



# WBS-2400

## Metro Base Station

### Installation Guide May 2008

**Note:** To better reflect the value of Wavion products we are changing the name of our product family from Access Points (AP) to Wireless Base Stations (WBS), consequently the existing **WS-410** product name will be changed to **Wavion WBS-2400**.

The new product name emphasizes the difference in architecture (Multiple Radio system) and the value to customer, superiority in performance (coverage, capacity, indoor penetration and immunity to interference) of Wavion WiFi base station over any other standard outdoor WiFi access point products available in the market.

All references in Wavion's documentation to WS-410 refers also to the WBS-2400 , and vice versa. Both products are exactly the same except for the name change.

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## 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.

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## About This Guide

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### Preface

This guide details the Wavion WBS-2400 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:	<a href="mailto:support@wavionnetworks.com">support@wavionnetworks.com</a>
Web:	<a href="http://www.wavionnetworks.com">www.wavionnetworks.com</a>

# Introduction

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The WBS-2400 is a new category of Wi-Fi Base Station 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 WBS-2400 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 WBS-2400 is provided through SNMP, a graphical user interface, and SYSLOG services.

The WBS-2400 Wi-Fi Base Station 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.





# Installing the Wavion WBS-2400 Metro Base Station

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This guide explains how to safely install the Wavion WBS-2400 Metro Base Station. The following topics are covered in this chapter:

- [Important Safety Instructions](#) on page 10
- [Preparing for Installation](#) on page 11
- [Mounting Strategies](#) on page 13
- [Using Hose Clamps](#) on page 14
- [Mounting on a Pole, or Streetlight](#) on page 14
- [Grounding the Wavion WBS-2400](#) on page 23
- [Connecting Antennas](#) on page 27
- [Connecting Power](#) on page 28
- [Connecting a Data Port](#) on page 34
- [Connecting Peripherals](#) on page 38
- [Safety Information for the Wavion WBS-2400](#) on page 40
- [Service Instructions](#) on page 41

## 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 WBS-2400 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 WBS-2400 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 WBS-2400 must be installed only with the equipped antennas.



**CAUTION:** A minimum distance of 40cm from the WBS-2400'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 WBS-2400 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 WBS-2400:

- One pole bracket
- Two 3-6-inch diameter worm drive hose clamps
- Seven 8mm stainless steel hex head machine bolts
- Allen wrench - 4mm and 5mm
- Six Antennas

You must supply the following tools:

- 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 WBS-2400 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 WBS-2400 near devices operating in the 2.4 GHz frequency range.
- The WBS-2400 should be installed at the highest point of a metal pole such that there will be no interference caused by RF reflections. If this is not possible, the WBS-2400 should be installed at least 3 meters from the metal pole.
- It is always best to have the maximum distance possible from an RF radiating source.

### Preparing the Site

When installing the Wavion WBS-2400, you must follow the appropriate electrical and building codes to ensure safe 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 WBS-2400, there is a distance limit of 100m maximum between devices for 10/100BaseT operation.

An appropriate ground cable should be available. Grounding through electrical wiring or CAT-5 cable is not sufficient.

Please refer to standards for building entrance protection.

### Power Source Options

The Wavion WBS-2400 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 55 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 55 for details.
- DC power source (2-wire service); 48VDC See [Chapter 7: Installation Accessories](#) on page 55 for details.
- The WBS-2400 can be powered by a Wavion Injector connected to Ethernet port B (ETH B). See [Chapter 7: Installation Accessories](#) on page 55 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 WBS-2400 and the ground termination point to confirm. Make sure that grounding is complete before you connect power to the Wavion WBS-2400.

## Safety Precautions

Installing the Wavion WBS-2400 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 WBS-2400 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 WBS-2400 prior to mounting. Before mounting the WBS-2400, read the wiring instructions in [Grounding the Wavion WBS-2400](#) on page 23 and [Connecting a Data Port](#) on page 34.



**NOTE:** The WBS-2400 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 WBS-2400 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 WBS-2400 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 be used to thread each hose clamp. Choose the slot that is appropriate for the size of the pole.

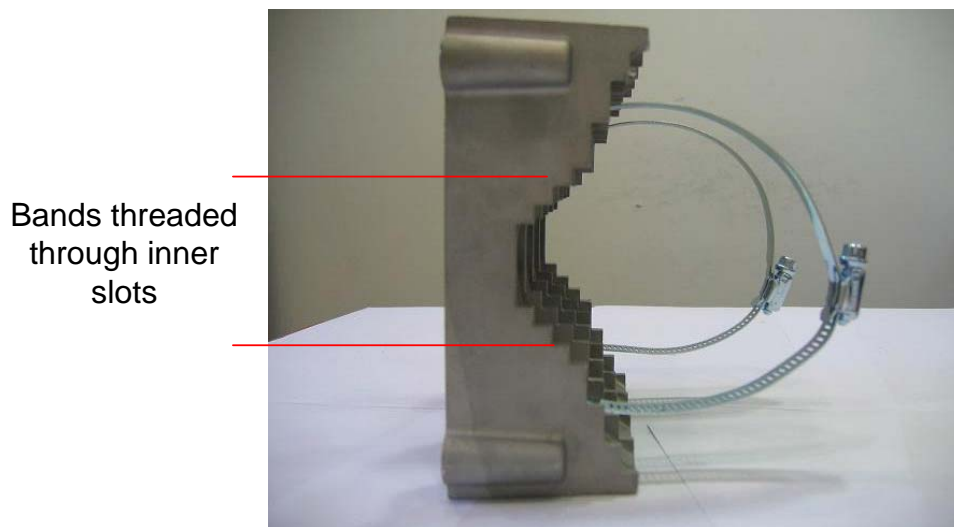


Figure 3.2. **Using Hose Clamps**

## Mounting on a Pole, or Streetlight

The following explains how to mount the Wavion WBS-2400 on a pole, tower, or streetlight. It is recommended to mount the WBS-2400 on aluminum or galvanized steel structures.



**NOTE:** The Wavion WBS-2400 must be mounted with the top of the unit parallel with the ground and with the antennas pointing upward.  
**NOTE:** Before mounting the WBS-2400, read the wiring instructions in [Grounding the Wavion WBS-2400](#) on page 23 and [Connecting a Data Port](#) on page 34.  
**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 WBS-2400 on an outdoor metal pole. Figure 3.4 shows the correct way to mount the Wavion WBS-2400 on an outdoor wooden pole. There is much similarity between the two installations. Metal pole installation requires that the antennas are higher than the top of the pole. This is not a requirement for wooden poles.



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



Figure 3.3. **Mounting on a Metal Pole**



Figure 3.4. **Mounting on a Wooden Pole**

**To mount the Wavion WBS-2400 on a metal or wood pole**

1. Choose a mounting location. You can attach the WBS-2400 to any pole or pipe with diameter of 3-10 inches. Wooden poles of larger diameter require different types of clamps.
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.



**NOTE:** Installations on large wooden poles require band clamps such as those supplied by Panduit, [www.panduit.com](http://www.panduit.com). Such a product is listed as "Metal, Locking Tie Extra Heavy Duty 304 Stainless Steel". The tie and the installation tool are shown below





Figure 3.5. **Wood Pole Mounting Tool and Clamp**

4. Attach the back plate to the hose bracket as labeled #1 in [Figure 3.6](#)
5. Insert the six flathead bolts into the holes in the back plate labeled #2 in [Figure 3.6](#) and tighten.

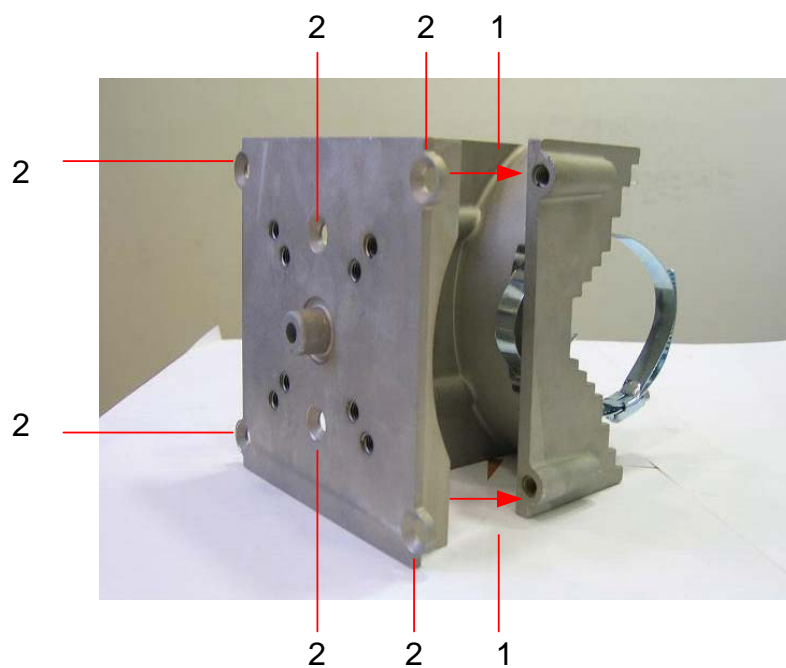


Figure 3.6. **Attaching the Back Plate to the Pole Bracket**

6. Attach the tray to the back plate as shown in [Figure 3.7](#).



**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.

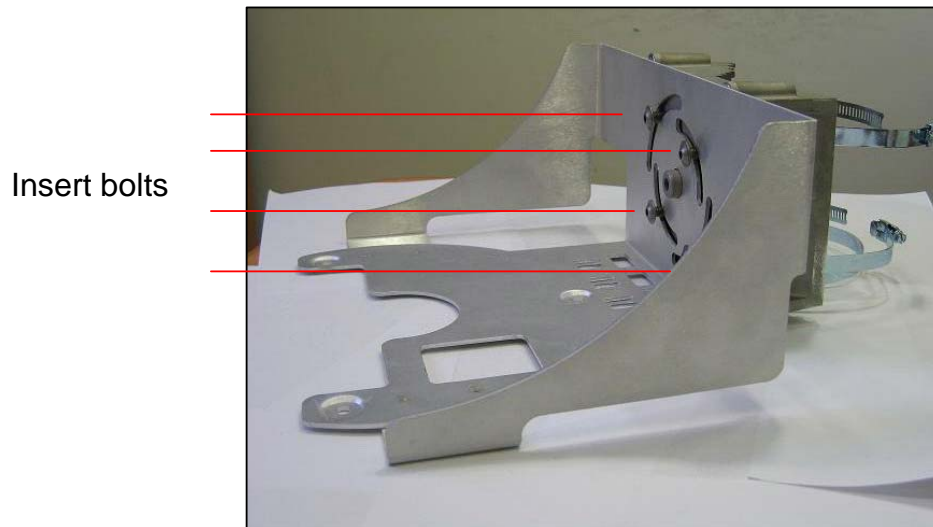


Figure 3.7. **Attaching the Tray to the Back Plate**

8. Slide the WBS-2400 onto the tray. Insert three 8mm stainless steel hex head bolts from underneath the tray into the WBS-2400. Use a 5mm Allen wrench to tighten the bolts.

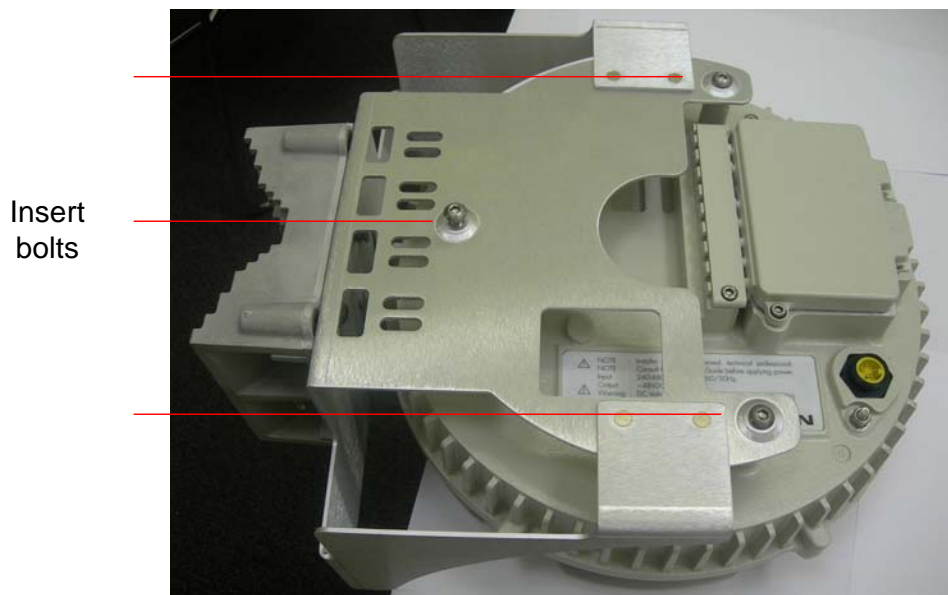


Figure 3.8. **Attaching the WBS-2400 to the Tray**

To continue installing the WBS-2400, see [Grounding the Wavion WBS-2400](#) on page 23

## Wood Brace Mounting

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

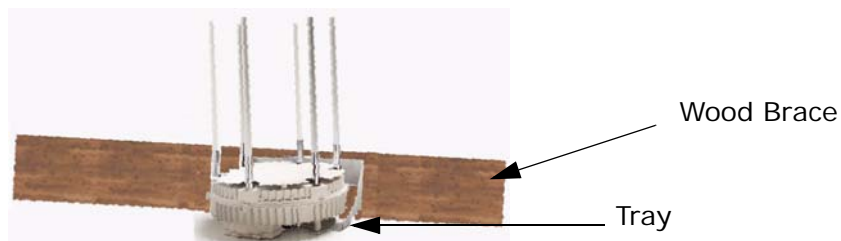


Figure 3.9. **Wood Brace Mounting Option**

You can attach the WBS-2400 to any wood brace.



**NOTE:** Before attaching the WBS-2400 make sure that the wood can support the WBS-2400 weight plus wind loading. Please see Chapter 9 for wind loading considerations.

### To mount the Wavion WBS-2400 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 3.10](#). Use an appropriate Allen wrench to tighten the bolts. Make sure that the wood brace is level.

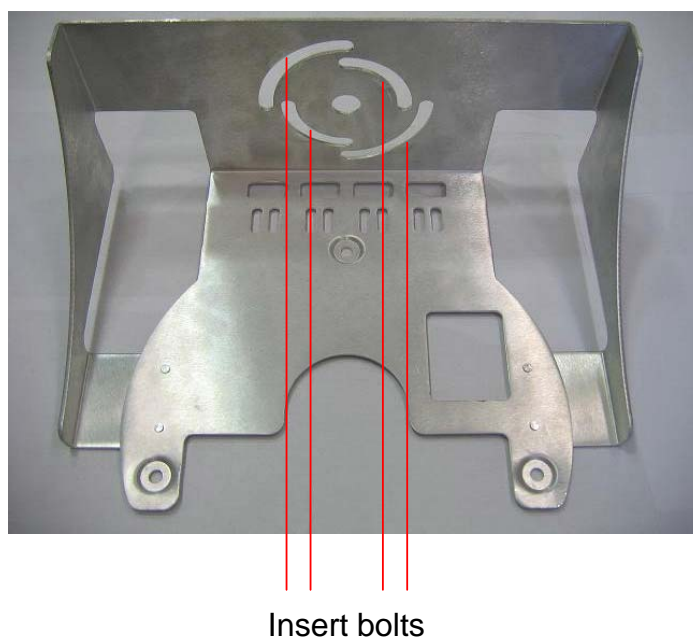


Figure 3.10. **Tray Mount for Wood Brace**

- Slide the WBS-2400 onto the tray. Insert three 8mm stainless steel hex head machine bolts from underneath the tray into the WBS-2400. Use a 5mm Allen wrench to tighten the bolts.

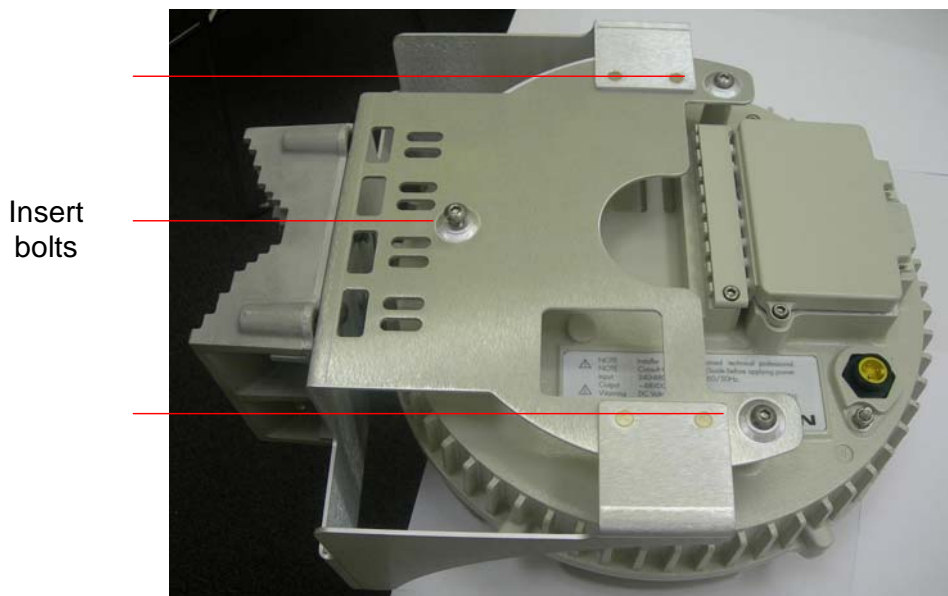


Figure 3.11. **Attaching the WBS-2400 to the Tray**

To continue installing the WBS-2400, see [Grounding the Wavion WBS-2400](#) on page 23.

### Streetlight Mounting

You can mount the Wavion WBS-2400 on the horizontal or angled arm of a streetlight.

#### To mount the Wavion WBS-2400 on a streetlight

- Choose a mounting location. You can attach the WBS-2400 to any streetlight arm with diameter of 3 to 10 inches.
- 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.
- 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 if you need a different size.

- Attach the back plate to the pole bracket as labeled #1 in [Figure 3.12](#)

5. Insert the six bolts into the holes in the back plate labeled #2 in [Figure 3.12](#) and tighten.

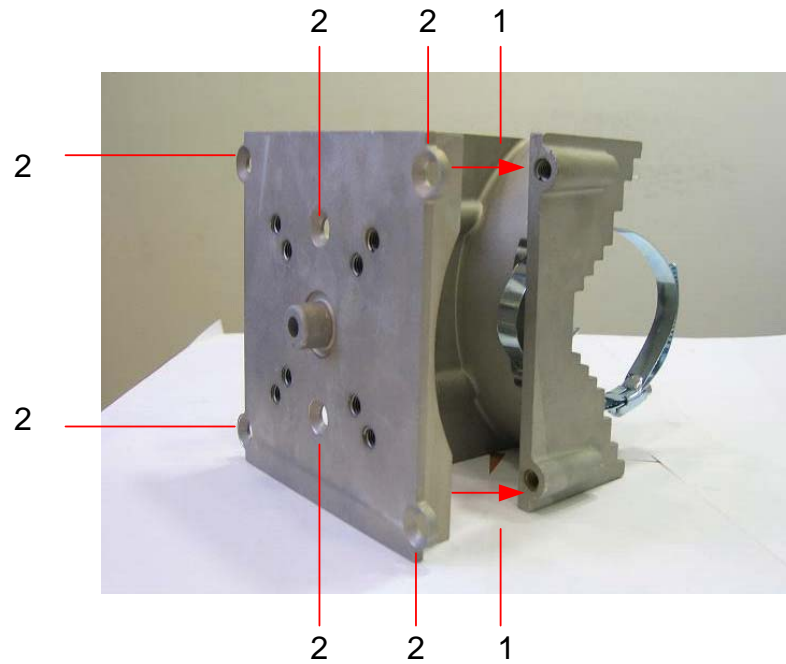


Figure 3.12. **Attaching the Back Plate to the Pole Bracket**

6. Attach the tray to the back plate as shown in [Figure 3.13](#).



**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.

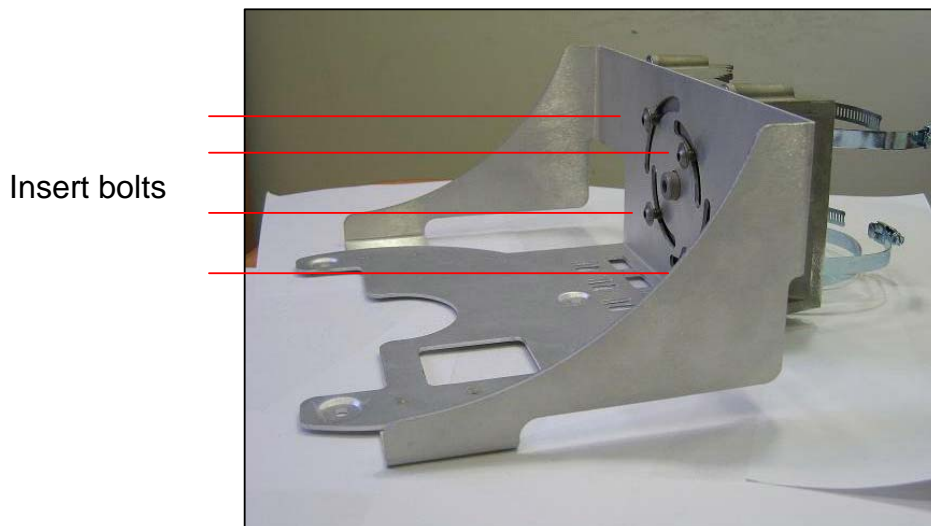


Figure 3.13. **Attaching the Tray to the Back Plate**

8. Slide the WBS-2400 onto the tray. Insert 3 8mm stainless steel hex head machine bolts from underneath the tray into the WBS-2400 and tighten the bolts. Tighten the bolts using a 5mm Allen wrench.

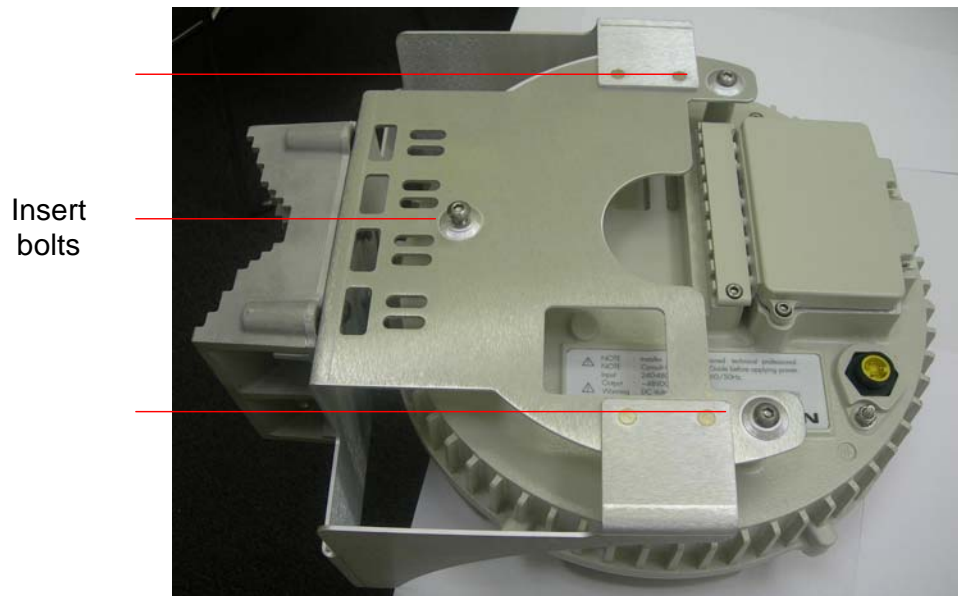


Figure 3.14. **Attaching the WBS-2400 to the Tray**

To continue installing the WBS-2400, see [Grounding the Wavion WBS-2400](#) on page 23.

## Grounding the Wavion WBS-2400



**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 WBS-2400.

The method for grounding the Wavion WBS-2400 is shown in the figure below.

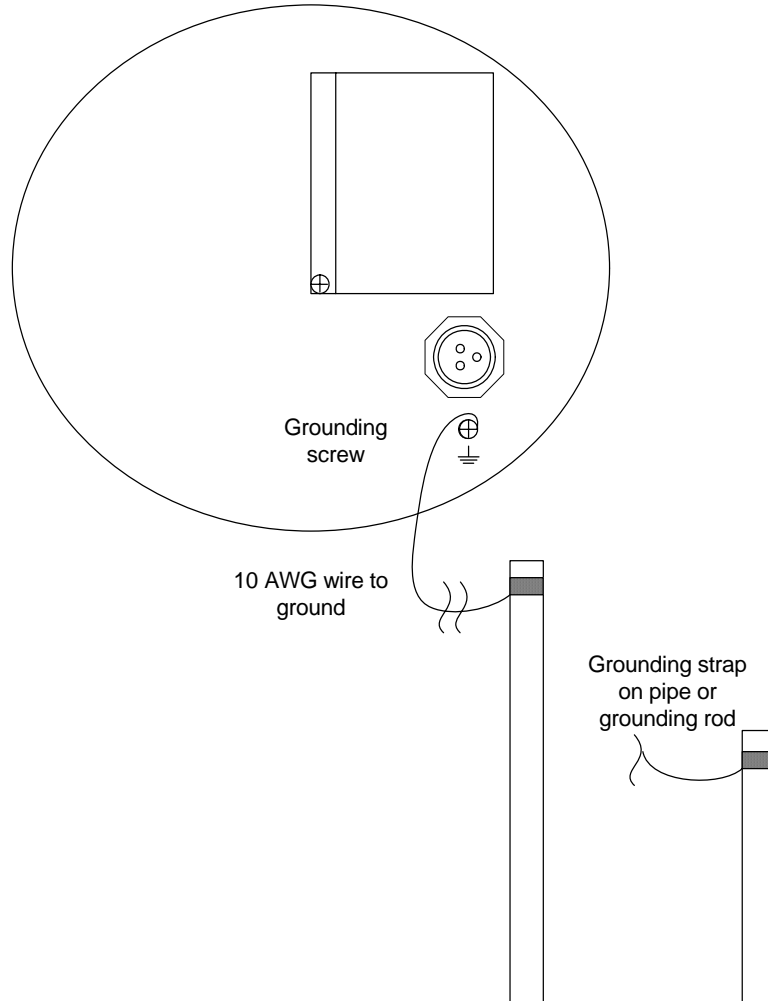


Figure 3.15. **Grounding Method**

**To ground the Wavion WBS-2400**

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



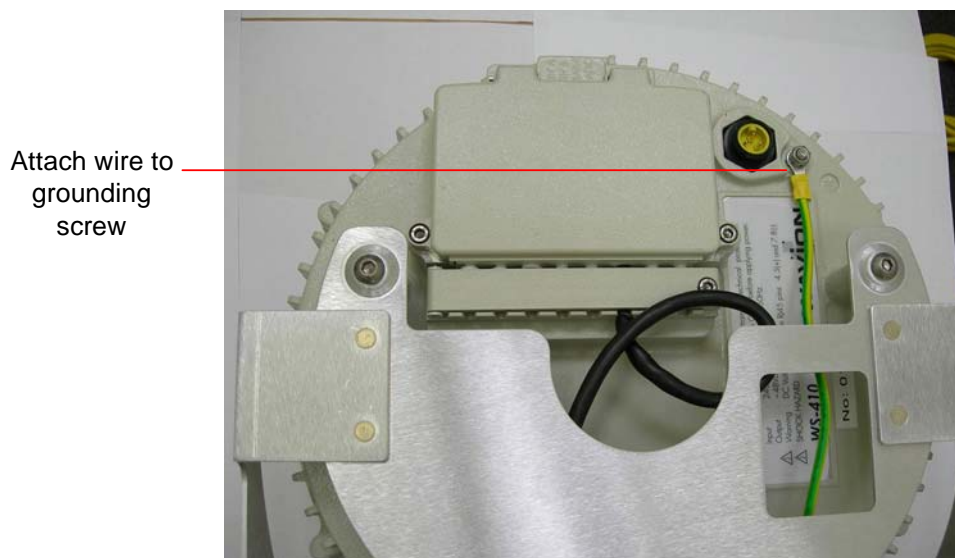
Grounding screw

Figure 3.16. **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 3.17](#).

### 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.

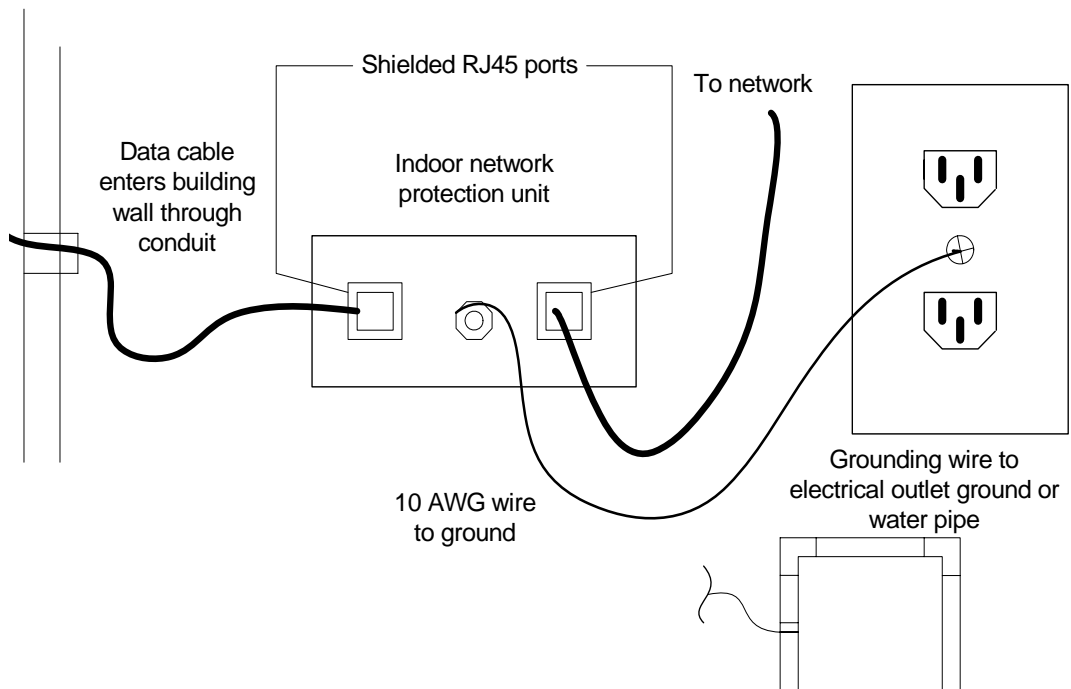


Figure 3.17. **Grounding the Indoor Network Protection Unit**

## Connecting Antennas

This section explains how to connect the six antennas to the WBS-2400. In order for the WBS-2400 to work properly, six antennas must be connected.

Screw each of the 6 antennas into the an N-Type connectors on the WBS-2400.

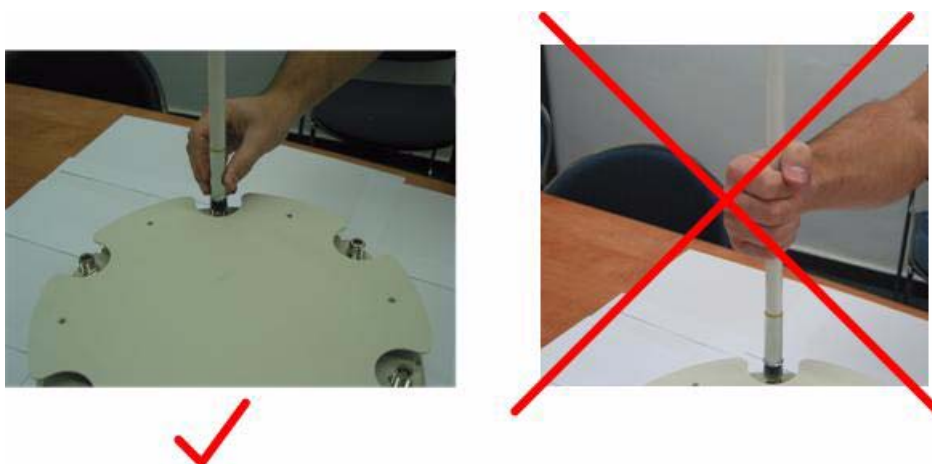


Figure 3.18. **Connecting the Antennas**

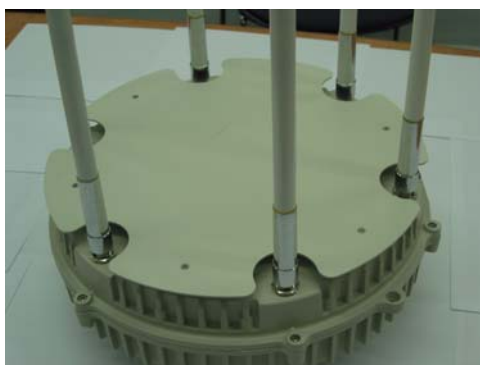


**WARNING:** Only connect the unit to the power supply once all the antennas are connected.

**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 WBS-2400 to power. There are three options for connecting the Wavion WBS-2400 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 55 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 55 for details.
- DC power source (2-wire service); 48VDC See [Chapter 7: Installation Accessories](#) on page 55 for details.
- Wavion injector connected to Ethernet port B (ETH B). See [Chapter 7: Installation Accessories](#) on page 55 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 WBS-2400 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 WBS-2400.

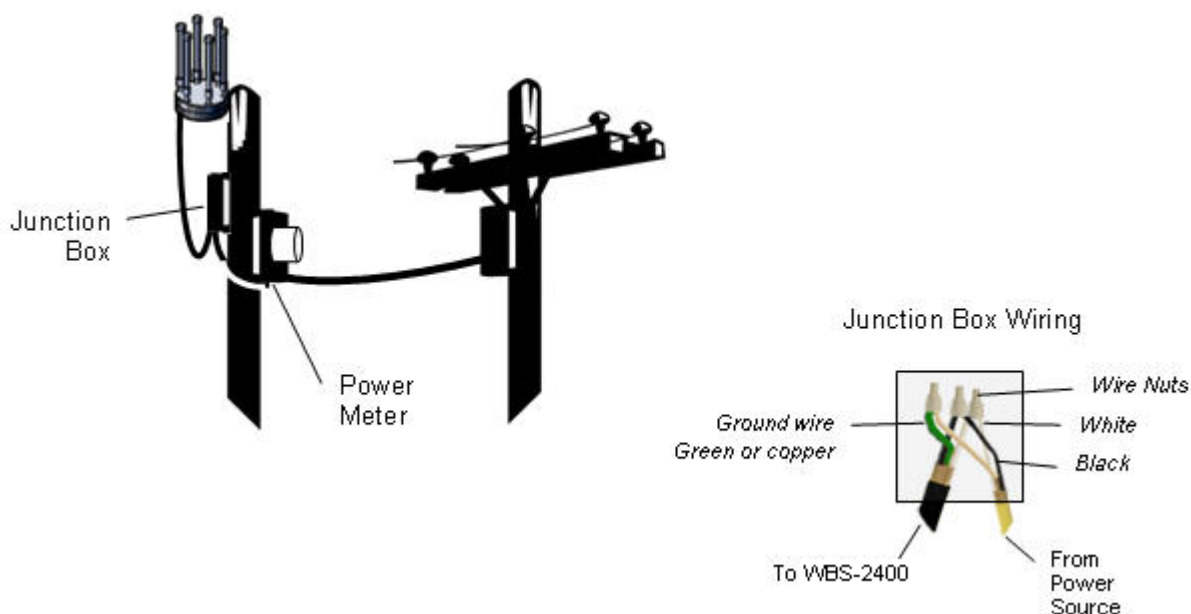
## Connecting to AC Power (Category C)

The AC power connections for a Category C AC power source are shown in [Figure 3.19](#).



**WARNING:** All wiring should be performed by a licensed electrician. All wiring and connections must conform to local uniform building codes.

Figure 3.19. 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 55 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 WBS-2400 and tighten the nut.

Connect  
the AC  
cable



7. Connect the Wavion WBS-2400 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 55 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 55 for details.
  - Reenergize the circuit and check that the power to the WBS-2400 turns on.



**NOTE:** The Wavion WBS-2400 is equipped with additional AC surge protection and fuse branch circuit protection. AC current protection of 20Amp should be installed.

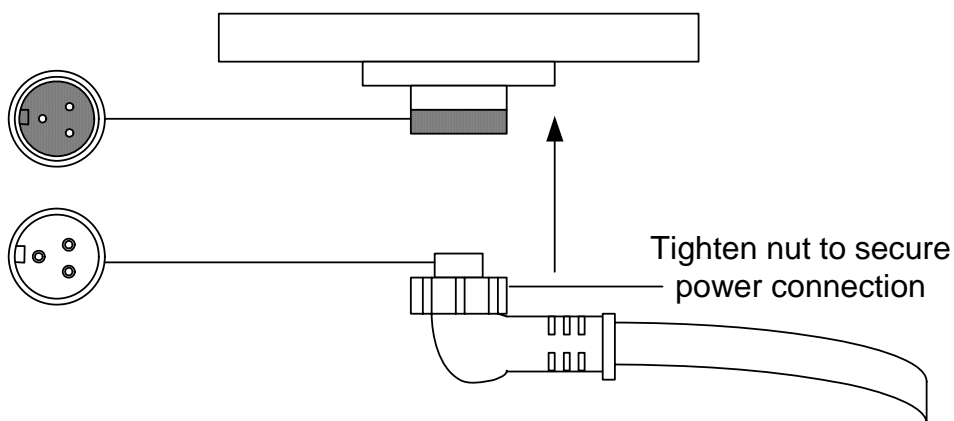


Figure 3.20. **Connecting the AC Power Cable**

## 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 55 for details.

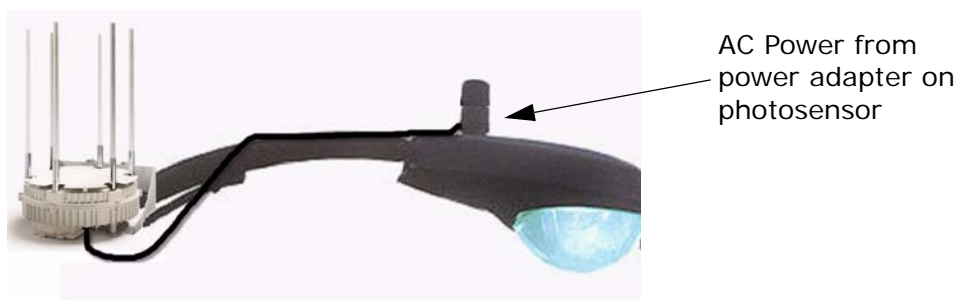


Figure 3.21. **Connecting Streetlight Power**



**WARNING:** Connect the WBS-2400 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.



**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 55 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 WBS-2400 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 WBS-2400 and tighten by hand.

7. Reenergize the circuit and confirm that the power to the WBS-2400 comes on.



**NOTE:** The Wavion WBS-2400 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 55.

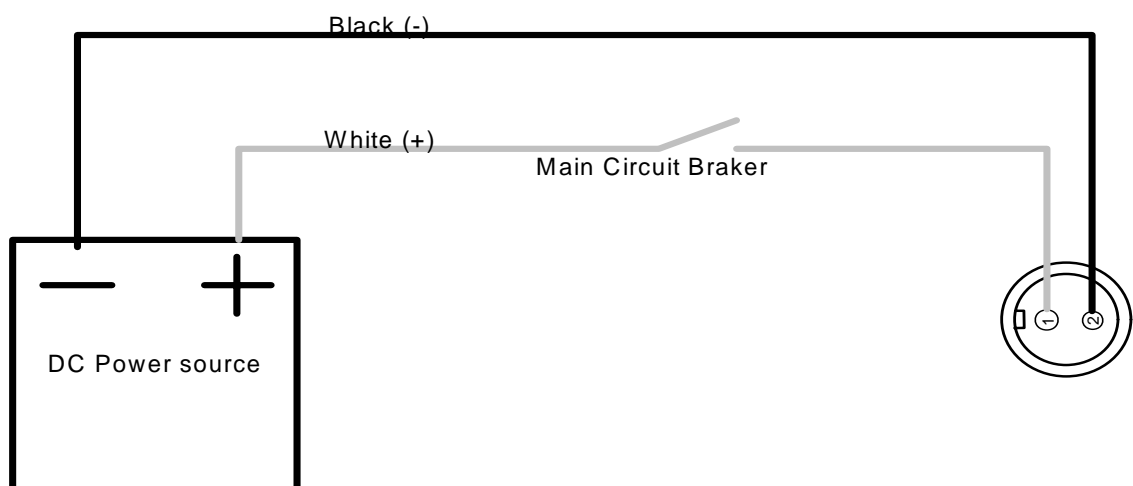
## Connecting to DC Power

The DC power connections for a DC power source are shown in [Figure 3.22](#).



**WARNING:** All wiring should be performed by a licensed electrician. All wiring and connections must conform to local uniform building codes.

Figure 3.22. **Connecting DC Power**



### To connect an DC power source

1. Verify that the service voltage is the following: 48VDC in the correct polarity.
2. Connect positive Voltage to White wire of the DC cable.
3. Connect Negative Voltage to Black wire of the DC cable.
4. Make sure the power is turned off on the designated circuits.
5. Install a 1/2 inch liquid-tight conduit from the building entrance point to within 3 feet of the outdoor system.



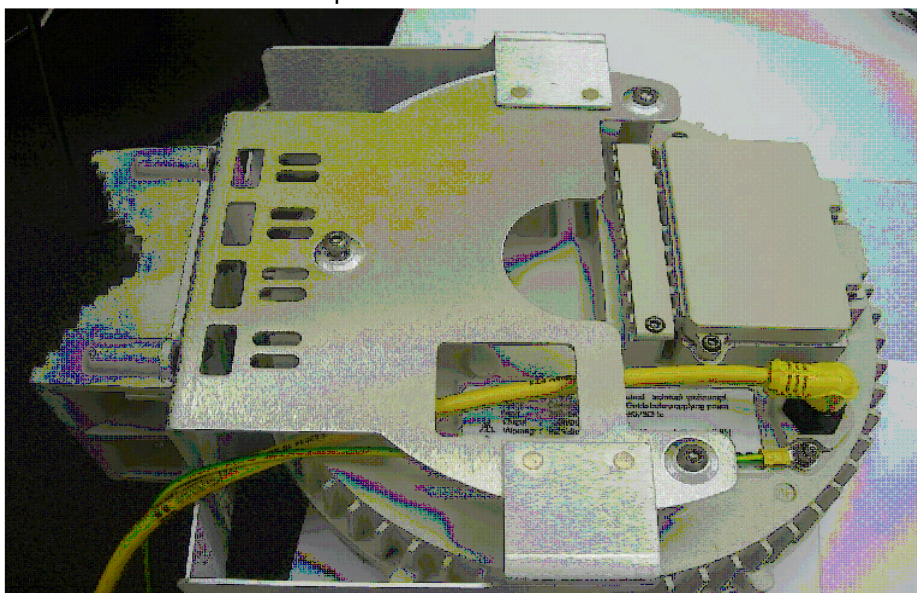
- Run 2-wire DC service through the conduit..



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

- Connect the DC cable to the WBS-2400 and tighten the nut.
- Reenergize the circuit and check that the power to the WBS-2400 turns on.

Connect the DC cable



**NOTE:** The Wavion WBS-2400 is equipped with fuse branch circuit protection. External DC current protection of 10Amp should be installed.

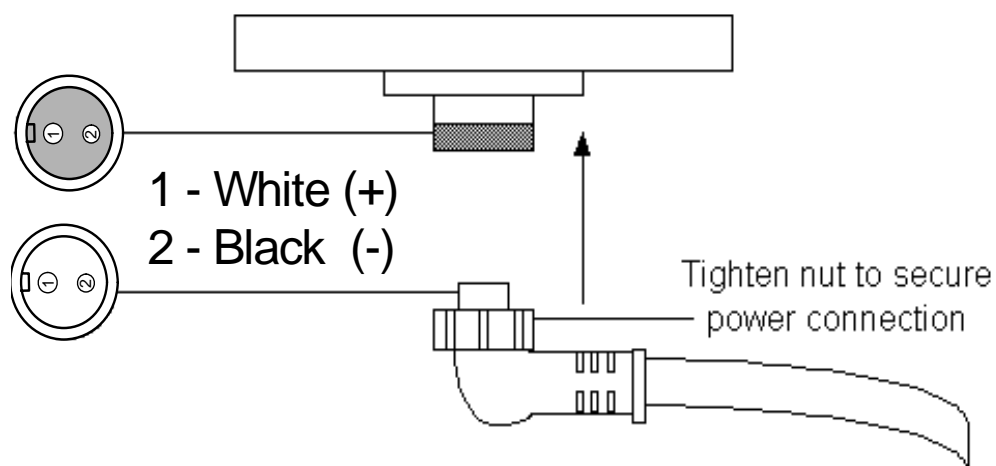


Figure 3.23. **Connecting the DC Power Cable**

## Connecting a Data Port

The Wavion WBS-2400 is equipped with four RJ45 connectors. The left hand port named "SERIAL" is for engineering use only. Use the ETH A port if you are connected to the external unit (backhaul, camera, and etc.) for which you have to supply 12/24VDC power. Use the ETH B port if you are connected to external unit for which you have to supply 48VDC power. In case you do not need to power an external device you can connect either ETH A, ETH B, or ETH C ports. All three Ethernet ports can be active simultaneously.



**NOTE:** Use only shielded Cat5e cable rated for outdoor use. See [Chapter 7: Installation Accessories](#) on page 55 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 A and 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 WBS-2400. Connect the Ethernet cable to the appropriate data port (ETH A, ETH B, or ETH C).

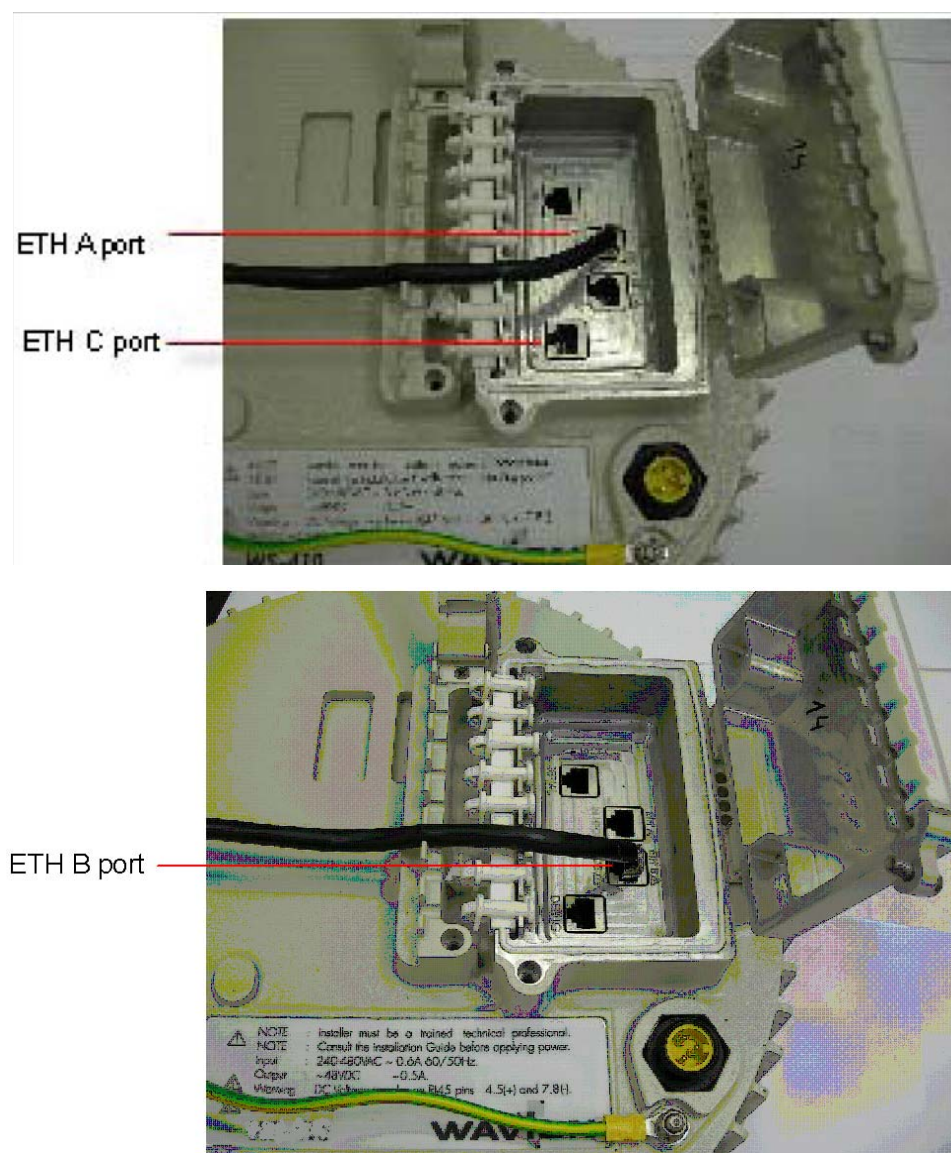


Figure 3.24. **Data Port Connection Options**

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 WBS-2400.

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 WBS-2400 by unscrewing the two bolts.
5. Open the strip next to the connector access cover by unscrewing the bolt.

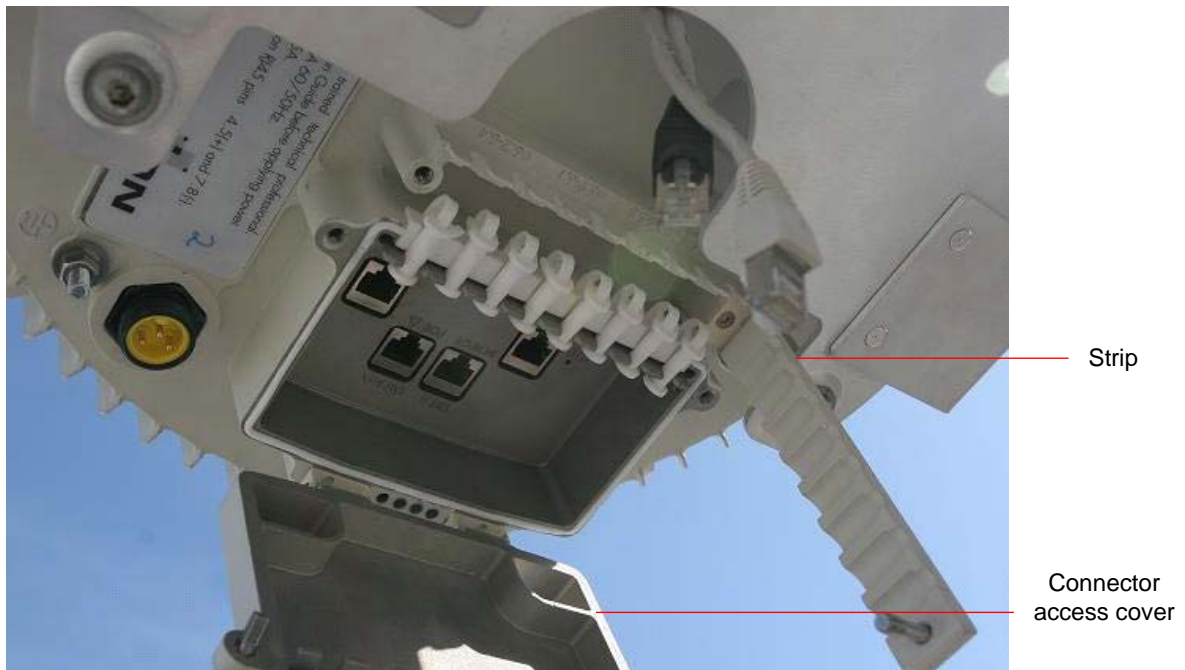


Figure 3.25. **Opening the Strip and Connector Access Cover**

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

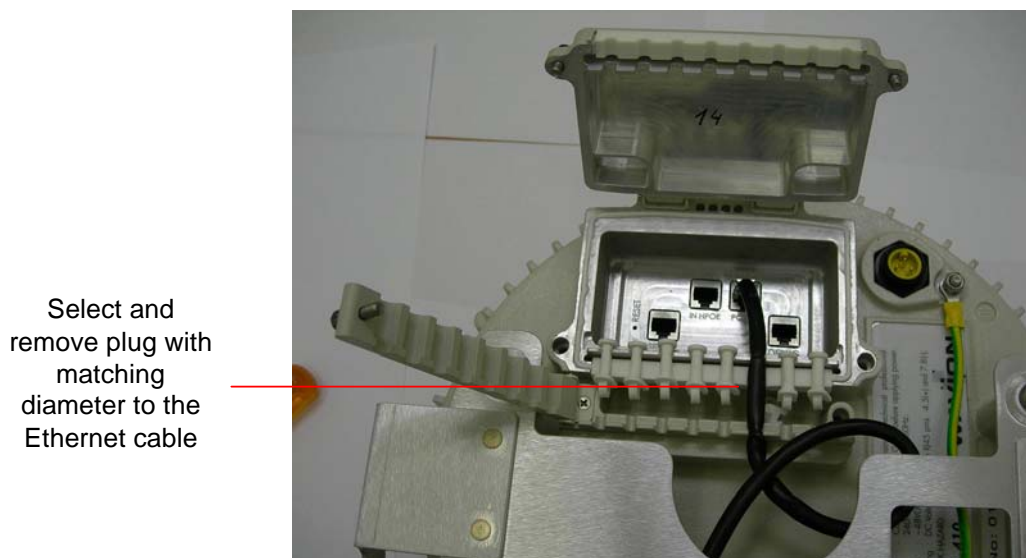
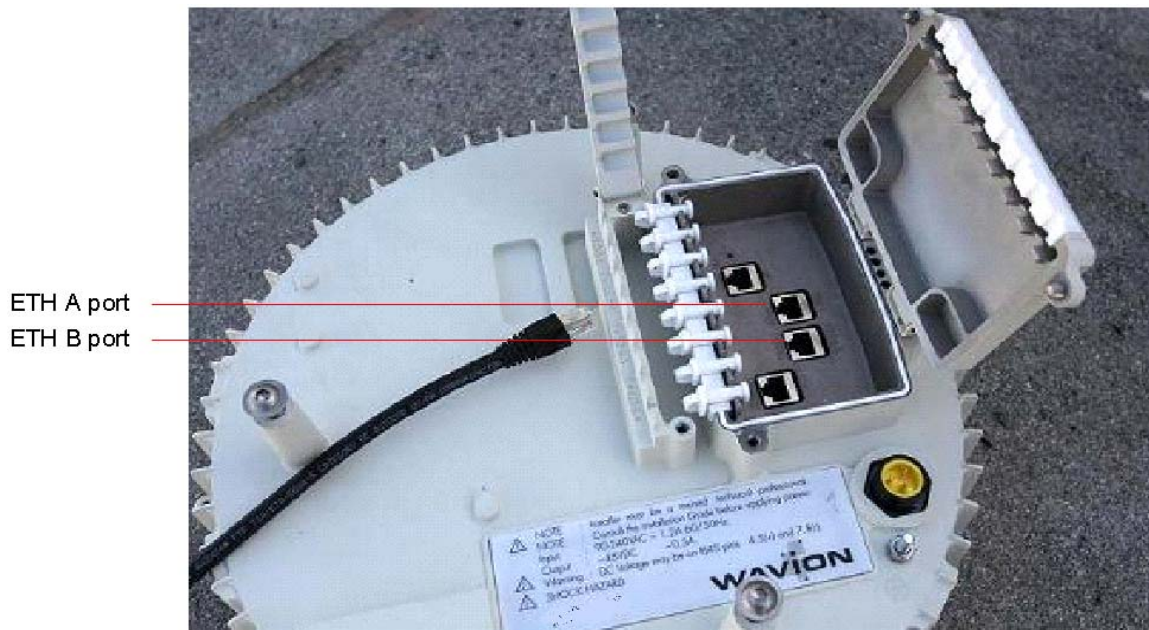


Figure 3.26. **Removing the Plug Matching the Diameter of the Cable**



7. Connect the cable ends on the WBS-2400 to the ETH A,ETH B, or ETH C ports. Use a shielded RJ45 8-pin modular plug to terminate the cables at the desired lengths.



8. The port named "DEBUG" is functioning as ETH C port.
9. Make sure that the protection unit is properly grounded.
10. Apply silicon across the rubber plugs.
11. Close the strip and tighten the bolt using the 4mm Allen wrench.
12. Close the connector access cover and tighten the bolts using the 4mm Allen wrench. This ensures a watertight seal.

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

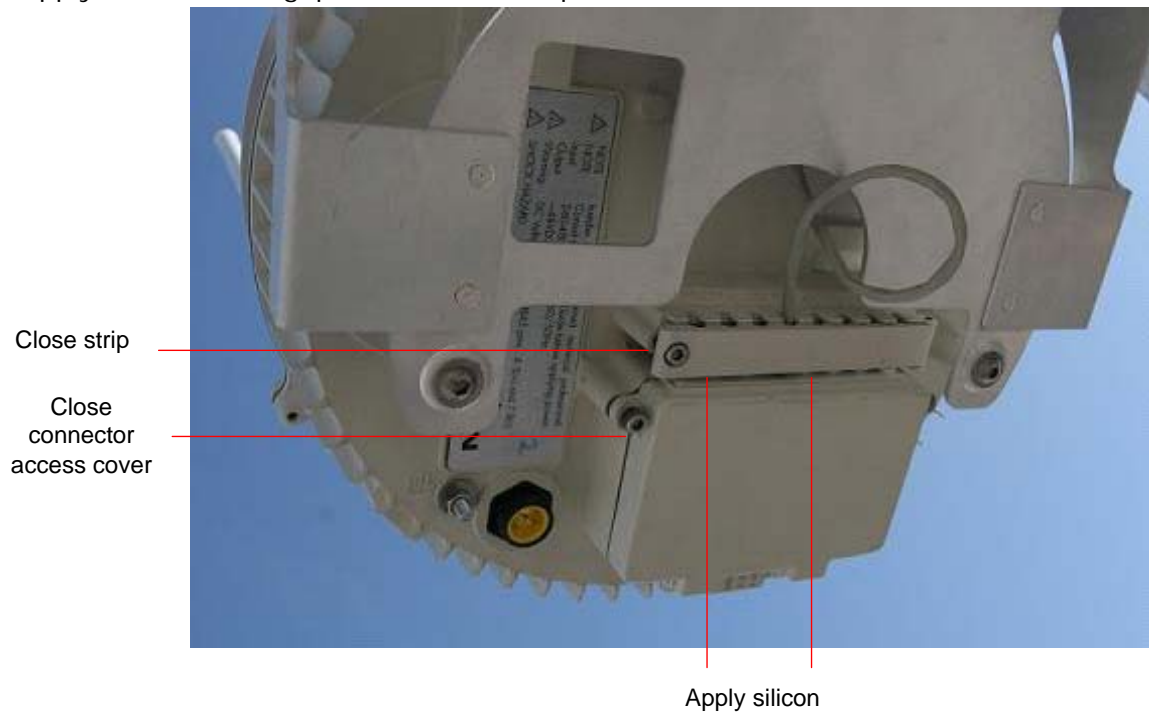


Figure 3.27. **Closing the Covers**

14. 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 WBS-2400 can source 24VDC or 12VDC power on ETH A and 48VDC power on the ETH B connectors on pins 4,5 and 7,8, This allows the WBS-2400 to power an external device.

## PoE Power Sourcing Power Output

Voltage	Max Power Output
48VDC	30W
24VDC	24W
12VDC	12W



**WARNING:** Table above defines maximum output power in case that only one of two ports (ETH A or ETH B) is sourcing power to the external device. If both ports are powering the external device the total output power should not exceed 30W.



**NOTE:** The output power support is available on selected models. Please refer to appendix A: WBS-2400 Product list.



**NOTE:** PoE output can only be supported if the WBS-2400 is powered by AC or DC voltage input.



**NOTE:** Use only shielded Cat5e cable rated for outdoor use. [Chapter 7: Installation Accessories](#) on page 55 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.

## ETH A and ETH B 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, 12/24/48 VDC (+)
5	T	PoE+	Blue-White	Power output, 12/24/48 VDC (+)
6	R	RXD-	Green	RX Data 10/100BaseT
7	T	PoE-	Brown-White	Power output, 12/24/48 VDC (-)
8	R	PoE-	Brown	Power output, 12/24/48 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 WBS-2400



**NOTE:** The antennas on the WBS-2400 must be higher than the antennas on the backhaul unit.

The following backhaul unit can be powered by the WBS-2400:

- Motorola Canopy uses 24VDC PoE input voltage. Please use the correct WBS-2400 product version to power the Canopy unit.
- Alvarion VL uses 48VDC PoE input voltage (Please refer to [Chapter 7: Installation Accessories](#) on page 55 for details on connecting the Alvarion unit to the WBS-2400)



**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 WBS-2400, connect the Ethernet cable to either ETH A or ETH B.



**NOTE:** When using a Wavion injector, the WBS-2400 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 WBS-2400

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 WBS-2400 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 WBS-2400:

- 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 WBS-2400 must be used only with Wavion approved components and antennas.

## Service Instructions

The Wavion WBS-2400 contains no user serviceable parts inside.



## Power Consumption

This chapter describes the power consumption details for the WBS-2400. The power consumption of the WBS-2400 varies according to the operational conditions and data transmission rates.

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

<b>WBS-2400 Input Voltage</b>	<b>WBS-2400 Input Power when PoE output is not used</b>	<b>WBS-2400 (Max) Input Power when a 24VDC PoE output is used</b>	<b>WBS-2400 (Max) Input Power when a 48VDC PoE output is used</b>
110 VAC 50/60 Hz	40W	72W	74W
220 VAC 50/60 Hz	44W	78W	81W



## Product Specification

The tables in this chapter contain specifications for the Wavion WBS-2400.

### Wireless Specifications

IEEE 802.11b/g compliant

Frequency band	2.4 - 2.483 GHz
Modulation	<ul style="list-style-type: none"> <li>• 802.11b: DSSS (DBPSK, DQPSK, CCK)</li> <li>• 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK)</li> </ul>
TX Power Maximum	802.11b and 802.11g
Beamformer Directed Power	EIRP + Beamforming 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

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-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 tool  
SNMPv2 with standard and Wavion MIB support  
Configuration save and restore  
Network and client statistics

### Physical Specifications

Network Interfaces	<ul style="list-style-type: none"><li>• Auto-sensing 10/100 Ethernet</li><li>• Input from Wavion Injector</li></ul>
Auxiliary Network Interface	<ul style="list-style-type: none"><li>• For connection to a backhaul interface where PoE to the backhaul device is required.</li><li>• Auto-sensing 10/100 Ethernet</li><li>• Input/Output Power over Ethernet</li></ul>
Power Input	<ul style="list-style-type: none"><li>• Weather-tight power connector plug for 100-240 VAC power input</li><li>• Power from a Wavion Injector (ETH B port only)</li></ul>

## Physical Specifications

Indicator Lights	<ul style="list-style-type: none"> <li>• Two Ethernet port LED Link/Act indicators (only for ETH A and ETH B ports)</li> <li>• System Status LED indicator</li> <li>• RF channel status indicator</li> </ul>
Physical Dimensions	<p>Base:</p> <ul style="list-style-type: none"> <li>• Diameter - 13in (33cm)</li> <li>• Height - 5in (12cm)</li> </ul> <p>Antenna Array:</p> <ul style="list-style-type: none"> <li>• Height - 17in (43cm)</li> </ul> <p>Weight: 20lbs (8kg)</p>

## Power Specifications

Power Input	<ul style="list-style-type: none"> <li>• 100 - 240 VAC weather-proof power cable, 50/60 Hz with standard AC connector or street light NEMA photo-electric control power tap</li> <li>• 55VDC, supplied over Ethernet from Wavion injector.</li> </ul>
Input Power Consumption	<ul style="list-style-type: none"> <li>• Power from Wavion Injector 35W @ 55VDC</li> <li>• For AC input see <a href="#">Chapter 4: Power Consumption</a> on page 43</li> </ul>
Output Power over Ethernet Option	<p>For powering an external device:</p> <ul style="list-style-type: none"> <li>• 48VDC, 0.6A max.</li> <li>• 24VDC, 1A max.</li> <li>• 12VDC, 1A max.</li> <li>• The output power from both ETH A and ETH B ports must NOT exceed 30W.</li> </ul>

## Environmental Specifications

Operating Temperature Range	-40°C to +55°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
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**Approvals**

Safety	TUVus
EMC	47 CFR Part 15, Sub Part B, Class B (USA)



# Antenna Specifications and Patterns

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The chapter describes antenna specifications and patterns for the antennas supplied with the Wavion WBS-2400.

## SF-245W 2.4GHz Omnidirectional Antenna

### Specifications

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

### Pattern

Elevation pattern at:

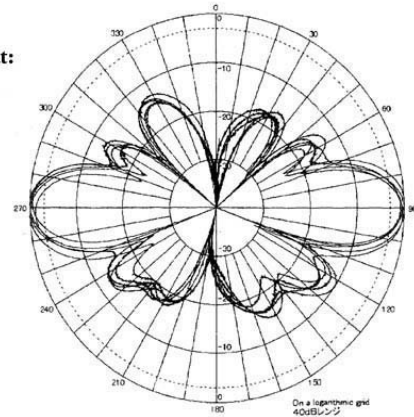
2400MHz

2425MHz

2450MHz

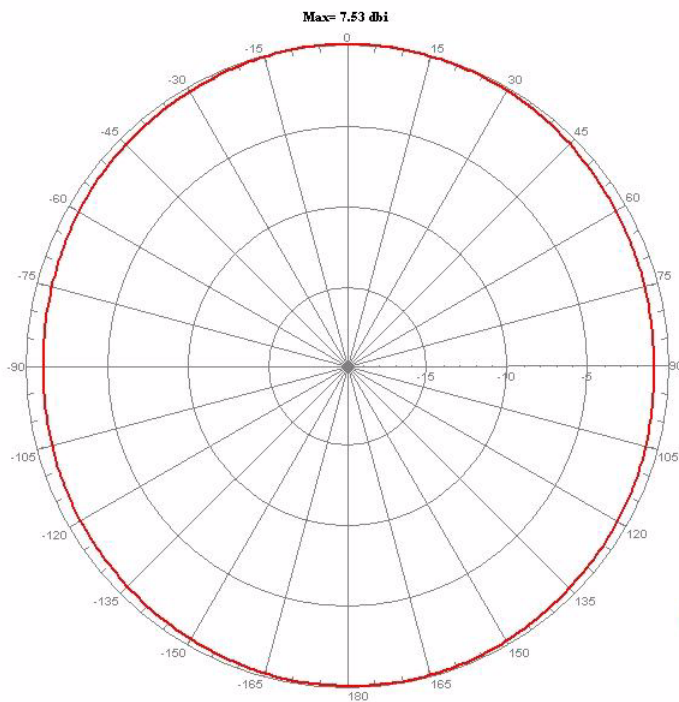
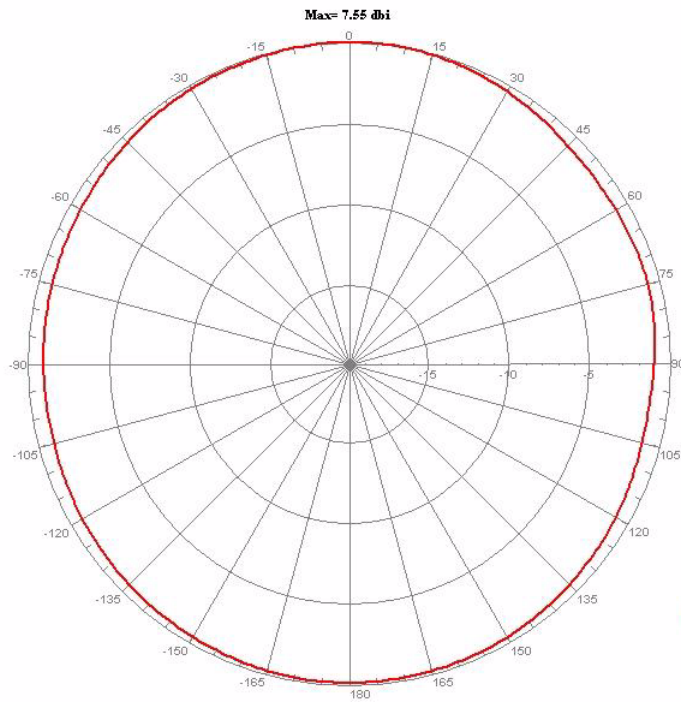
2475MHz

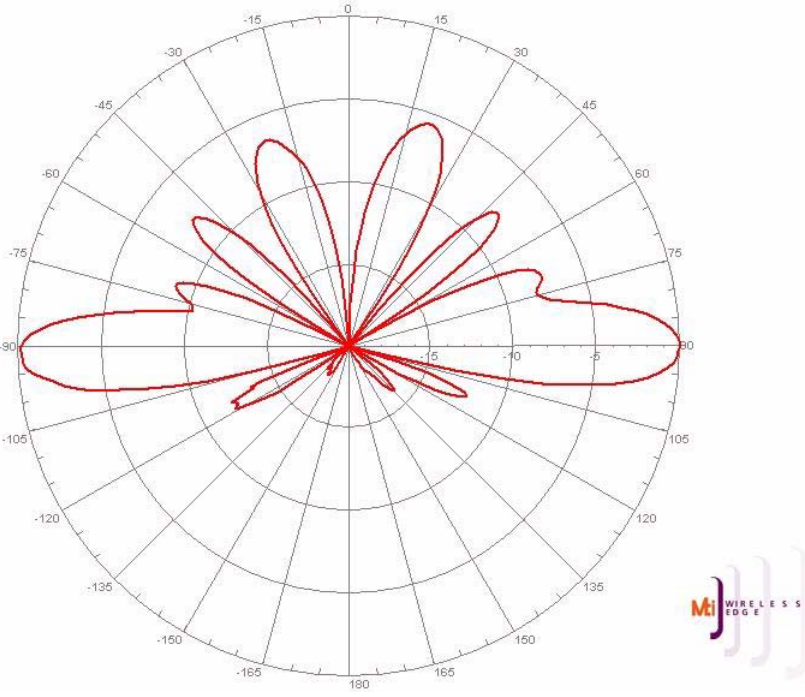
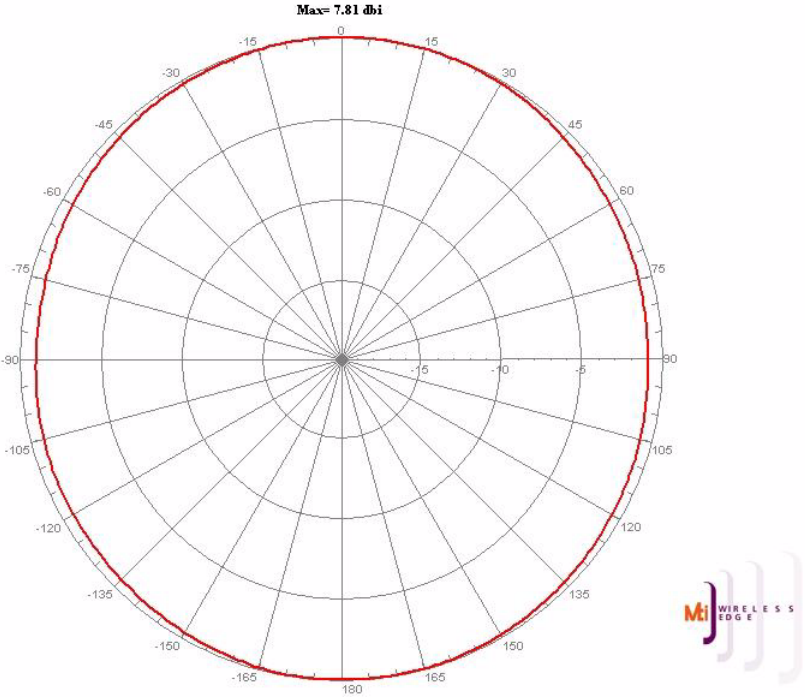
2500MHz

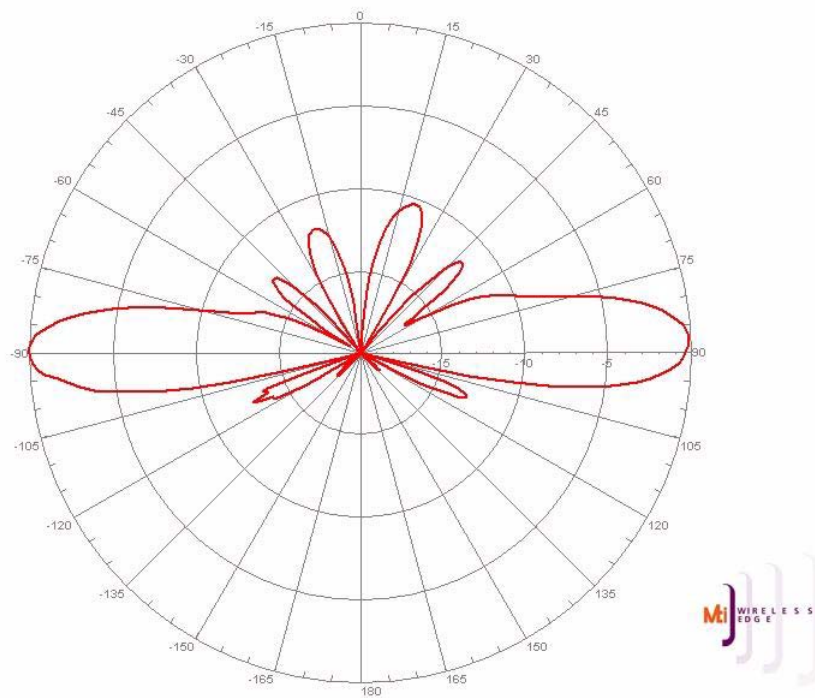
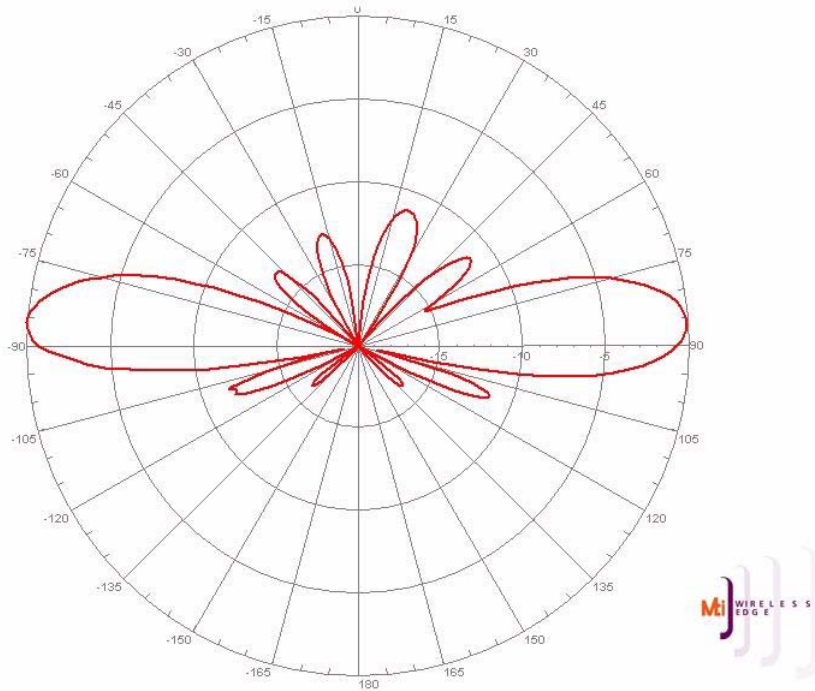


## MT\_341017/N/A and MT\_342015NV\_SN\_035\_EL 2.4 GHz Antenna

The following describes the patterns for the antenna:









# Installation Accessories

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This chapter describes the accessories available for the WBS-2400 and ordering information. The following topics are covered in this chapter:

- [Power Cable](#) on page 56
- [Ethernet Cables](#) on page 56
- [Lightning Protection](#) on page 56
- [Power Over Ethernet](#) on page 56
- [Client Connectivity](#) on page 57

## Power Cable

Description	Part Number
Power Cable for Wavion Base Station, 110 VAC, 20 feet	WPC-AC-6M-US
Power Cable for Wavion Base Station, 110 VAC, 6 feet.	WPC-AC-2M-US
Power Cable for Wavion Base Station,, 110-240 VAC, 20 feet (Unterminated)	WPC-AC-6M-UNV
Street Light Power Tap for Wavion Switch 410, 110/220 VAC, 30 feet	WPC-SLP-9M
Street Light Power Tap for Wavion Switch 410, 110/220 VAC, 6 feet	WPC-SLP-2M
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	WPC-
Power Cable for Wavion Base Station, 48 VDC, 6 feet.	WPC-DC-6M-UNV

## 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 Injector for powering the WBS-2400 over an Ethernet cable. Output 55VDC, 1A.	WPI-AC-55W



## Client Connectivity

Description	Manufacturer
Alvarion - Use Alvarion Indoor-Outdoor CAT 5e cable with pin crossing (pin 5 of the WBS-2400 PoE connector goes to pin 7 of Alvarion RJ45 connector, pin 7 of the WBS-2400 PoE connector goes to pin 5 of the Alvarion RJ45 connector)	See Installation Guide
Motorola (Canopy) - Use outdoor CAT 5e cable with spare pin crossing (pin 4 5 of the WBS-2400 PoE connector goes to pin 7 8 Motorola RJ45 connector respectively) (pin 7 8 of the WBS-2400 PoE connector goes to pin 4 5 Motorola RJ45 connector respectively)	



# AC Wiring Diagrams

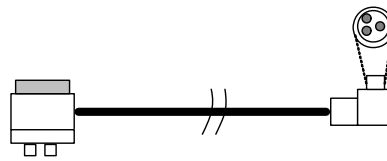
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This chapter contains the following wiring diagrams for AC power:

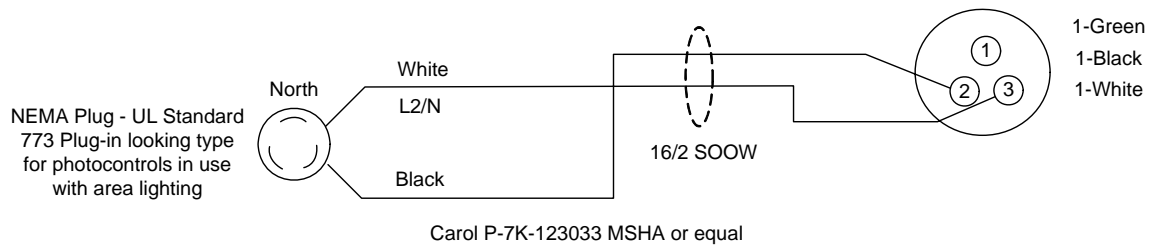
- [AC Wiring Photoelectric Power Tap](#) on page 60
- [AC Wiring Power Cable 120VAC, 15A Plug](#) on page 62

## AC Wiring Photoelectric Power Tap

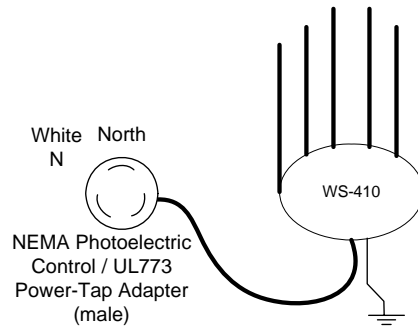
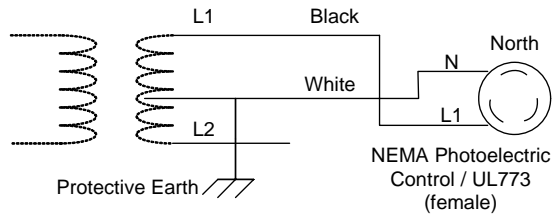
**WS410PT-02-GE-AA (6') or  
WS410PT-01-GE-AA (30')**  
Photoelectric Power-Tap  
Power Input Cable  
2Wire - 100-240VAC



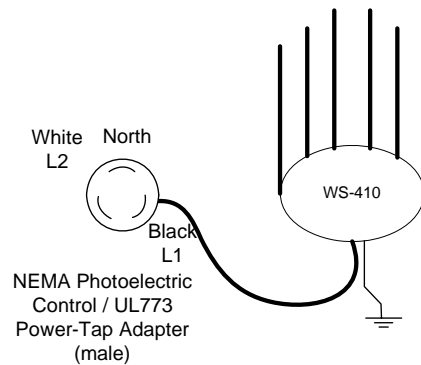
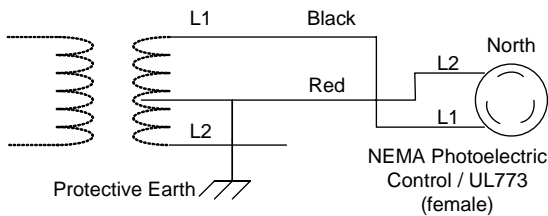
Length: 4' or 20'



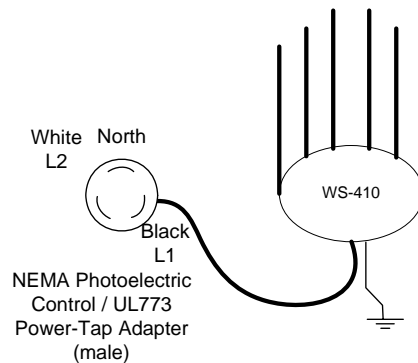
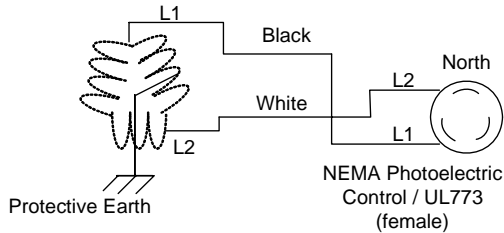
**Power-Tap single phase - two wire service**



**Power-Tap single phase - two wire service**



**Three phase - two wire service (Delta)**



**208Vac three phase - two wire service (grounded-Wye)**

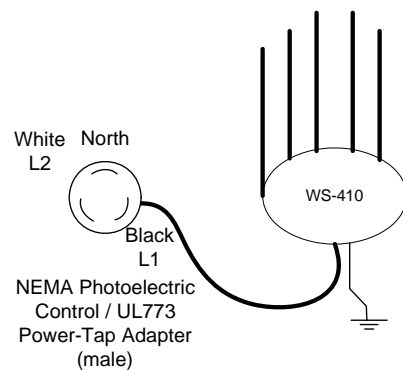
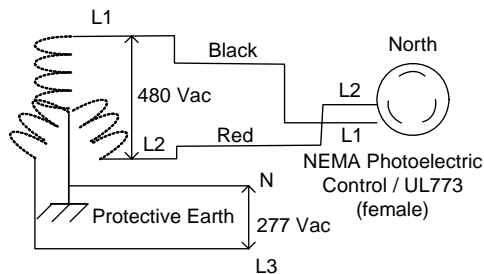


Figure 8.28. AC Wiring Photoelectric Power Tap

## AC Wiring Power Cable 120VAC, 15A Plug

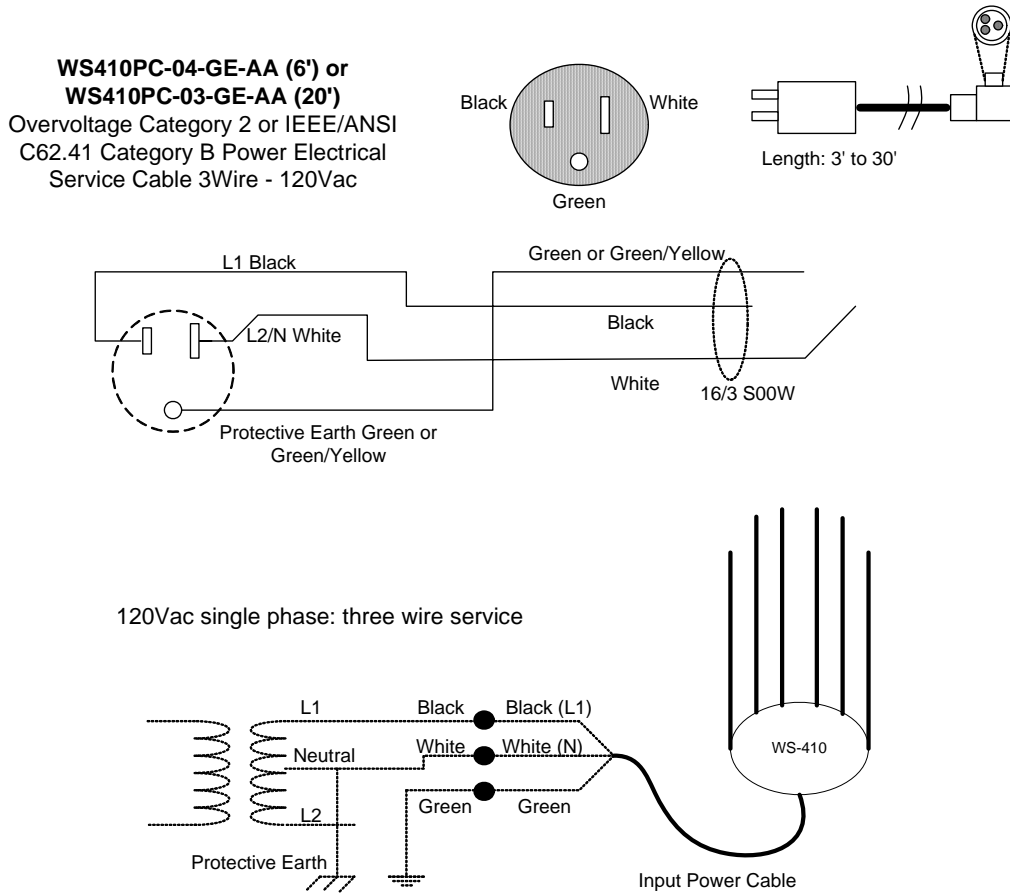


Figure 8.29. AC Wiring Power Cable 120VAC, 15A Plug

## Backhaul Unit Installation Instructions

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This chapter describes how to install a backhaul unit with the WBS-2400.

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 WBS-2400 is installed in a higher position than the backhaul unit so the antennas are unobstructed. If the backhaul unit is powered externally, connect to either ETH A, ETH B, or ETH C port. If the backhaul unit is not powered externally, connect to either ETH A or ETH B port, according to the backhaul input voltage.



**WARNING:** Disconnect power to the WBS-2400 before connecting the backhaul unit.



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





# Wind Loading Considerations

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This chapter describes wind loading considerations for the WBS-2400.



**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 WBS-2400 weighs approximately 16 lbs, including all mounting hardware. When the Wavion WBS-2400 is mounted on a pole, the sail area of the WBS-2400 is approximately 1 square foot. The Wavion WBS-2400 can load a pole with a maximum load of 3400 Newton in wind conditions of 165mph.



## Appendix A: WBS-2400 Product list

Part Number	Product name	Product description
12405101	WBS-2400-POE-FCC	Spatially adaptive, multimulti radio WiFi base station, PoE input, no PoE output. FCC/TUV compliant
12405102	WBS-2400-POE-EU	Spatially adaptive, multi radio WiFi base station, PoE input, no PoE output. ETSI / CE compliant
12405201	WBS-2400-AC-48-FCC	Wavion 2.4GHz Spatially adaptive, multi radio WiFi base station, with 2.4GHz self backhaul. 100-240VAC input and 48VDC PoE output for external device. FCC/TUV compliant
12405202	WBS-2400-AC-48-EU	Spatially adaptive, multi radio WiFi base station, 100-240VAC input and 48VDC PoE output for external device. ETSI / CE compliant
12405501	WBS-2400-DC-48-FCC	Spatially adaptive, multi radio WiFi base station, 48VDC input and 48VDC PoE output for external device. FCC/TUV compliant
12405502	WBS-2400-DC-48-EU	Spatially adaptive, multi radio WiFi base station, 48VDC input and 48VDC PoE output for external device. ETSI / CE compliant
12405301	WBS-2400-AC-24-FCC	Spatially adaptive, multi radio WiFi base station, 100-240VAC input and 24/48VDC PoE output for external device FCC/TUV compliant
12405302	WBS-2400-AC-24-EU	Spatially adaptive, multi radio WiFi base station, 100-240VAC input and 24/48VDC PoE output for external device. ETSI / CE compliant

<b>Part Number</b>	<b>Product name</b>	<b>Product description</b>
12405601	WBS-2400-DC-24-FCC	Spatially adaptive, multi radio WiFi base station, 48VDC input and 24/48VDC PoE output for external device. FCC/TUV compliant
12405602	WBS-2400-DC-24-EU	Spatially adaptive, multi radio WiFi base station, 48VDC input and 24/48VDC PoE output for external device. ETSI / CE compliant
12405401	WBS-2400-AC-12-FCC	Spatially adaptive, multi radio WiFi base station, 100-240VAC input and 12/48VDC PoE output for external device FCC/TUV compliant
12405402	WBS-2400-AC-12-EU	Spatially adaptive, multi radio WiFi base station, 100-240VAC input and 12/48VDC PoE output for external device. ETSI / CE compliant
12405701	WBS-2400-DC-12-FCC	Spatially adaptive, multi radio WiFi base station, 48VDC input and 12/48VDC PoE output for external device. FCC/TUV compliant
12405702	WBS-2400-DC-12-EU	Spatially adaptive, multi radio WiFi base station, 48VDC input and 12/48VDC PoE output for external device. ETSI / CE compliant

# Acronyms

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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

<b>Acronym</b>	<b>Description</b>
MIL-STD	Military Standard
N	Neutral
NEC	National Electrical Codes
NEMA	National Electrical Manufacturers Association
OFDM	Orthogonal 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