized radio stations. This device shall not influence aircraft security and/or interfere with legal communications. If this device is found to cause interference, the operator of this equipment shall cease operating this device immediately.

Installation Hardware and Tools

Wavion provides the following accessories to install the Wavion WS-410:

- One pole bracket
- Two 3-6-inch diameter worm drive hose clamps
- Seven 8mm stainless steel hex head machine bolts

You must supply the following tools:

- Allen wrench - 4mm and 5mm
- 1/4-inch flat blade screwdriver
- Wood brace mounting only: four 5/8-inch diameter, 3-inch long lag bolts

Choosing a Location

The Wavion WS-410 is a radio device and susceptible to interference that can reduce throughput and range. To ensure the best performance follow these guidelines:

- Direct line-of-sight operation is preferred.
- It is recommend not to install the WS-410 near devices operating in the 2.4 GHz frequency range.

Preparing the Site

When installing the Wavion WS-410, you must follow the appropriate electrical and building codes to ensure sage and durable wiring. Follow the National Electrical Code (NEC) requirements, unless local codes in your area take precedence over the NEC code. For installations that have 10/100 Base-T Category 5 network cables attached to the Wavion WS-410, there is a distance limit of 100m maximum between devices for 10/100BaseT operation.

Please refer to standards for building entrance protection.

Power Source Options

The Wavion WS-410 supports the following options for connecting to a power source:

- AC power source (3-wire service) — 3W(P+N+PE) or 3W(2P+PE); 110-220 VAC, 50/60 Hz. See Chapter 7: Installation Accessories on page 53 for details.

WARNING: 480 VAC power source is supported by a WS-410 unit only by using a special street light step down power tap. See Chapter 7: Installation Accessories on page 53.

- NEMA plug, for streetlight photoelectric control power tap (2-wire service) —2W(2P) or 2W(P+N); 100-240 VAC 50/60 Hz. See Chapter 7: Installation Accessories on page 53 for details.
- The WS-410 can be powered by a Wavion Injector connected to Ethernet port B (ETH B). See Chapter 7: Installation Accessories on page 53 for details.

WARNING: Use only a rated power source to connect the AC powered outdoor system. Do not connect to a power source of different voltage.

CAUTION: You must always install an external grounding wire. You must also ground the outdoor data protection device to a bonded pipe or ground rod. Perform a simple continuity check between the WS-410 and the ground termination point to confirm. Make sure that grounding is complete before you connect power to the Wavion WS-410.

Safety Precautions

Installing the Wavion WS-410 can be very hazardous. Take precautions to avoid the following:

- Exposure to high voltage lines
- Contact with AC wiring
- Injuries from dropped tools and equipment
- Falls when working at heights or with ladders

Mounting Strategies

Consider the available mounting structures and antenna clearance when choosing a mounting location. The Wavion WS-410 should always be mounted with the top of the unit parallel to the ground, and with the antennas pointing upward and clear of obstruction.

It is recommended to attach ground and data cables to the WS-410 prior to mounting. Before mounting the WS-410, read the wiring instructions in Grounding the Wavion WS-410 on page 22 and Connecting a Data Port on page 32.

NOTE: The WS-410 should be mounted with at least 4 ft of clearance around the antennas to eliminate potential interference from the mounting structure.

Figure 3.1. demonstrates acceptable options for mounting on a streetlight. In both cases the WS-410 is mounted to ensure clearance for the antennas above the height of the streetlight.

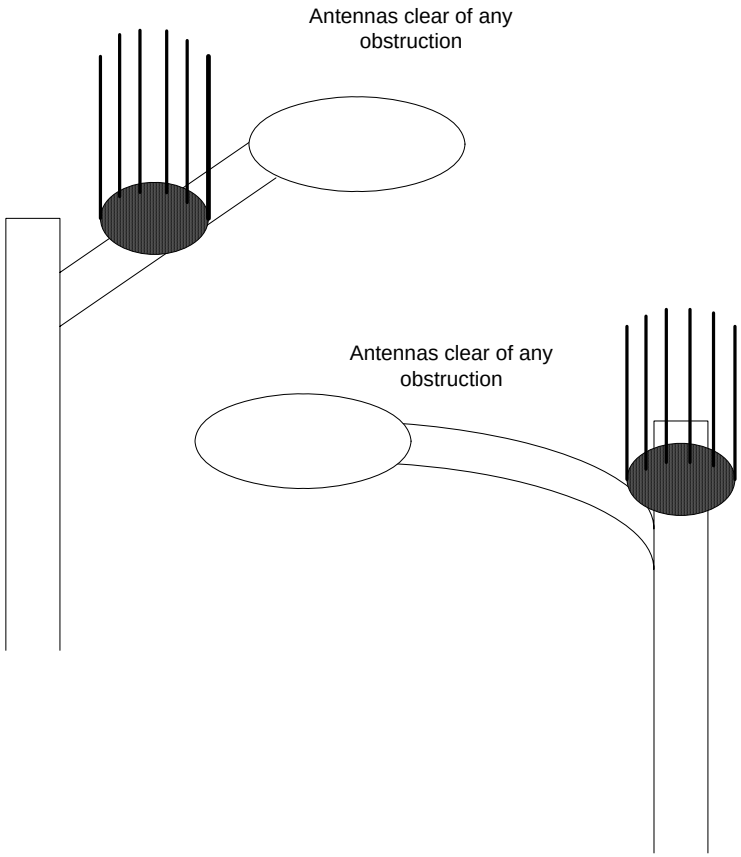


Figure 3.1. **Example Mounting Locations on a Streetlight**

Using Hose Clamps

Hose clamps are used by the mounting assembly to secure the WS-410 to the mounting structure. Figure 3.2 demonstrates how to correctly use the hose clamps. The bands must be threaded through slots in the pole bracket, and then attached to either a vertical or a horizontal pole and tightened.

There are three slots inside the pole bracket that can used to thread each hose clamp. Choose the slot that is appropriate for the size of the pole.

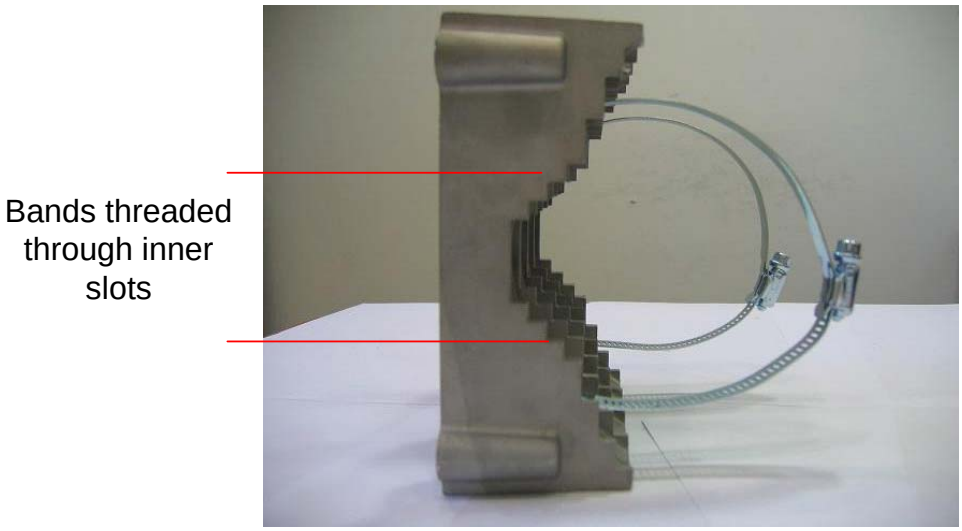


Figure 3.2. **Using Hose Clamps**

Mounting on a Pole, or Streetlight

The following explains how to mount the Wavion WS-410 on a pole, tower, or streetlight. It is recommended to mount the WS-410 on aluminum or galvanized steel structures.

NOTE: The Wavion WS-410 must be mounted with the top of the unit parallel with the ground and with the antennas pointing upward.

NOTE: Before mounting the WS-410, read the wiring instructions in Grounding the Wavion WS-410 on page 22 and Connecting a Data Port on page 32.

NOTE: Mounting to wood, concrete, or painted poles requires primary grounding for the unit. Check the national electrical codes in your area for specific rules.

Metal or Wood Pole Mounting

Figure 3.3 shows the correct way to mount the Wavion WS-410 on an outdoor metal or wood pole.

NOTE: Antennas must be higher than the top of the pole and clear of any obstructions.

Figure 3.3. **Mounting on a Pole**

To mount the Wavion WS-410 on a metal or wood pole

1. Choose a mounting location. You can attach the WS-410 to any pole or pipe with diameter of 3-10 inches.
2. Slip the bands of the hose clamps through the inner slots of the pole bracket. Choose the slot that is appropriate for the diameter of the mast.
3. Use the hose clamps to fasten the pole bracket to the pole.

NOTE: The hose clamps supplied support a mast diameter of 3-6 inches. You can supply your own hose clamps if you need a different size.

4. Attach the back plate to the hose bracket as labeled #1 in Figure 3.4

5. Insert the six flathead bolts into the holes in the back plate labeled #2 in Figure 3.4 and tighten.

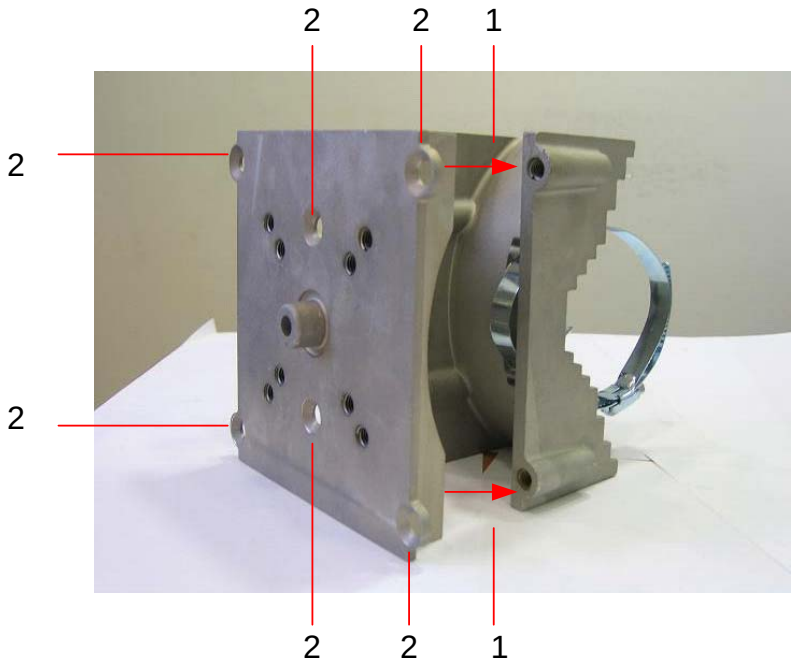


Figure 3.4. **Attaching the Back Plate to the Pole Bracket**

6. Attach the tray to the back plate as shown in Figure 3.5.

NOTE: The tray must be parallel to the ground. The tray can be rotated to obtain the correct position.

7. Insert the four 8mm stainless steel hex head bolts into the tray as shown below and tighten. Use a 5mm Allen wrench to tighten the bolts.

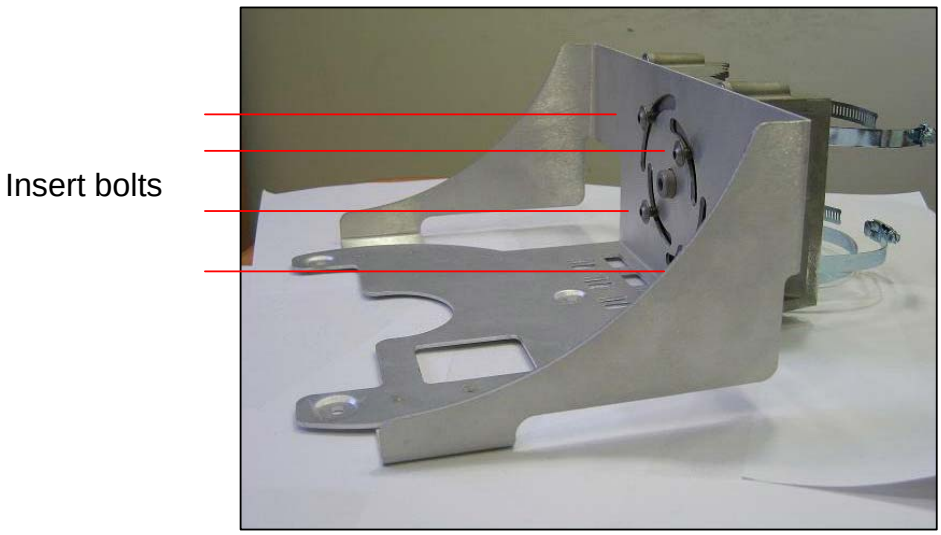


Figure 3.5. **Attaching the Tray to the Back Plate**

8. Slide the WS-410 onto the tray. Insert three 8mm stainless steel hex head bolts from underneath the tray into the WS-410. Use a 5mm Allen wrench to tighten the bolts.

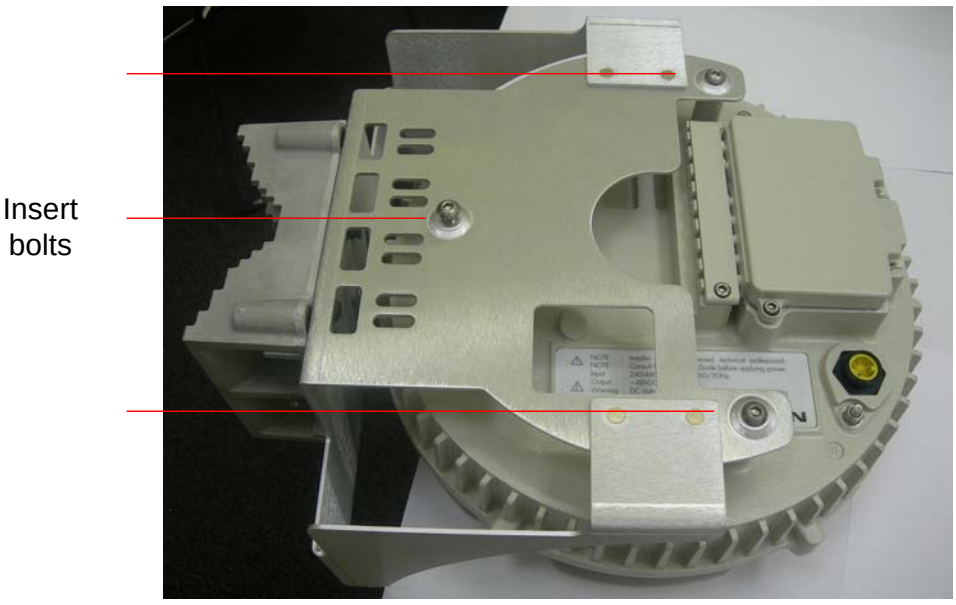


Figure 3.6. **Attaching the WS-410 to the Tray**

To continue installing the WS-410, see Grounding the Wavion WS-410 on page 22

Wood Brace Mounting

You can mount the tray directly onto a wood brace without using pole hose clamps.

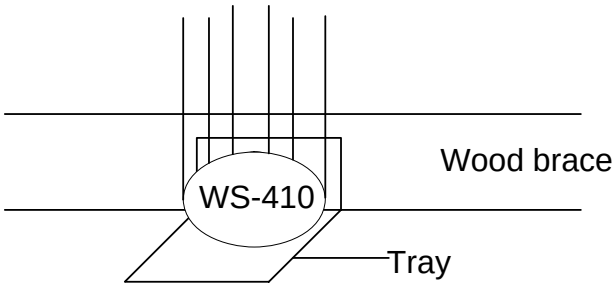


Figure 3.7. **Wood Brace Mounting Option**

You can attach the WS-410 to any wood brace.

NOTE: Before attaching the WS-410 make sure that the wood can support the WS-410 weight plus wind loading. Please see Chapter 9 for wind loading considerations.

To mount the Wavion WS-410 on a wood brace

1. Select a mounting location.
2. Attach the tray directly to the wood brace using four 5/8 inch diameter, 3 inch long lag bolts as shown in Figure 3.8. Use an appropriate Allen wrench to tighten the bolts. Make sure that the wood brace is level.

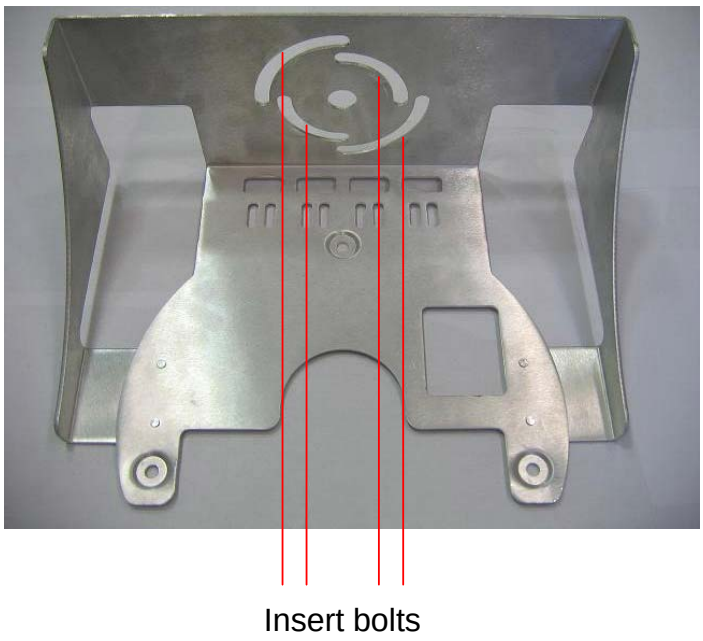


Figure 3.8. **Tray Mount for Wood Brace**

3. Slide the WS-410 onto the tray. Insert three 8mm stainless steel hex head machine bolts from underneath the tray into the WS-410. Use a 5mm Allen wrench to tighten the bolts.

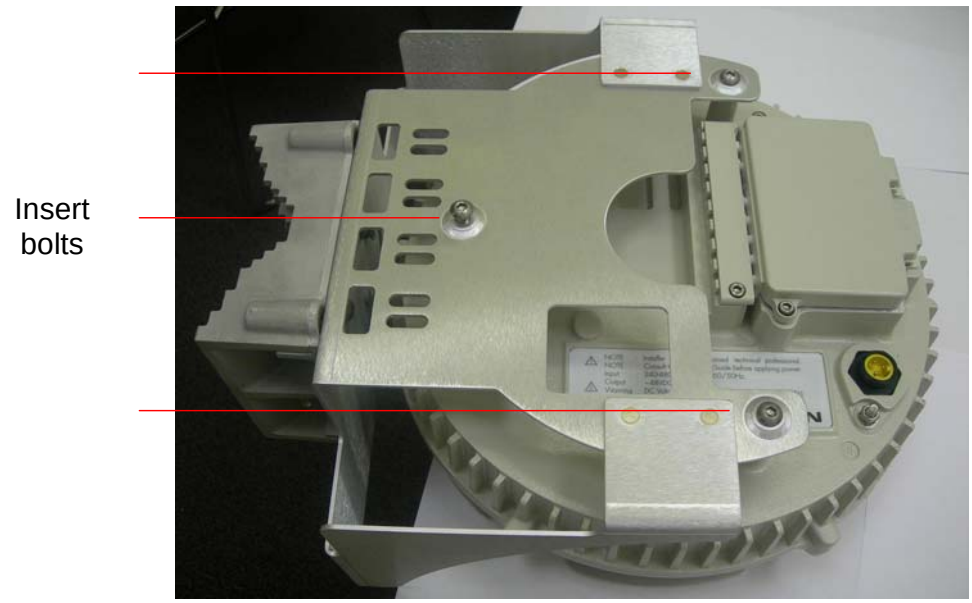


Figure 3.9. **Attaching the WS-410 to the Tray**

To continue installing the WS-410, see Grounding the Wavion WS-410 on page 22.

Streetlight Mounting

You can mount the Wavion WS-410 on the horizontal or angled arm of a streetlight.

To mount the Wavion WS-410 on a streetlight

1. Choose a mounting location. You can attach the WS-410 to any streetlight arm with diameter of 3 to 10 inches.
2. Slip the bands of the hose clamps through the inner slots of the pole bracket. Choose the slot that is appropriate for the diameter of the mast.
3. Use the hose clamps to fasten the pole bracket to the pole.

NOTE: The hose clamps supplied supports a mast diameter of 3-6 inches. You can supply your own hose clamps is you need a different size.

4. Attach the back plate to the pole bracket as labeled #1 in Figure 3.10

5. Insert the six bolts into the holes in the back plate labeled #2 in Figure 3.10 and tighten.

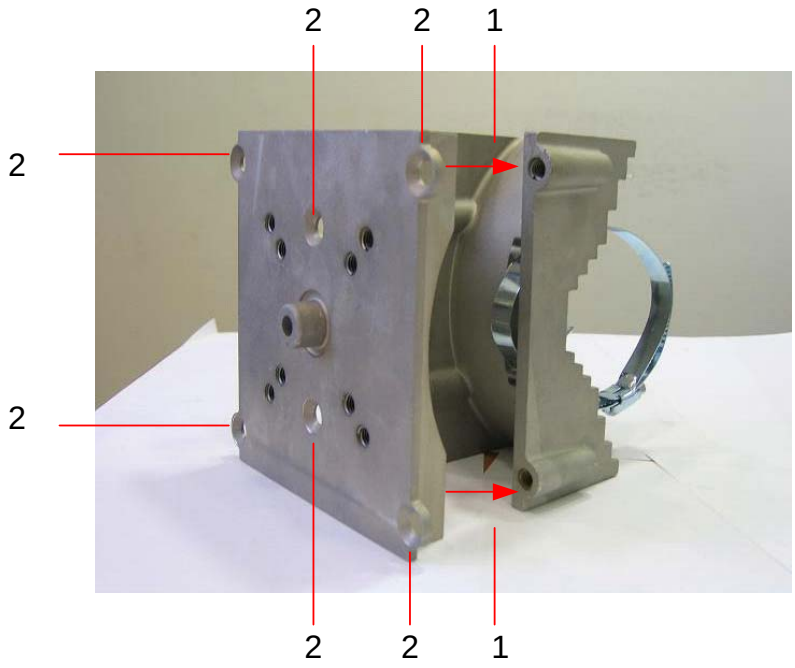


Figure 3.10. **Attaching the Back Plate to the Pole Bracket**

6. Attach the tray to the back plate as shown in Figure 3.11.

NOTE: The tray must be parallel to the ground. The tray can be rotated to obtain the correct position.

7. Insert four 8mm stainless steel hex head machine bolts into the tray. Tighten the bolts using a 5mm Allen wrench.

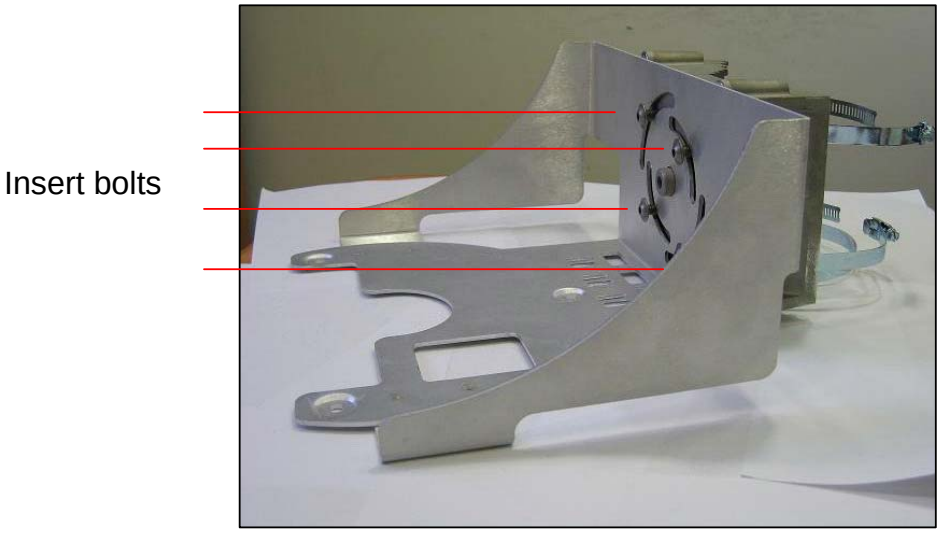


Figure 3.11. **Attaching the Tray to the Back Plate**

8. Slide the WS-410 onto the tray. Insert 3 8mm stainless steel hex head machine bolts from underneath the tray into the WS-410 and tighten the bolts. Tighten the bolts using a 5mm Allen wrench.

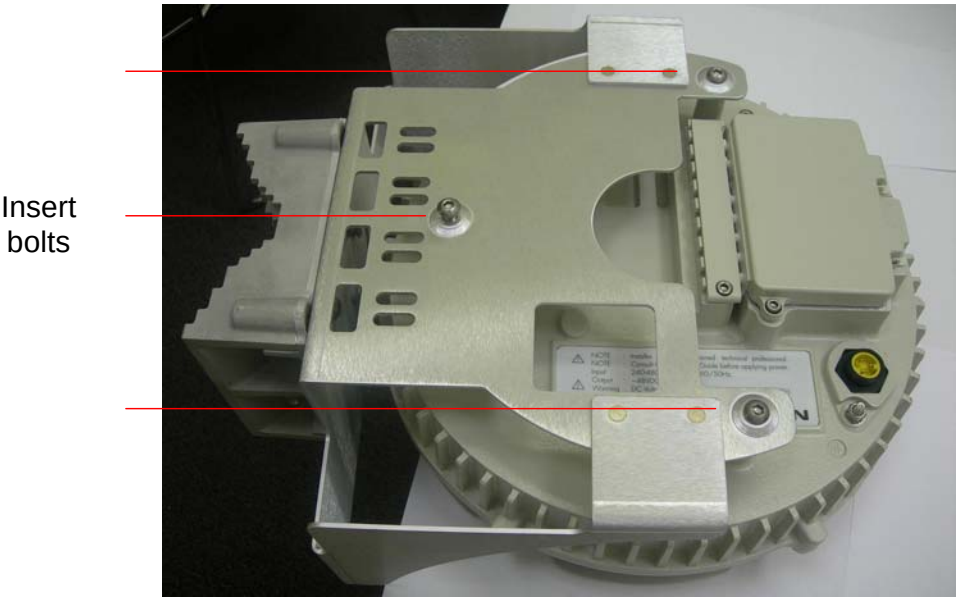


Figure 3.12. **Attaching the WS-410 to the Tray**

To continue installing the WS-410, see Grounding the Wavion WS-410 on page 22.

Grounding the Wavion WS-410

CAUTION: You must always install an external grounding wire. You must also ground the outdoor data protection device to a ground rod or a bonded pipe. Make sure you have completed grounding before you connect power to the WS-410.

The method for grounding the Wavion WS-410 is shown in the figure below.

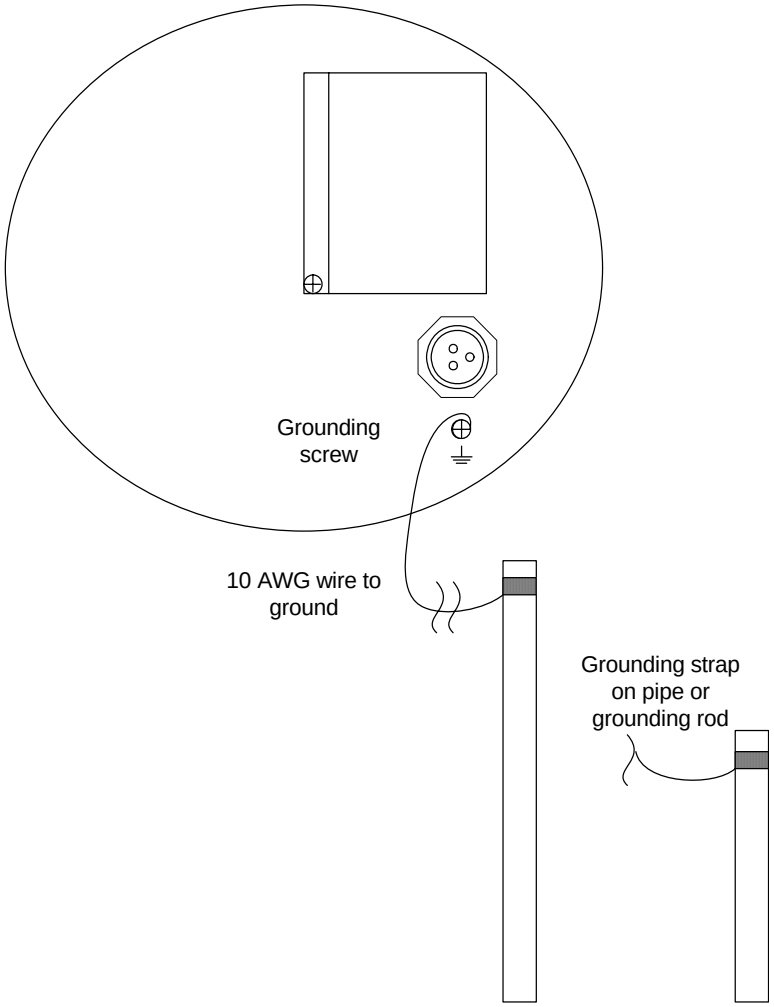


Figure 3.13. **Grounding Method**

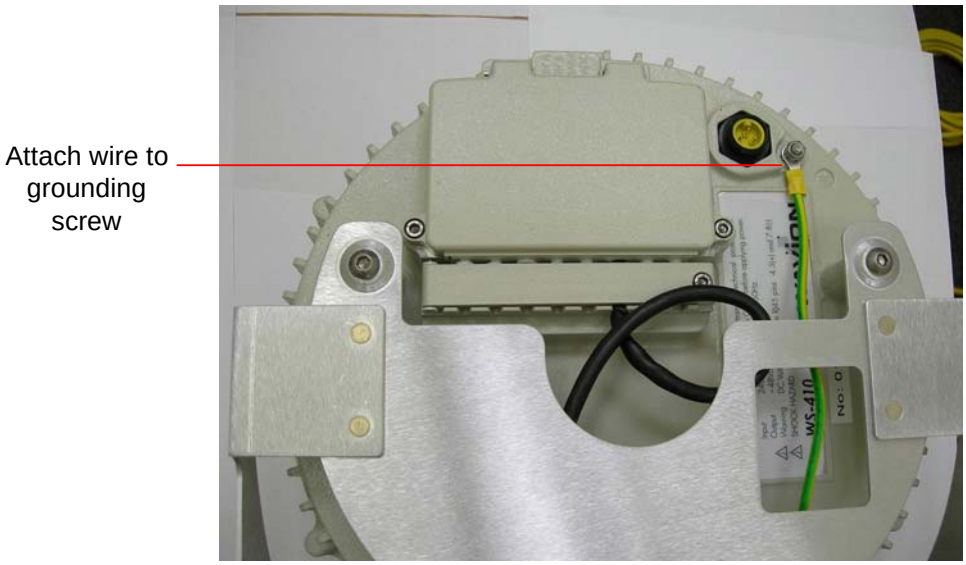
To ground the Wavion WS-410

1. Remove the nut and star washers from the grounding screw.

Figure 3.14. **Grounding Screw**

2. Attach one star washer to the grounding screw.

3. Attach #10 AWG bare copper wire with an M6 terminal ring to the grounding screw.



4. Attach the second star washer and tighten the nut.
5. Attach the other end of the grounding wire to a grounding strap that is attached to a grounded surface or other earth ground (for example, a grounding rod).

Grounding the Data Protection Device

The grounding method for an indoor data protection device is shown in Figure 3.15.

To ground an indoor data protection device

1. Position the protection device as close to the entrance of the building entrance as possible.
2. Attach a length of #10 AWG bare copper wire to the ground post on the data protection device.
3. Attach the other end of the grounding wire to the ground connection of an electrical outlet or a grounded water pipe.

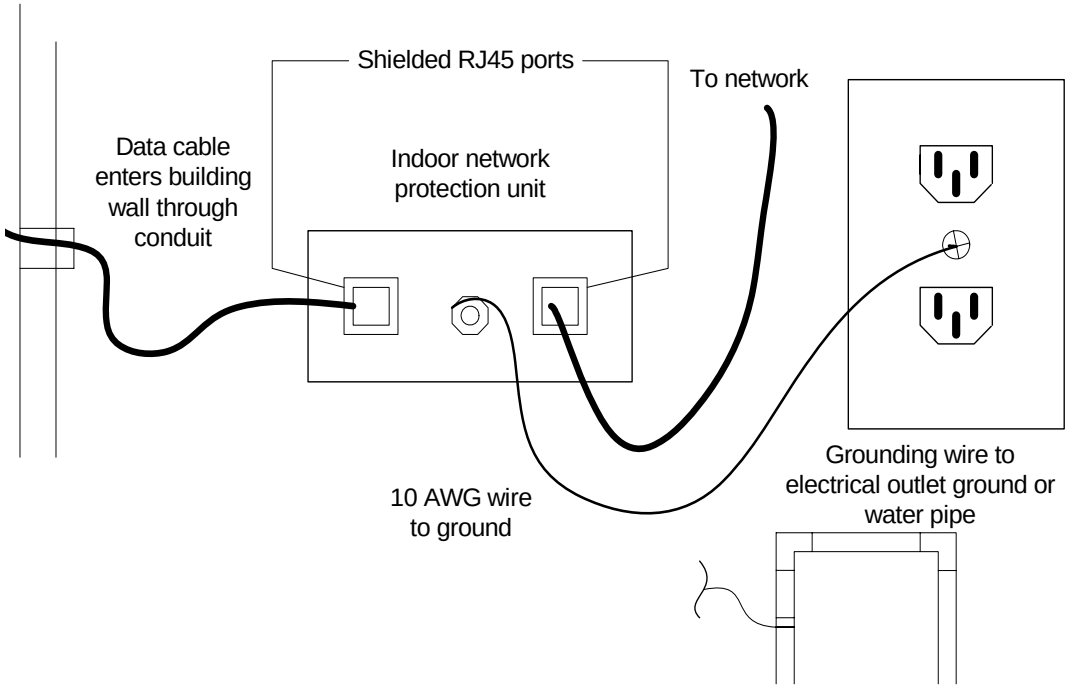


Figure 3.15. **Grounding the Indoor Network Protection Unit**

Connecting Antennas

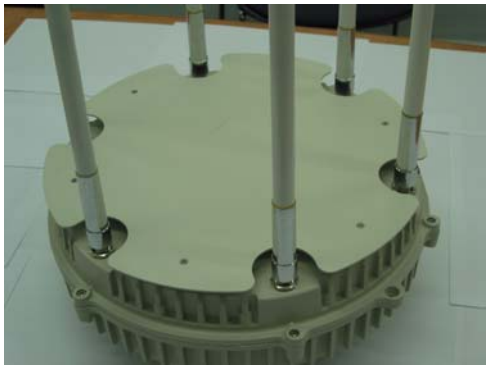
This section explains how to connect the six antennas to the WS-410. In order for the WS-410 to work properly, six antennas must be connected.

Screw each of the 6 antennas into the an N-Type connectors on the WS-410.

Figure 3.16. **Connecting the Antennas**

WARNING: Only connect the unit to the power supply once all the antennas are connected.
WARNING: Use caution when connecting the antennas. Undue haste can damage the unit.
WARNING: Do not screw in the antenna when holding the top section of the antenna. You will most likely damage the antenna.

The successful insertion of six antennas should look as follows.



Connecting Power

The following describes how to connect the WS-410 to power. There are three options for connecting the Wavion WS-410 to a power source:

- AC power source (3-wire service) — 3W(P+N+PE) or 3W(2P+PE); 110-220 VAC, 50/60 Hz. Chapter 7: Installation Accessories on page 53 for details.
- NEMA plug, for streetlight photoelectric control power tap (2-wire service) —2W(2P) or 2W(P+N); 100-240 VAC 50/60 Hz. See Chapter 7: Installation Accessories on page 53 for details.
- Wavion injector connected to Ethernet port B (ETH B). See Chapter 7: Installation Accessories on page 53 for details.

WARNING: Turn the power off before working on an electrical circuit. Turn off the breaker to the circuit you plan to work on. Post a sign on the service panel so nobody tries to reconnect power while you are working on the circuits. Double-check the circuit with a circuit tester before you touch it to make sure the correct breaker has been disconnected.

CAUTION: You must always install an external grounding wire. Perform a simple continuity check between the WS-410 and the ground termination point to confirm. You must also ground the outdoor data protection device to a ground rod or a bonded pipe. Make sure you have completed grounding before you connect power to the WS-410.

Connecting to AC Power (Category C)

The AC power connections for a Category C AC power source are shown in Figure 3.17.

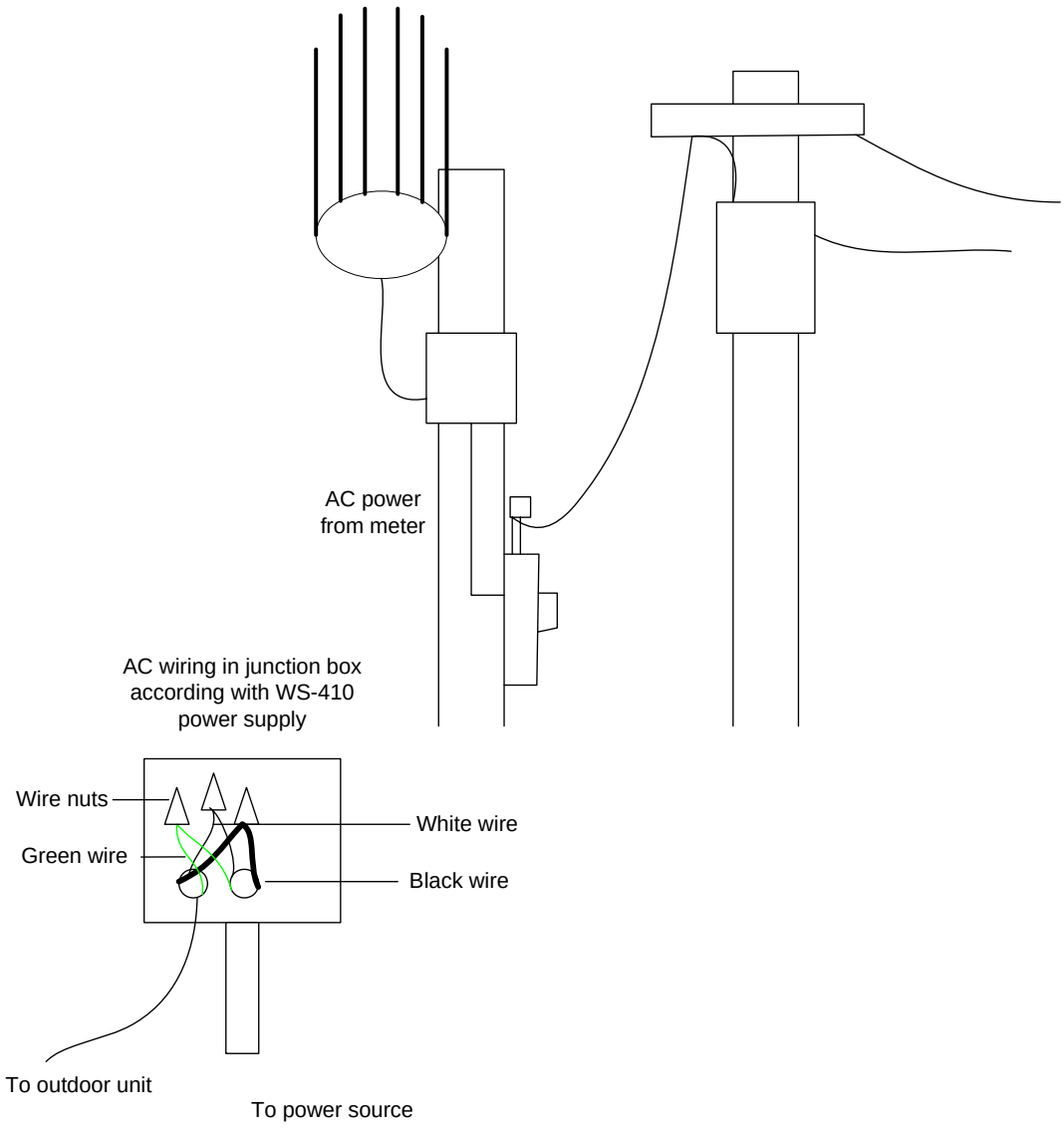


Figure 3.17. **Connecting Category C AC Power**

To connect an AC power source

1. Verify that the service voltage is the following:

- NEMA plug, for streetlight photoelectric control power tap (2-wire service) —2W(2P) or 2W(P+N); 100-240 VAC 50/60 Hz. See Chapter 7: Installation Accessories on page 53 for details.

2. Make sure the power is turned off on the designated circuits.
3. Install a 1/2 inch liquid-tight conduit from the building entrance point to within 3 feet of the outdoor system.
4. Run 3-wire AC service through the conduit.

5. Connect the conduit to a junction box. The conduit and junction box must be IEEE/ANSI compliant and suitable for outdoor use.

NOTE: Data and power must not be enclosed in the same conduit.

6. Connect the AC cable to the WS-410 and tighten the nut.

Connect the AC cable

7. Connect the Wavion WS-410 to one of the following power sources:

- AC power source (3-wire service) — 3W(P+N+PE) or 3W(2P+PE); 110-220 VAC, 50/60 Hz. See Chapter 7: Installation Accessories on page 53 for details.
- NEMA plug, for streetlight photoelectric control power tap (2-wire service) —2W(2P) or 2W(P+N); 100-240 VAC 50/60 Hz. See Chapter 7: Installation Accessories on page 53 for details.

NOTE: If the street light is sourcing 480VAC, a special step-down power tap adaptor must be used.

8. Reenergize the circuit and check that the power to the WS-410 turns on.

NOTE: The Wavion WS-410 is equipped with additional AC surge protection and fuse branch circuit protection. AC current protection of 20Amp should be installed.

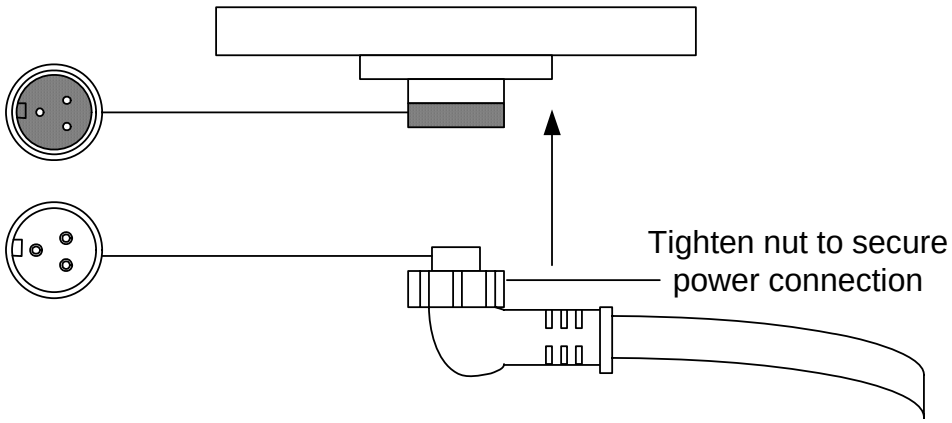


Figure 3.18. **Connecting the AC Power Cable**

Connecting to Streetlight Power (Category C)

The following describes the power connections for Category C streetlight power. For outdoor lighting commonly used by utilities, use the 3-prong NEMA twist-lock adapter with twist-lock style photoelectric controls. The street light adapter uses a 3-pronged NEMA twist-lock adapter that is installed between the outdoor lighting control and its fixture. The NEMA twist-lock adapter is designed to be used with UL 773 listed outdoor lighting controls operating with the following:

NEMA plug, for streetlight photoelectric control power tap (2-wire service) —2W(2P) or 2W(P+N); 100-240 VAC 50/60 Hz. See Chapter 7: Installation Accessories on page 53 for details.

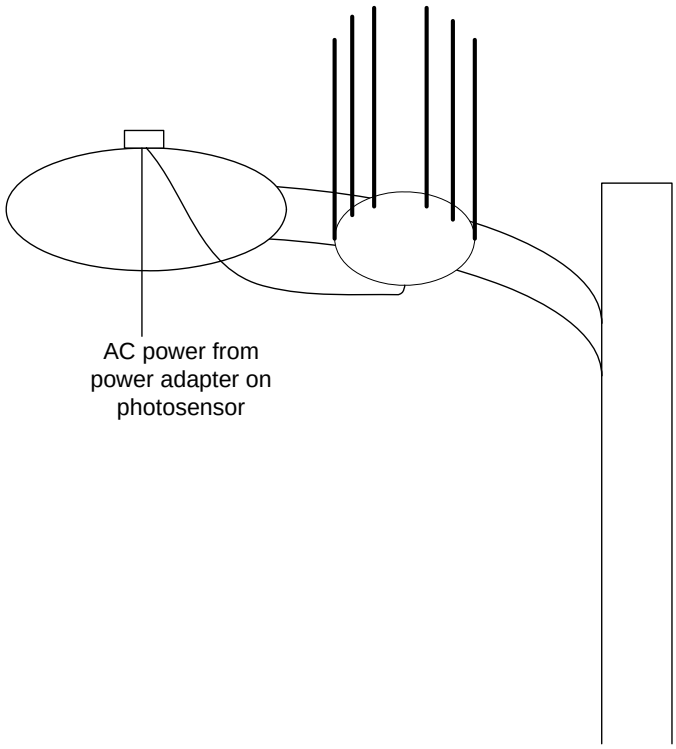


Figure 3.19. **Connecting Streetlight Power**

WARNING: Connect the WS410 only to a twist-lock style outdoor lighting control powered by 100-240 VAC 50/60 Hz. Do not connect it to twist-lock style outdoor lighting controls powered by higher voltage. If the street light is sourcing 480VAC, a special step-down power tap adaptor must be used.

WARNING: Be extremely careful when connecting to Category C streetlight power.

To connect a streetlight power source

1. Verify that the service voltage is the following:

- NEMA plug, for streetlight photoelectric control power tap (2-wire service) —2W(2P) or 2W(P+N); 100-240 VAC 50/60 Hz. See Chapter 7: Installation Accessories on page 53 for details.

2. Make sure that the power is turned off on the designated circuits.
3. Remove the photosensor from the streetlight.

4. Connect the NEMA 3 prong plug from the Wavion WS-410 to the photosensor connector on the streetlight.
5. Connect the photosensor to the top of the NEMA 3 prong plug.
6. Connect the AC plug to the WS-410 and tighten by hand.
7. Reenergize the circuit and confirm that the power to the WS-410 comes on.

NOTE: The Wavion WS-410 is equipped with additional AC surge protection and fuse branch circuit protection. AC current protection of 20Amp should be installed.

NOTE: Do not leave connectors open to the environment. Cover connectors with the closure cap when not in use and tighten the cap. See Chapter 7: Installation Accessories on page 53.

Connecting a Data Port

The Wavion WS-410 is equipped with four RJ45 connectors. The bottom two ports are for engineering use only. Typically, you will connect to the ETH A port. Use the ETH B port if you are connected to a backhaul unit for which you have to supply power. Only one port is active at any time.

NOTE: Use only shielded Cat5e cable rated for outdoor use. See Chapter 7: Installation Accessories on page 53 for details. The shields of the Cat5 cable must be properly terminated and bonded to the unit and to the protective earth (PE) at the building entrance. This provides protection against the risk of fire, electrical hazard and ensures the reliable operation of this equipment,

NOTE: National Electrical Codes (NEC) Article 800 requires the use of an Agency Listed (UL/CSA) Building Entrance Protector for all power and communications cables entering a building. Article 800 is intended to protect the building and occupants from fires caused by transient voltage and current surges.

WARNING: DC voltage may be present on Ethernet B pins 4,5 (+) and 7,8 (-)

NOTE: This is not a mid-span powered device. Do not attempt to daisy-chain Power Over Ethernet devices.

The figures below show the options for routing cables to the Wavion WS-410. Connect the Ethernet cable to the appropriate data port (ETH A or ETH B).

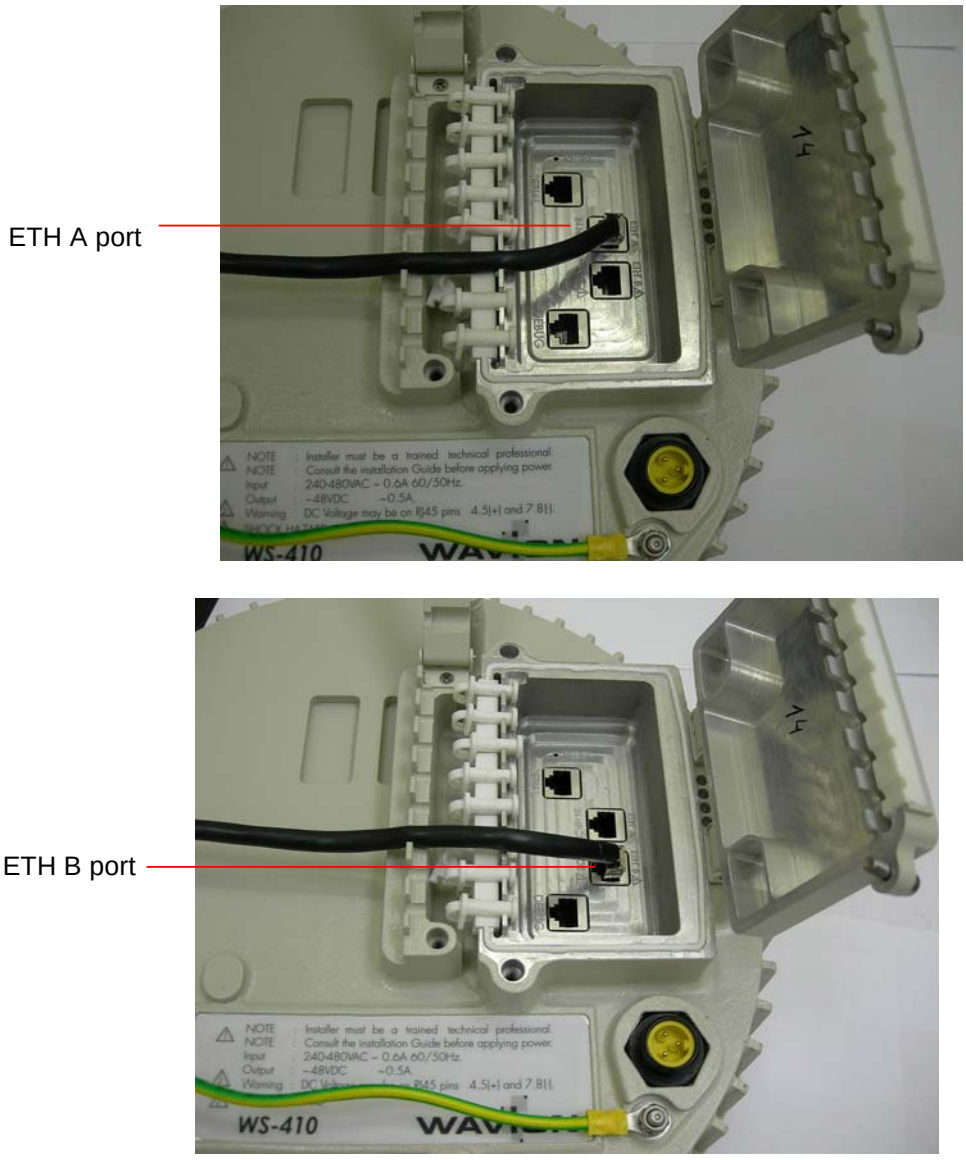


Figure 3.20. **Data Port Connection Options**

When connecting to the Ethernet port, if you need to terminate the Ethernet cable, use a standard RJ45 termination. Use a shielded RJ45 plug and be sure to connect the shield of the Ethernet cable to the shield of the RJ 45 plug.

To connect to the data port

1. Make sure that the power is turned off for the designated circuits.
2. Run shielded Category 5 Ethernet cable appropriate for outdoor use from a data protection unit to the Wavion WS-410.

3. Connect one end of the Category 5 cable to the data protection unit.
4. Open the connector access cover on the bottom of the WS-410 by unscrewing the two bolts.
5. Open the strip next to the connector access cover by unscrewing the bolt.

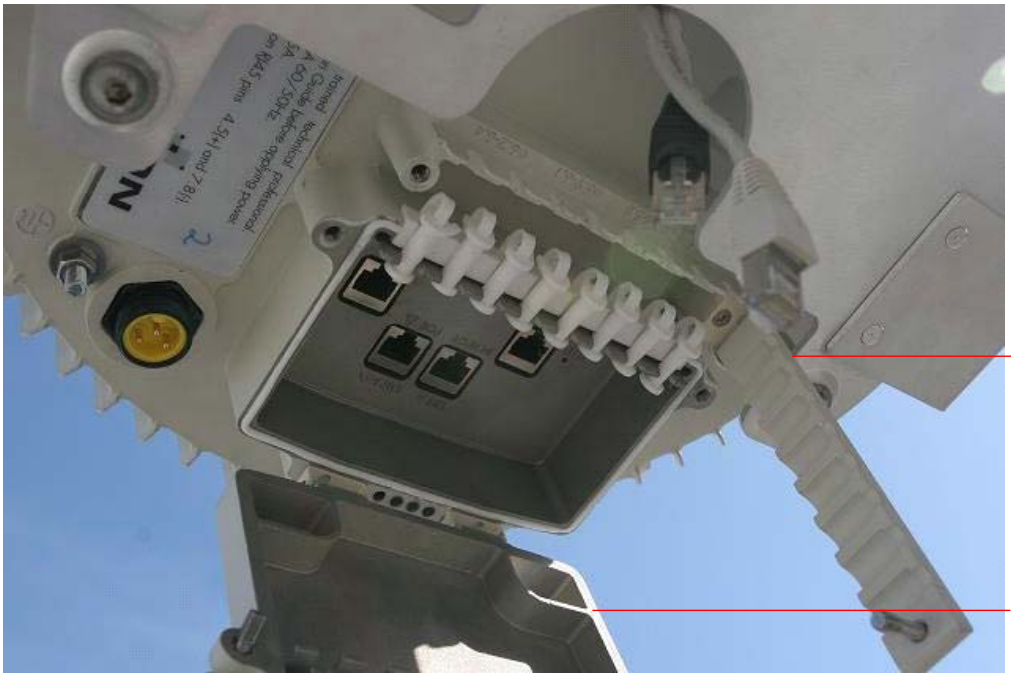


Figure 3.21. **Opening the Strip and Connector Access Cover**

6. Select the slot that matches the diameter of the Ethernet cable and remove the rubber plug.

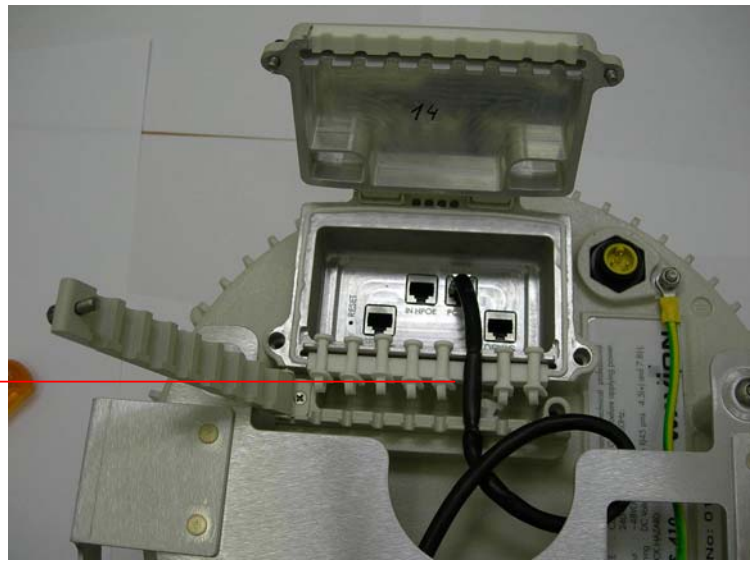
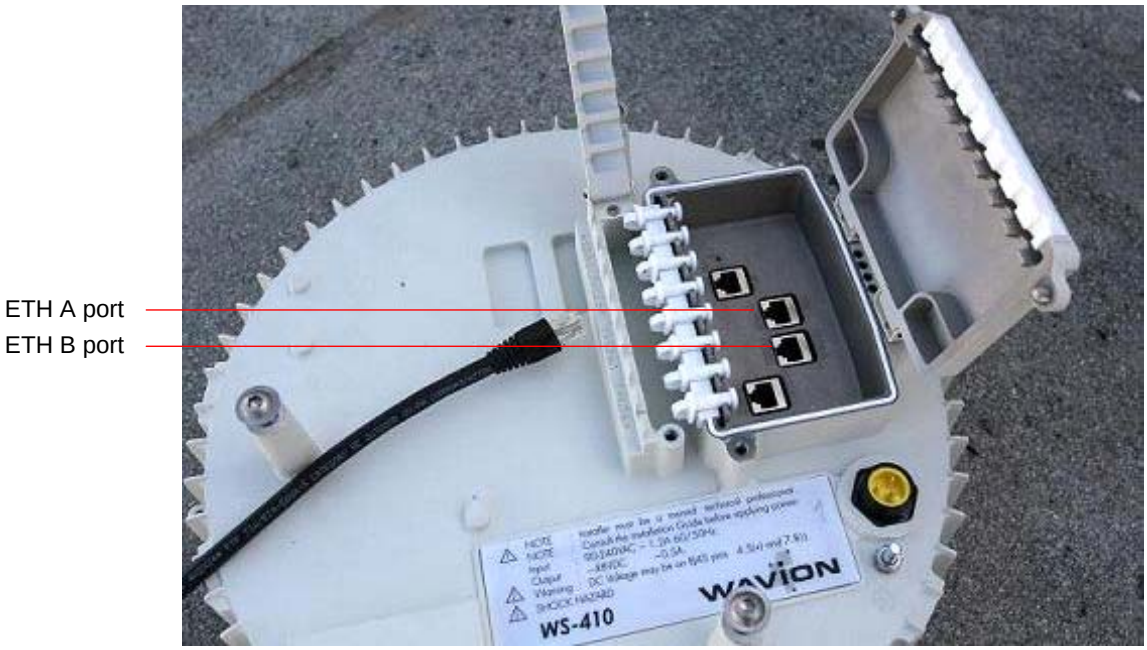


Figure 3.22. **Removing the Plug Matching the Diameter of the Cable**

7. Connect the cable ends on the WS-410 to the ETH A port or to the ETH B port if you are using a backhaul unit that requires a power supply. Use a shielded RJ45 8-pin modular plug to terminate the cables at the desired lengths.



8. Make sure that the protection unit is properly grounded.
9. Apply silicon across the rubber plugs.
10. Close the strip and tighten the bolt using the 4mm Allen wrench.
11. Close the connector access cover and tighten the bolts using the 4mm Allen wrench. This ensures a watertight seal.

12. Apply silicon in the gap between the strip and the connector access cover.

Figure 3.23. **Closing the Covers**

13. Create a drip loop of at least 10 inches by looping the cables back to the tray and using a tie wrap to secure.

WARNING: If you are using a Wavion Injector, make sure you are not supplying power to the injector until you insert the RJ45 connector into its socket, or you may risk electric shock.

Connecting Peripherals

The WS-410 can source DC power on the Ethernet B connector pins 4,5 and 7,8, This allows the WS-410 to power a backhaul device.

PoE Power Sourcing Power Output

Voltage	Max Power Output
48VDC	30W
24VDC	24W

NOTE: Two different WS410 product versions are available. One supports only PoE 48VDC output and the second one supports both 24 or 48VDC PoE output selectable from the product's management GUI.

NOTE: PoE can only be supported if the WS-410 is powered by AC voltage input.

NOTE: Use only shielded Cat5e cable rated for outdoor use. Chapter 7: Installation Accessories on page 53 for details. For protection against risk of fire, electrical hazard and to ensure the reliable operation of this equipment, the shields of the Cat5 cable must be properly terminated and bonded to the unit and to the protective earth (PE) at the building entrance.

RJ45 Pin Descriptions for Data Connection

Pin	T/R	Signal	Color	Description
1	T	TXD+	Orange-White	TX Data 10/100BaseT
2	R	TXD-	Orange	TX Data 10/100BaseT
3	T	RXD+	Green-White	RX Data 10/100BaseT
4	R	PoE+	Blue	Power output, 24/48 Vdc (+)
5	T	PoE+	Blue-White	Power output, 24/48 Vdc (+)
6	R	RXD-	Green	RX Data 10/100BaseT
7	T	PoE-	Brown-White	Power output, 24/48 Vdc (-)
8	R	PoE-	Brown	Power output, 24/48 Vdc (-)

Using a Backhaul Unit

If the installation location does not provide a place to connect to the internet (for example, on an electricity pole), you need to use a backhaul unit.

There are two types of backhaul units:

- A backhaul unit that provides its own power
- A backhaul unit that uses power supplied by the WS-410

NOTE: The antennas on the WS-410 must be higher than the antennas on the backhaul unit.

The following backhaul unit can be powered by the WS-410:

- Motorola Canopy uses 24VDC PoE input voltage. Please use the correct WS410 product version to power the Canopy unit.
- Alvarion VL uses 48VDC PoE input voltage (Please refer to Chapter 7: Installation Accessories on page 53 for details on connecting the Alvarion unit to the WS410)

WARNING: Make sure the backhaul unit has the correct voltage appropriate for the installation.

NOTE: When using a backhaul unit that uses power supplied by the WS-410, connect the Ethernet cable to the port labeled ETH B.

NOTE: When using a Wavion injector, the WS-410 cannot supply power to the backhaul unit.

NOTE: Make sure to use the correct part number for the backhaul unit to avoid causing damage to the unit.

Safety Information for the Wavion WS-410

The Federal Communications Commission (FCC) with its action in ET Docket 96-8 has adopted a safety standard for human exposure to RF electromagnetic energy emitted by FCC certified equipment. Proper operation of the Wavion WS-410 according to the instructions found in this manual results in user exposure that is substantially below the FCC recommended limits.

Follow these guidelines to ensure safe operation of the Wavion WS-410:

- Do not touch or move the antennas while the unit is transmitting or receiving.
- Make sure the antennas are connected when operating the radio or attempting to transmit data, otherwise, the radio may be damaged.
- Do not hold the antenna to be close to or touching any exposed parts of the body, especially the face or eyes, while transmitting.
- The use of wireless devices on airplanes is governed by the Federal Aviation Administration (FAA).
- The use of wireless devices in hazardous locations is limited to the constraints posed by the safety directors of such environments.
- The use of wireless devices in hospitals is restricted to the limits set forth by each hospital.
- Do not operate a portable transmitter near unshielded blasting caps or in an explosive environment.
- The Wavion WS-410 must be used only with Wavion approved components and antennas.

Service Instructions

The Wavion WS-410 contains no user serviceable parts inside.

CHAPTER 4

Power Consumption

This chapter describes the power consumption details for the WS-410. The power consumption of the WS410 varies according to the operational conditions and data transmission rates.

The table below shows the overall maximum power consumption under different conditions.

WS410 Input Voltage	WS410 Input Power when PoE output is not used	WS410 (Max) Input Power when a 24VDC PoE output is used	WS410 (Max) Input Power when a 48VDC PoE output is used
110 VAC 50/60 Hz	40W	72W	74W
220 VAC 50/60 Hz	44W	78W	81W

CHAPTER 5

Product Specification

The tables in this chapter contain specifications for the Wavion WS-410.

Wireless Specifications	
IEEE 802.11b/g compliant	
Frequency band	2.4 - 2.483 GHz
Modulation	• 802.11b: DSSS (DBPSK, DQPSK, CCK) • 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK)
TX Power Maximum	802.11b and 802.11g
Beamformer Directed Power	EIRP + Beamfroming gain: 42.5dBm
EIRP Calculations	Antenna Gain - 7.5 dBi Total EIRP - 3.5 dBm
RX Sensitivity*	802.11b and 802.11g
Antenna Array	Six 7.5dBi omni-directional antennas

* RX Sensitivity

-105.5 dBm @	1 Mbps
-103 dBm @	2 Mbps
-100.5 dBm @	5.5 Mbps
96 dBm @	11 Mbps
-102.5 dBm @	6 Mbps
-100.5 dBm @	9 Mbps
-99.5 dBm @	12 Mbps
-98 dBm @	18 Mbps
-95 dBm @	24 Mbps
-92 dBm @	36 Mbps
-88 dBm @	48 Mbps
-86 dBm @	54 Mbps

Networking and QoS Specifications

Full 802.11b/g client compatibility

16 VLANs

16 SSIDs

Security Specifications

Packet filtering via layer 2 & 3

WEP (64 bit or 128 bit)

WPA:

Encryption: WEP or TKIP

Authentication: Pre-Shared Key or 802.1x with RADIUS Server (EAP-TLS, PEAP, EAP-TTLS)

VPN pass-through and tagging

HTTPS for web-based management tools

Management Specifications

Web based configuration and management too

SNMPv2 with standard and Wavion MIB support

Configuration save and restore

Network and client statistics

Physical Specifications

Network Interfaces	• Auto-sensing 10/100 Ethernet • Input from Wavion Injector
Auxiliary Network Interface	• For connection to a backhaul interface where PoE to the backhaul device is required. • Auto-sensing 10/100 Ethernet • Input/Output Power over Ethernet
Power Input	• Weather-tight power connector plug for 100-240 VAC power input • Power from a Wavion Injector (ETH B port only)
Indicator Lights	• Two Ethernet port LED indicators • System Status LED indicator • RF channel status indicator
Physical Dimensions	Base: • Diameter - 13in (33cm) • Height - 5in (12cm) Antenna Array: • Height - 17in (43cm) Weight: 20lbs (8kg)

Power Specifications	
Power Input	• 100 - 240 VAC weather-proof power cable, 50/60 Hz with standard AC connector or street light NEMA photo-electric control power tap • 55VDC, supplied over Ethernet from Wavion injector.
Input Power Consumption	• Power from Wavion Injector 35W @ 55VDC • For AC input see Chapter 4: Power Consumption on page 41
Output Power over Ethernet Option	For powering an external device: • 48VDC, 0.6A max. • 24DC, 1A max.

Environmental Specifications	
Operating Temperature Range	-40°C to +50°C
Storage Temperature Range	-45°C to +85°C
Weather Rating	IP65
Wind Survivability	165 mph
Salt and Fog Rust Resistance	MIL-STD-810F 509.4
Shock and Vibration	ESTI 300-192-4 spec T41.E
Transportation	ISTA2A

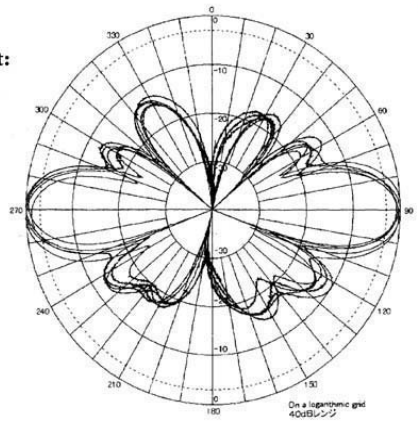
Approvals	
RF	FCC CFR part 15, Class C
Safety	TUVus
EMC	47 CFR Part 15, Sub Part B, Class B (USA)

CHAPTER 6

Antenna Specifications and Patterns

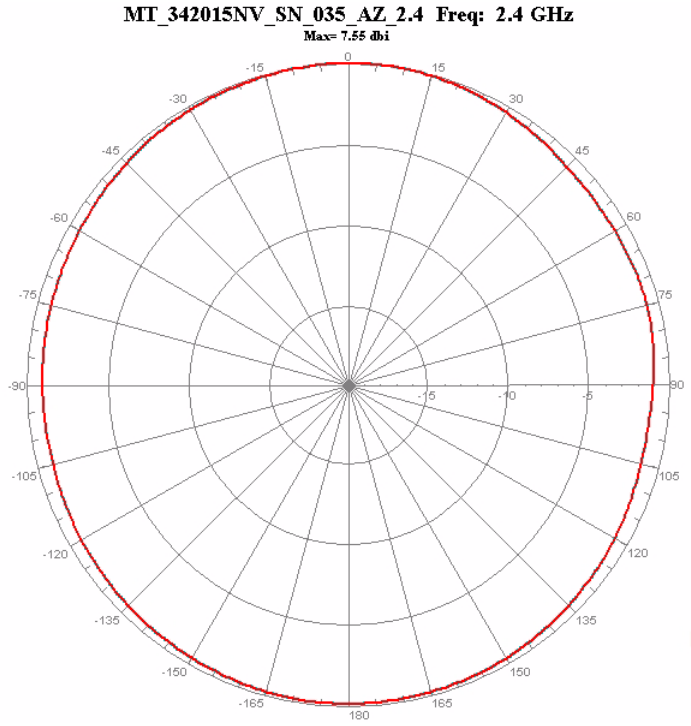
The chapter describes antenna specifications and patterns for the antennas supplied with the Wavion WS-410.

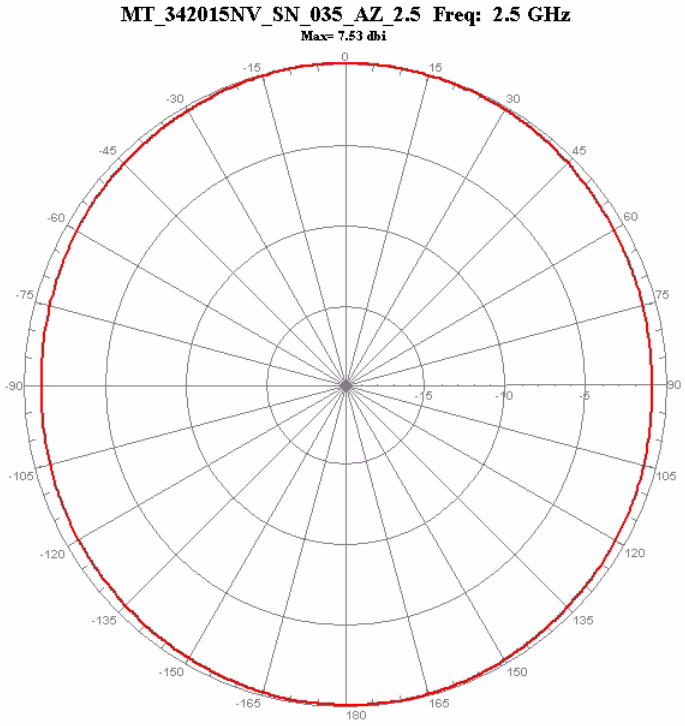
SF-245W 2.4GHz Omnidirectional Antenna

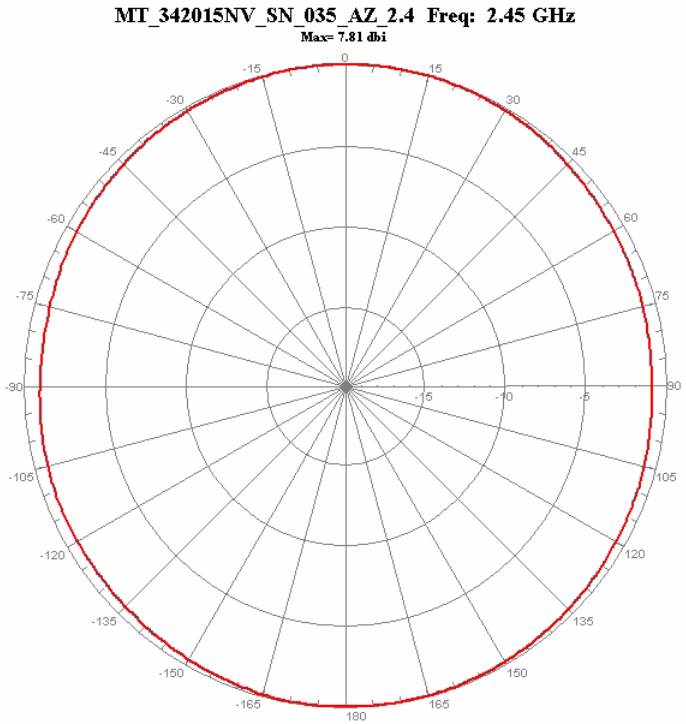
Specifications	Pattern
2400-2500MHz Gain: 7.4dBi Length: 17.5 inches Weight: 4.7 oz -3dB Beam-width: 20 degrees Cross Polar Rejection: 15dB + Max Power: 50 watts Max wind survival: 150MPH + Wind Load: 7.1 sq in Connector: Integral N-male Radome: White UV stabilized fiberglass Mast mounting hardware optional Mobile lip mount optional Mobile permanent mount optional	Elevation pattern at: 2400MHz 2425MHz 2450MHz 2475MHz 2500MHz 

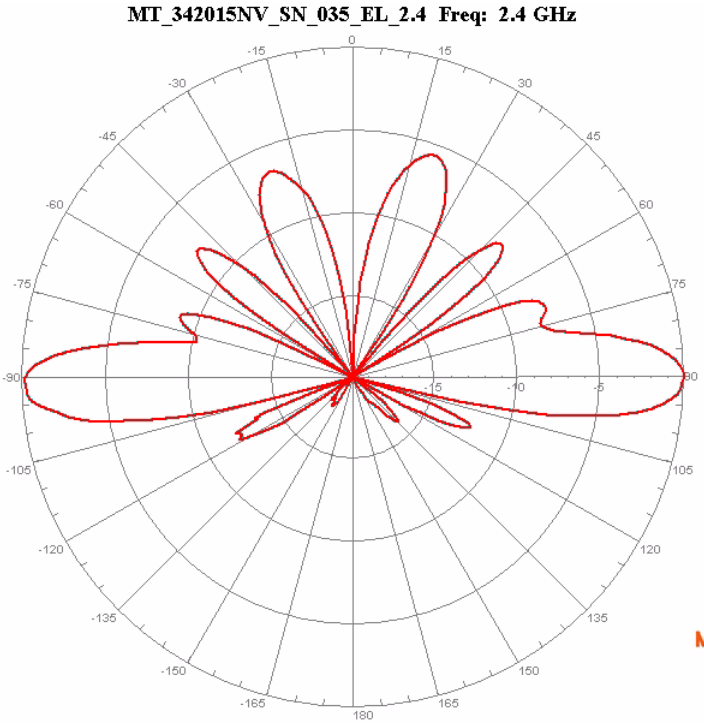
MT_342015NV_SN_035_EL 2.4 GHz Antenna

The following describes the patterns for the antenna:

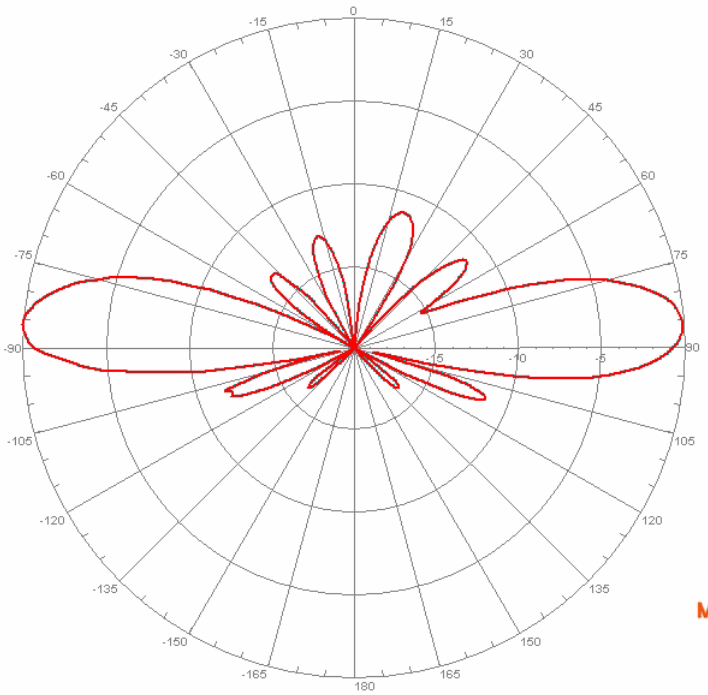

MT_342015NV_SN_035_AZ_2.4 Freq: 2.4 GHz
Max= 7.55 dbi
0
15
30
45
60
75
90
105
120
135
150
165
180
-15
-30
-45
-60
-75
-90
-105
-120
-135
-150
-165
-15
-10
-5


MT_342015NV_SN_035_AZ_2.5 Freq: 2.5 GHz
Max= 7.53 dbi
0
15
30
45
60
75
90
105
120
135
150
165
180
-15
-30
-45
-60
-75
-90
-105
-120
-135
-150
-165
-15
-10
-5

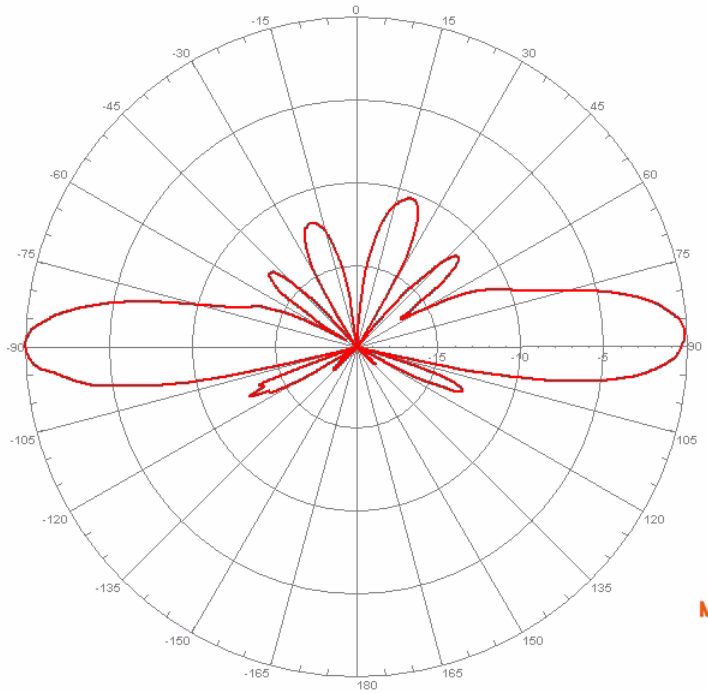

MT_342015NV_SN_035_AZ_2.4 Freq: 2.45 GHz
Max= 7.81 dbi
0
15
30
45
60
75
90
105
120
135
150
165
180
-15
-30
-45
-60
-75
-90
-105
-120
-135
-150
-165
-15
-10
-5


MT_342015NV_SN_035_EL_2.4 Freq: 2.4 GHz
0
15
30
45
60
75
90
105
120
135
150
165
180
-15
-30
-45
-60
-75
-90
-105
-120
-135
-150
-165
-15
-10
-5

MT_342015NV_SN_035_EL_2.5 Freq: 2.5 GHz



MT_342015NV_SN_035_EL_2.4 Freq: 2.45 GHz



CHAPTER 7

Installation Accessories

This chapter describes the accessories available for the WS-410 and ordering information. The following topics are covered in this chapter:

Power Cable

Description	Part Number
Power Cable for Wavion Switch 410, 110 VAC, 20 feet	WS410PC-01-GE-AA
Power Cable for Wavion Switch 410, 110 VAC, 6 feet.	WS410PC-02-GE-AA
Power Cable for Wavion Switch 410, 110 VAC, 20 feet (INTL)	WS410PC-03-GE-AA
Power Cable for Wavion Switch 410, 110 VAC, 6 feet (INTL)	WS410PC-04-GE-AA
Street Light Power Tap for Wavion Switch 410, 110/220 VAC, 30 feet	WS410PT-01-GE-AA
Street Light Power Tap for Wavion Switch 410, 110/220 VAC, 6 feet	WS410PT-02-GE-AA
Closure Caps for Plugs and Receptacles. An all-weather cover/cup for the AC power connector, to be used when no AC power is required	WS410CC-01-GE-AA

Ethernet Cables

Description	Manufacturer	Part Number	Distributor	Contact Information	Order Number
Outdoor CAT5 4-pair data cable	Belden	7929A	Anixter	www.anixter.com	
Outdoor CAT5e double jacket 4-pair data cable	Teldor	8393204101	G.Bares	Tel: +972-(4)-8215450	

Lightning Protection

Description	Manufacturer	Part Number	Distributor	Contact Information	Order Number
Data protection device	Hyperlink	HGLN-CAT5-1		www.hyperlinktech.com	

Power Over Ethernet

Description	Part Number
Wavion Injctor for powering the WS410 over an Ethernet cable. Output 55VDC, 1A.	WS410PI-03-GE-AA

Power Tap Option for 270-480 VAC Street Light

Description	Manufacturer	Part Number	Distributor	Contact Information	Order Number
AC step down from 270-480VAC to 110 or 220VAC.	Fisher-Pierce	FP289 family		http://www.fisherpierceolc.com/pdf/FP289-StepDown.pdf	See web site.

Client Connectivity

Description	Manufacturer
Alvarion - Use Alvarion Indoor-Outdoor CAT 5e cable with pin crossing (pin 5 of the WS-410 PoE connector goes to pin 7 of Alvarion RJ45 connector, pin 7 of the WS-410 PoE connector goes to pin 5 of the Alvarion RJ45 connector) Motorola (Canopy) - Use outdoor CAT 5e cable with spare pin crossing (pin 4 5 of the WS-410 PoE connector goes to pin 7 8 Motorola RJ45 connector respectively) (pin 7 8 of the WS-410 PoE connector goes to pin 4 5Motorola RJ45 connector respectively)	See Installation Guide

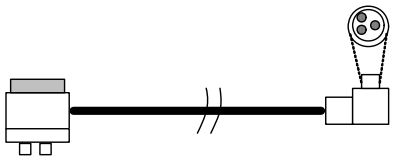
CHAPTER 8

AC Wiring Diagrams

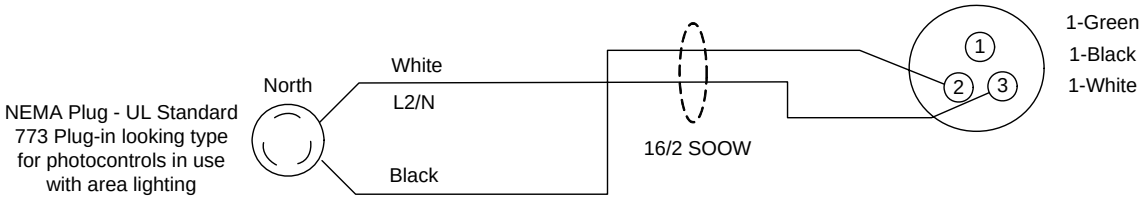
This chapter contains the following wiring diagrams for AC power:

AC Wiring Photoelectric Power Tap

WS410PT-02-GE-AA (6') or
WS410PT-01-GE-AA (30')
Photoelectric Power-Tap
Power Input Cable
2Wire - 100-240VAC



Length: 4' or 20'



Carol P-7K-123033 MSHA or equal

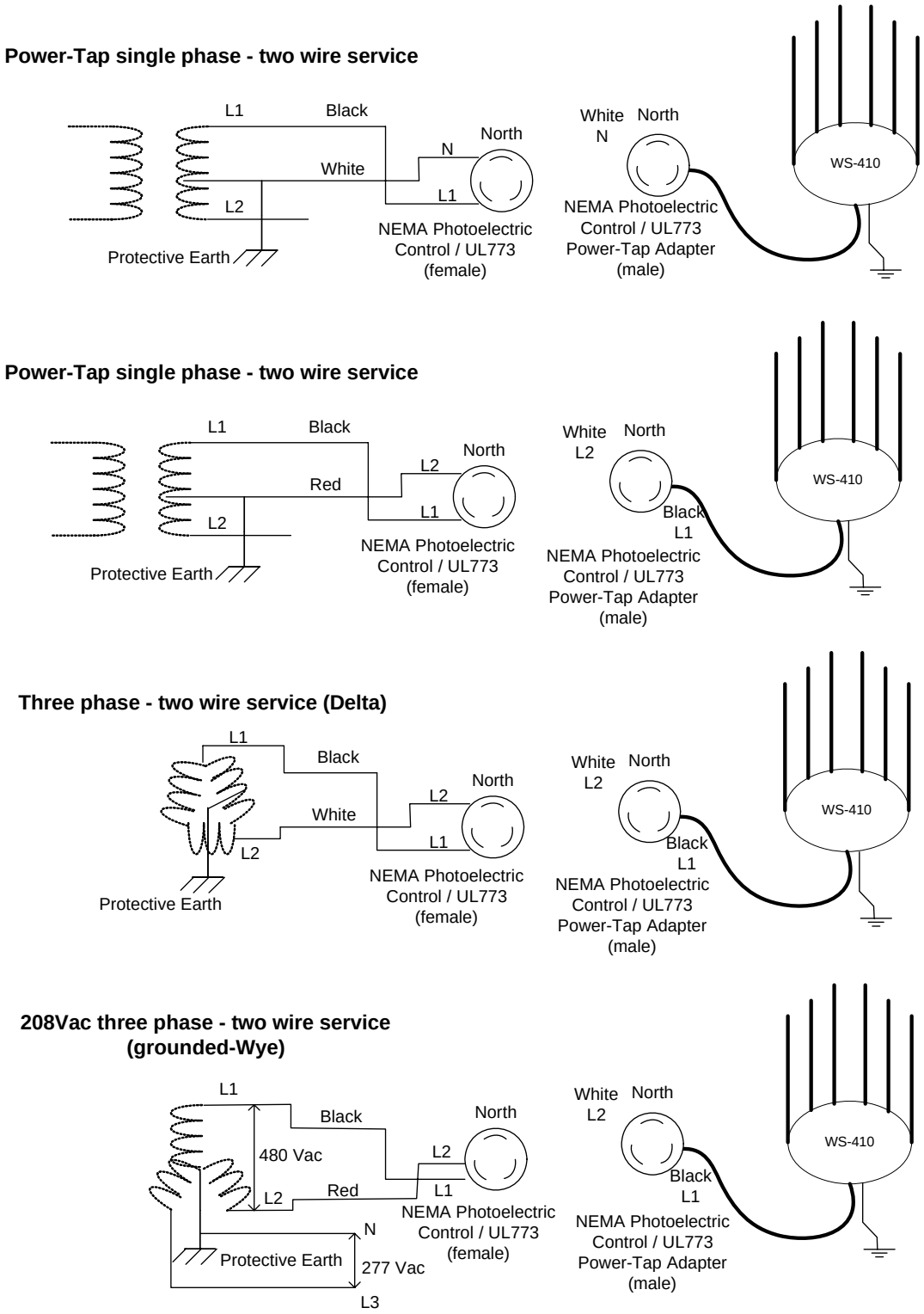


Figure 8.24. **AC Wiring Photoelectric Power Tap**

AC Wiring Power Cable 120VAC, 15A Plug

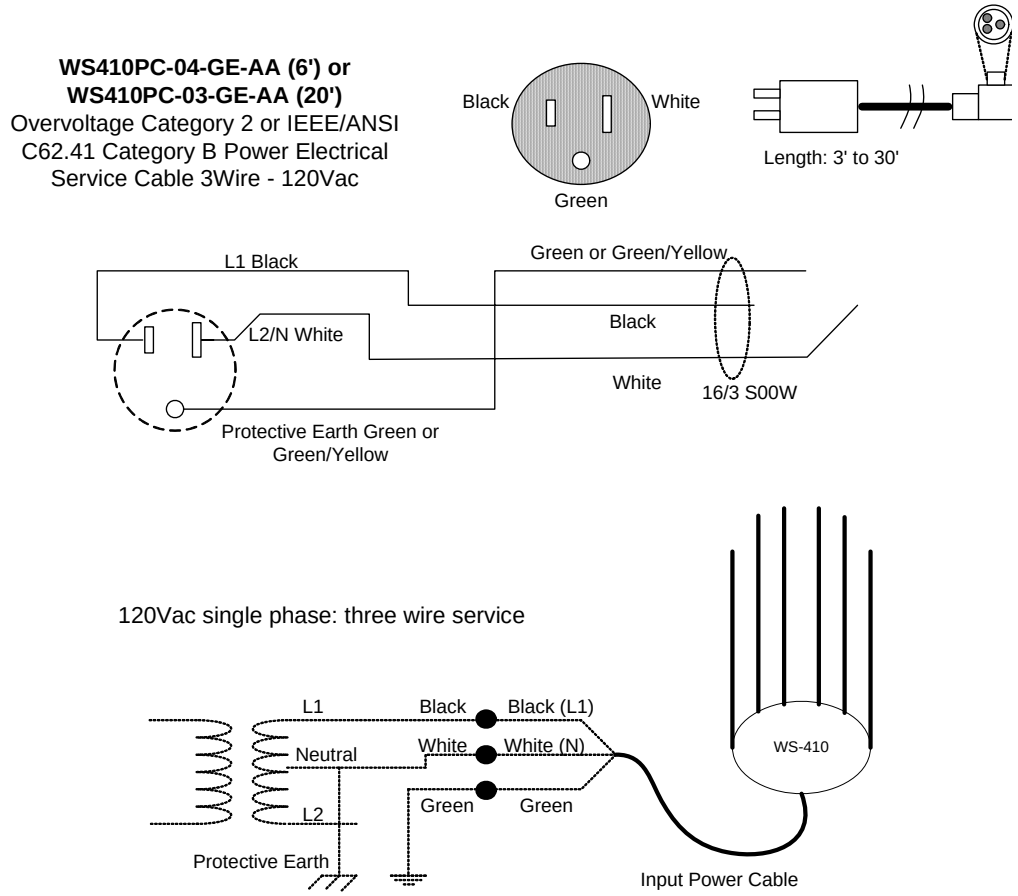


Figure 8.25. **AC Wiring Power Cable 120VAC, 15A Plug**

CHAPTER 9

Wind Loading Considerations

This chapter describes wind loading considerations for the WS-410.

NOTE: It is recommended to evaluate the static and dynamic load bearing capabilities for each assembly and installation individually. It is your responsibility to evaluate the load bearing capabilities of the structure.

The Wavion WS-410 weighs approximately 16 lbs, including all mounting hardware. When the Wavion WS-410 is mounted on a pole, the sail area of the WS-410 is approximately 1 square foot. The Wavion WS-410 can load a pole with a maximum load of 3400 Newton in wind conditions of 165mph.

CHAPTER 10

Backhaul Unit Installation Instructions

This chapter describes how to install a backhaul unit with the WS-410.

Use the assembly equipment provided with the backhaul unit to install. Wavion does not provide brackets or mounting equipment for the backhaul unit. Make sure the WS-410 is installed in a higher position then the backhaul unit so the antennas are unobstructed. If the backhaul unit is powered externally, connect to the Ethernet A port. If the backhaul unit is not powered externally, connect to the Ethernet B port.

WARNING: Disconnect power to the WS-410 before connecting the backhaul unit.

NOTE: Make sure to use the correct Wavion part number for each backhaul unit

Acronyms

Acronym	Description
2P	Two-Phase or Split Phase
2W	Two-Wire
3W	Three-Wire
AC	Alternating Current
ANSI	American National Standards Institute
AWG	American Wire Gauge
C	Celsius
CAT	Category
CCK	Complementary Code Keying
CFR	Code of Federal Regulations
CSA	Canadian Standard Association
dB	Decibels
dBi	Decibels Relative to an Isotropic Radiator
DBPSK	Differential-Binary Phase-Shift Keying
DC	Direct Current
DQPSK	Differential-Quadrature Phase-Shift Keying
DSSS	Direct-Sequence Spread Spectrum
EMC	Electromagnetic Compatibility
EN	IEC standard
ESD	Electrostatic Discharge
FCC	Federal Communications Commission
Hz	Hertz
HPoE	High Power over Ethernet
IEEE	Institute of Electrical and Electronics Engineers
IP67	Ingress Protection Standard
ISTA	International Safe Transit Association
LAN	Local Area Network
Mbps	Megabits Per Second
MHz	Megahertz

Acronym	Description
MIL-STD	Military Standard
N	Neutral
NEC	National Electrical Codes
NEMA	National Electrical Manufacturers Association
OFDM	Orthongonal Frequency Division Multiplexing
P	Phase
PE	Protective Earth
PoE	Power over Ethernet
RJ45	Registered Jack 45
RSS	Received Signal Strength
Rx	Receive
RXD	Receive Data
TUV	Technical Inspection Association
Tx	Transmit
TXD	Transmit Data
UL	Underwriters Laboratories
VAC	Voltage (Alternating Current)
VCCI	Voluntary Control Council for Interference
VDC	Voltage (Direct Current)
W	Watts