# Tropos® Networks Mesh Router
# Outdoor Installation Guide
# Models 6410 and 6420
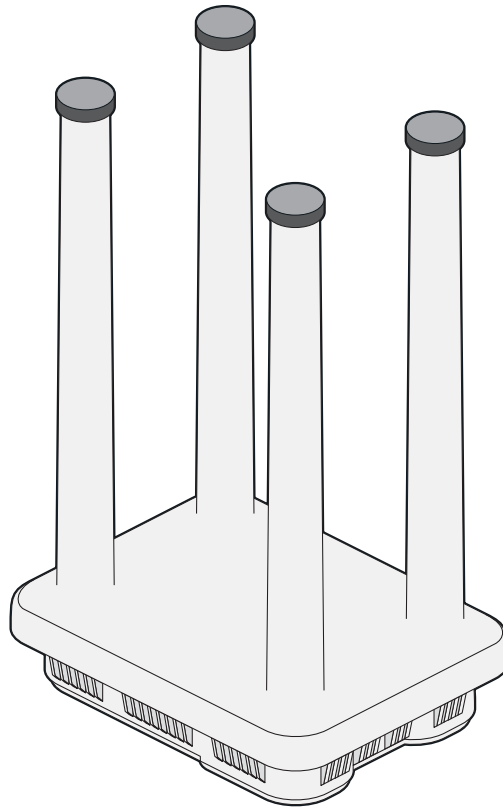
Power and productivity
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ABB

## Copyright Notice

## FCC Notice to Users and Operators

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B 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.
- Consult the dealer or an experienced radio/TV technician.

This Part 15 radio device operates on a non-interference basis with other devices operating at this frequency. Any changes or modification to said product not expressly approved by Tropos Networks could void the user's authority to operate this device.

## 5.8 GHz Point-to-Point and Point-to-Multipoint Systems

Operation of this device in point-to-multipoint systems is limited by federal regulation to 36 dBm EIRP. Unit conducted power in the 5.8 GHz band should be adjusted such that the sum of conducted power and antenna gain does not exceed 36 dBm EIRP.

The maximum antenna gain for point-to-point operation is 19 dBi. The effective EIRP limit for point-to-point system is 45 dBm EIRP.

## Industry Canada

Notice to users and operators:

This Class B digital apparatus meets all requirements of the Canadian Interference Causing Equipment Regulations. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Cet appareillage numérique de la classe B répond à toutes les exigences de l'interférence canadienne causant des réglements d'équipement. L'opération est sujette aux deux conditions suivantes : (1) cet dispositif peut ne pas causer l'interférence nocive, et (2) ce dispositif doit accepter n'importe quelle interférence reçue, y compris l'interférence qui peut causer l'opération peu désirée.

This device has been designed to operate with the antennas listed in Chapter 6, "Antenna Information." Antennas not included in the chapter or having a gain greater than 12 dBi in the 2.4 GHz band and 19 dBi in the 5.8 GHz band are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

Operation is subject to the following two conditions:

1. This device may not cause interference, and
2. This device must accept any interference, including interference that may cause undesired operation of the device.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (EIRP) is not more than that permitted for successful communication.

## European Union WEEE Notice

For EU member countries, this symbol means: Do not dispose of this equipment as unsorted municipal waste. This equipment must be collected separately.

The return and collection of this product has not been defined at this time, please contact Tropos Networks for return and/or collection.

It is important for users of this equipment to participate in reuse, recycling, and other forms of recovery. The potential effects on the environment and human health as a result of the presence of hazardous substances in electrical and electronic equipment are a waste of natural resources and cause pollution.

## European Community Language Versions of Informal Statement for Inclusion in User Information

The following statements are in accordance with Article 6.3 of Directive 1999/5/EC.

| Danish | Undertegnede *Tropos Networks, Inc.* erklærer herved, at følgende udstyr 6410 6420 overholder de væsentlige krav og øvrige relevante krav i direktiv 1999/5/EF |
|---|---|
| Dutch | Hierbij verklaart *Tropos Networks, Inc.* dat het toestel 6410 6420 in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 1999/5/EG |
| | Bij deze verklaart *Tropos Networks, Inc.* dat deze 6410 6420 voldoet aan de essentiële eisen en aan de overige relevante bepalingen van Richtlijn 1999/5/EC. |
| English | Hereby, *Tropos Networks, Inc.* declares that this 6410 6420 is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC. |
| Finnish | *Tropos Networks, Inc.* vakuuttaa täten että 6410 6420 tyyppinen laite on direktiivin 1999/5/EY oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen. |
| French | Par la présente *Tropos Networks, Inc.* déclare que l'appareil 6410 6420 est conforme aux exigences essentielles et aux autres dispositions pertinentes de la directive 1999/5/CE |
| | Par la présente, *Tropos Networks, Inc.* déclare que ce 6410 6420 est conforme aux exigences essentielles et aux autres dispositions de la directive 1999/5/CE qui lui sont applicables |
| German | Hiermit erklärt *Tropos Networks, Inc.*, dass sich *dieser/diese/dieses* 6410 6420 in Übereinstimmung mit den grundlegenden Anforderungen und den anderen relevanten Vorschriften der Richtlinie 1999/5/EG befindet". (BMWi) |
| | Hiermit erklärt *Tropos Networks, Inc.* die Übereinstimmung des Gerätes 6410 6420 mit den grundlegenden Anforderungen und den anderen relevanten Festlegungen der Richtlinie 1999/5/EG. (Wien) |
| Greek | ΜΕ ΤΗΝ ΠΑΡΟΥΣΑ *Tropos Networks, Inc.* ΔΗΛΩΝΕΙ ΟΤΙ 6410 6420 ΣΥΜΜΟΡΦΩΝΕΤΑΙ ΠΡΟΣ ΤΙΣ ΟΥΣΙΩΔΕΙΣ ΑΠΑΙΤΗΣΕΙΣ ΚΑΙ ΤΙΣ ΛΟΙΠΕΣ ΣΧΕΤΙΚΕΣ ΔΙΑΤΑΞΕΙΣ ΤΗΣ ΟΔΗΓΙΑΣ 1999/5/ΕΚ |
| Italian | Con la presente *Tropos Networks, Inc.* dichiara che questo 6410 6420 è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 1999/5/CE. |
| Portuguese | *Tropos Networks, Inc.* declara que este 6410 6420 está conforme com os requisitos essenciais e outras provisões da Directiva 1999/5/CE. |
| Spanish | Por medio de la presente *Tropos Networks, Inc.* declara que el 6410 6420 cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 1999/5/CE |
| Swedish | Härmed intygar *Tropos Networks, Inc.* att denna 6410 6420 står I överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 1999/5/EG. |

# STOP!! STOP!! STOP!! STOP!!



# READ THIS FIRST!

## Important Safety Instructions

The exclamation point within an equilateral 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 an equilateral 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.

## Caution

Read these instructions.

Keep these instructions.

Heed all warnings.

Follow all instructions.

Do not defeat the safety purpose of the grounding.

Only use attachments/accessories specified by the manufacturer.

Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damage in any way, such as power-supply cord or plug is damaged, liquid has been spilled on objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, 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 router 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.

This apparatus must be connected to earth ground.

Do not open the unit — risk of electric shock inside.

Risque d'électrocution. Ne pas ouvrir l'unité.

## Caution

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

Les changements et modifications, non expressément approuvés dans le présent manuel, peuvent entraîner une interdiction d'utiliser cet appareil pour l'utilisateur.

**Service**

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

Vous ne devez pas réparer les pièces se trouvant à l'intérieur de l'appareil. Les réparations doivent être effectuées uniquement par du personnel qualifié.

The Tropos 6410 and 6420 routers are installed in wet, outdoor locations. Make sure closure caps are installed and all cable connections are securely fastened and waterproofed.

Surfaces may become hot. Use caution when accessing the Tropos 6410 and 6420 routers.

# Contents

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# **1** Introduction

This guide explains how to install the Tropos® 6410 and 6420 Mesh routers safely and is intended for trained technical professionals.

This chapter covers the following topics:

- "Tropos 6410 Router Product Summary" on page 11
- "Tropos 6420 Router Product Summary" on page 12

## Tropos 6410 Router Product Summary

The Tropos 6410 router has the following characteristics:

- 802.11b/g/n band, 2400-2483 MHz
- Support for 802.11b/g/n clients
- PoE power input: The Tropos 6410 and 6420 routers are DC powered. There are a number of methods for connecting power that are described in detail later in this installation manual. Tropos 6410 and 6420 routers can be powered using:
  — 802.3at compliant power applied to the 10/100/1000Base-T (LAN) port
  — 11-55VDC power applied to the 10/100Base-T (MGT) port
- 2 Ethernet ports
  — One LAN port for network backhaul communications; this port is a 10/100/1000Base-T Ethernet port.
  — One MGT port for connecting a wired client device; this is either a 10/100BaseT Ethernet port or a serial port depending on the product. See the model numbers in the following table. The serial or Ethernet port is factory-installed and cannot be changed in the field.

Table 1 lists the Tropos 6410 router models.

TABLE 1    6410 Router Models

| Model | Description |
|-------|-------------|
| 64103000 | 6410: 2.4GHz; 10/100/1000Base-T + 10/100Base-T; FCC markets |
| 64103000G | 6410: 2.4GHz; 10/100/1000Base-T + 10/100Base-T; FCC markets; GPS |
| 64103060 | 6410: 2.4GHz; 10/100/1000Base-T + serial; FCC markets |
| 64103060G | 6410: 2.4GHz; 10/100/1000Base-T + serial; FCC markets; GPS |
| 64103002 | 6410: 2.4GHz; 10/100/1000Base-T + 10/100Base-T; ETSI markets |

TABLE 1 6410 Router Models (*continued*)

| Model | Description |
|-------|-------------|
| 64103002G | 6410: 2.4GHz; 10/100/1000Base-T + 10/100Base-T; ETSI markets; GPS |
| 64103062 | 6410: 2.4GHz; 10/100/1000Base-T + serial; ETSI markets |
| 64103062G | 6410: 2.4GHz; 10/100/1000Base-T + serial; ETSI markets; GPS |
| 64103003 | 6410: 2.4GHz; 10/100/1000Base-T + 10/100Base-T; Global-A markets |
| 64103003G | 6410: 2.4GHz; 10/100/1000Base-T + 10/100Base-T; Global-A markets; GPS |
| 64103063 | 6410: 2.4GHz; 10/100/1000Base-T + serial; Global-A markets |
| 64103063G | 6410: 2.4GHz; 10/100/1000Base-T + serial; Global-A markets; GPS |
| 64103004 | 6410: 2.4GHz; 10/100/1000Base-T + 10/100Base-T; Global-B markets |
| 64103004G | 6410: 2.4GHz; 10/100/1000Base-T + 10/100Base-T; Global-B markets; GPS |
| 64103064 | 6410: 2.4GHz; 10/100/1000Base-T + serial; Global-B markets |
| 64103064G | 6410: 2.4GHz; 10/100/1000Base-T + serial; Global-B markets; GPS |

# Tropos 6420 Router Product Summary

The Tropos 6420 router has the following characteristics:

- 802.11a/b/g/n dual band, 2400-2483 MHz/5470-5850 MHz
- Support for 802.11a/b/g/n clients
- PoE power input: The Tropos 6410 and 6420 routers are DC powered. There are a number of methods for connecting power that are described in detail later in this installation manual. Tropos 6410 and 6420 routers can be powered using:
  — 802.3at compliant power applied to the 10/100/1000Base-T (LAN) port
  — 11-55VDC power applied to the 10/100Base-T (MGT) port
- 2 Ethernet ports
  — One LAN port for network backhaul communications; this port is a 10/100/1000Base-T Ethernet port (Gigabit Ethernet).
  — One MGT port for connecting a wired client device; this is either a 10/100BaseT Ethernet port or a serial port depending on the product. See the model numbers in the following table. The serial or Ethernet port is factory-installed and cannot be changed in the field.

Table 2 lists the Tropos 6420 router models.

TABLE 2    6420 Router Models

| Model | Description |
| --- | --- |
| 64203000 | 6420: 2.4GHz + 5GHz; 10/100/1000Base-T + 10/100Base-T; FCC markets |
| 64203000G | 6420: 2.4GHz + 5GHz; 10/100/1000Base-T + 10/100Base-T; FCC markets; GPS |
| 64203060 | 6420: 2.4GHz + 5GHz; 10/100/1000Base-T + serial; FCC markets |
| 64203060G | 6420: 2.4GHz + 5GHz; 10/100/1000Base-T + serial; FCC markets; GPS |
| 64203002 | 6420: 2.4GHz + 5GHz; 10/100/1000Base-T + 10/100Base-T; ETSI markets |
| 64203002G | 6420: 2.4GHz + 5GHz; 10/100/1000Base-T + 10/100Base-T; ETSI markets; GPS |
| 64203062 | 6420: 2.4GHz + 5GHz; 10/100/1000Base-T + serial; ETSI markets |
| 64203062G | 6420: 2.4GHz + 5GHz; 10/100/1000Base-T + serial; ETSI markets; GPS |
| 64203003 | 6420: 2.4GHz + 5GHz; 10/100/1000Base-T + 10/100Base-T; Global-A markets |
| 64203003G | 6420: 2.4GHz + 5GHz; 10/100/1000Base-T + 10/100Base-T; Global-A markets; GPS |
| 64203063 | 6420: 2.4GHz + 5GHz; 10/100/1000Base-T + serial; Global-A markets |
| 64203063G | 6420: 2.4GHz + 5GHz; 10/100/1000Base-T + serial; Global-A markets; GPS |
| 64203004 | 6420: 2.4GHz + 5GHz; 10/100/1000Base-T + 10/100Base-T; Global-B markets |
| 64203004G | 6420: 2.4GHz + 5GHz; 10/100/1000Base-T + 10/100Base-T; Global-B markets; GPS |
| 64203064 | 6420: 2.4GHz + 5GHz; 10/100/1000Base-T + serial; Global-B markets |
| 64203064G | 6420: 2.4GHz + 5GHz; 10/100/1000Base-T + serial; Global-B markets; GPS |

# **2**   Installing the Router

This chapter covers the following topics:

## Preparing for Installation

The Tropos 6410 and 6420 routers must be installed by a trained professional, value added reseller, or systems integrator who is familiar with RF planning issues and regulatory limits defined by the governing body of the country in which the unit will be installed. This section explains how to prepare the installation site.
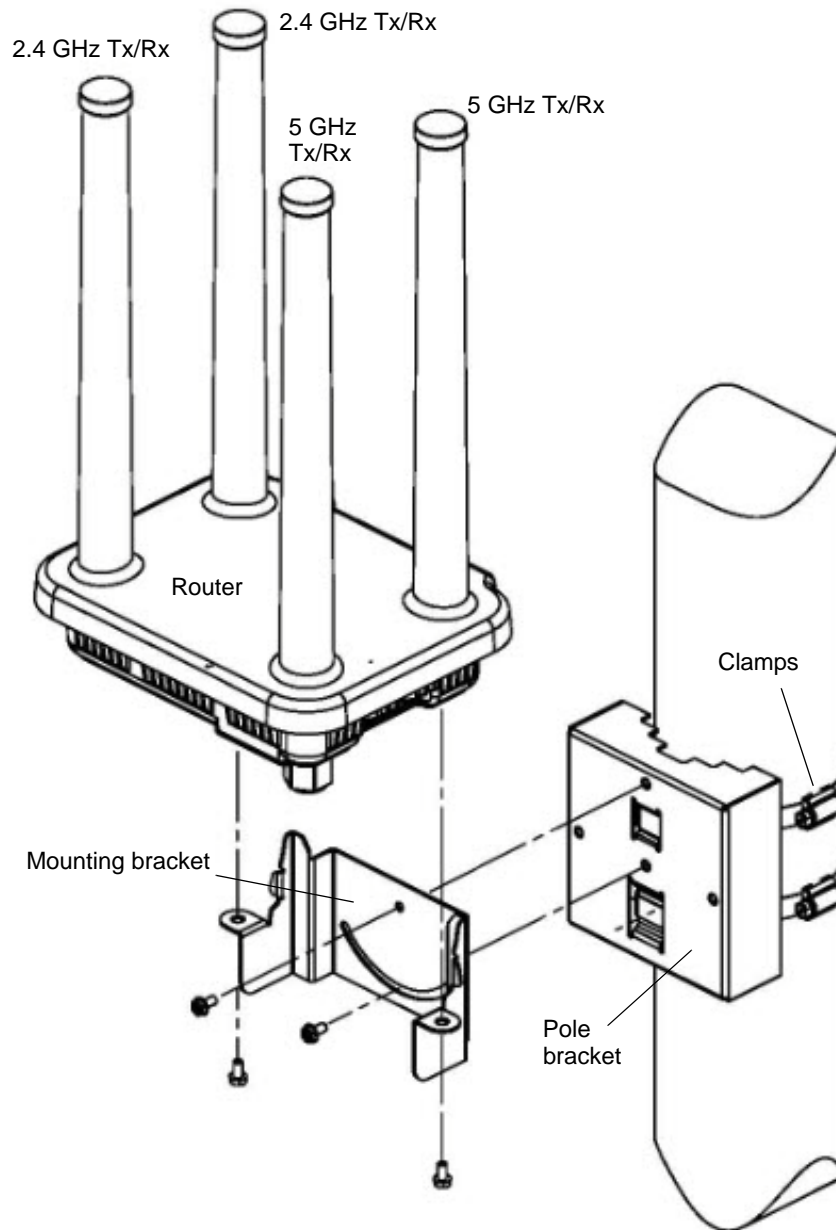
An exploded view of the router assembly is shown in Figure 1.

> ⓘ  **Note**
> *Operating the unit with non-qualified antennas is a violation of U.S. FCC Rules Part 15.203(c), Code of Federal Regulations, Title 47.*

FIGURE 1    Tropos 6410/ 6420 Router Exploded View

2.4 GHz Tx/Rx

2.4 GHz Tx/Rx

5 GHz Tx/Rx

5 GHz
Tx/Rx

Router

Clamps

Mounting bracket

Pole
bracket

## Installation Hardware and Tools

The following installation accessories are included in the shipping package:

- One pole bracket
- Two 4-inch diameter clamps
- Two 6-inch diameter clamps
- Five 5/16-inch #10-32 stainless steel hex head machine screws

You must supply the following tools:

- Level
- 5/16-inch nut driver
- 1/4-inch flat blade screwdriver
- Tower mounting only: stainless or galvanized steel pipe and 1/2-inch or 5/8-inch nuts, bolts, and washers to connect to the tower arm.
- Wood pole mounting only: one 1/4-inch diameter, 3 1/2-inch long lag bolt

## Site Planning

To ensure safe and durable wiring, router installation must follow appropriate electrical and building codes. Follow all local codes and regulations. For example in the U.S., follow the National Electrical Code (NEC) requirements, unless local codes in your area take precedence over the NEC code.

The maximum length of Cat 5 cable for 10BaseT, 10/100BaseT, and 10/100/1000BaseT Ethernet connections is 300 feet (90 meters).

The Ethernet duplex and speed setting is configurable.

(i) **Note**
*The U.S. National Electrical Codes (NEC) Article 800 requires the use of Agency Listed (UL/CSA/TUV) Building Entrance Protector for all power and data communications cables entering a building. The NEC intends by Article 800 to protect the building and occupants from fires caused by transient voltage and current surges.*

(i) **Note**
*Ethernet data cable installations having lengths greater than 140 feet in the outdoor environment must use a UL497 approved (UL/CSA/TUV Listed) primary protection device at the building entrance. Ethernet data cable installations having lengths less than 140 feet in the outdoor environment may use a UL497A (UL/ CSA/TUV Listed) secondary protection device at the building entrance. Tropos Data Protection Device and Network Protection Units are UL497A secondary protection devices.*

## Location Guidelines

Tropos routers are radio devices and therefore susceptible to interference that can reduce throughput and range. Follow these guidelines to ensure the best performance:

- Install the unit in an area where trees, buildings, and large steel structures do not obstruct radio signals to and from the antenna. Direct line-of-sight operation is best.
- Install the unit away from possible sources of 2.4 GHz and 5 GHz interference, such as cordless phones, wireless cameras, frequency hopping (FHSS) and DSSS LAN transceivers (non-802.11), electronic news gathering video links, radars, amateur radios, land mobile radio services, local government sites (such as law enforcement), fixed microwave services, local TV transmission, and private fixed point transmitters.

## Site Surveys

Due to variations in component configuration, placement, and physical environment, each installation is unique. Before installing routers, perform a site survey to determine the optimum placement of units for maximum range, coverage, and network performance. Consider the following factors when performing a site survey:

- Data rates—Sensitivity and range are inversely proportional to data bit rates. The maximum radio range is achieved at the lowest workable data rate. A decrease in receiver threshold sensitivity occurs as radio data rate increases.
- Antenna orientation—Proper antenna orientation is a critical factor in maximizing radio range. As a general rule, range increases in proportion to gain and antenna height measured from the ground. The Tropos 6410 and 6420 routers have integrated antennas; therefore, antenna location and orientation depend on the location of the unit.
- Physical environment—Clear or open areas provide better radio range than closed or filled areas. The less cluttered the operating environment, the greater the range.
- Obstructions—A physical obstruction, such as a building or tree, can block or hinder communication. Avoid locating antennas in a location where there is an obstruction between sending and receiving devices.
- Building materials—Radio penetration is influenced by the building material used in construction. For example, drywall construction permits greater range than concrete blocks.

## Safety

Installing the routers can pose a serious hazard. Be sure to take precautions to avoid the following:

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

# Mounting Strategies

When choosing mounting locations, consider the available mounting structures and antenna clearance. The router should always be mounted with the top of the unit horizontal and level and with the antennas facing upward.

It is usually best to attach ground and data cables to the router prior to mounting. Before mounting the router, review the wiring instructions in "Grounding the Router" on page 34 and "Connecting Data and Power Cables" on page 29 to determine the best strategy for the selected location.

(i) **Note**

*To eliminate potential interference from the mounting structure, the router should be mounted with at least 4 feet of clearance around the antennas.*

Acceptable options for mounting on a streetlight are shown in Figure 2. In each case the router is mounted to assure clearance for the antennas above the height of the streetlight.

FIGURE 2    Example Mounting Location - Antennas Facing Upward
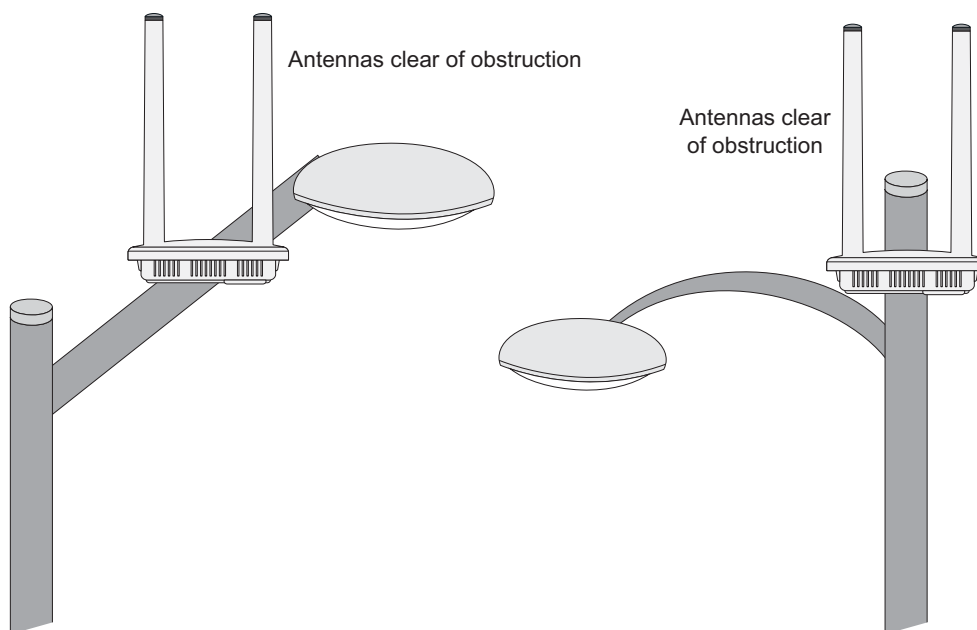
# Proper Use of Clamps

The mounting assembly contains two clamps to secure the router to the mounting structure. Figure 3 illustrates the proper use of the clamps. The clamps must be routed through slots in the pole bracket as shown in the figure, and then attached to the pole and tightened.

The pole bracket should be leveled before it is secured to the pole.

FIGURE 3    Proper Use of the Clamps



Band goes
behind inner tabs

Clamps

Mounting bracket
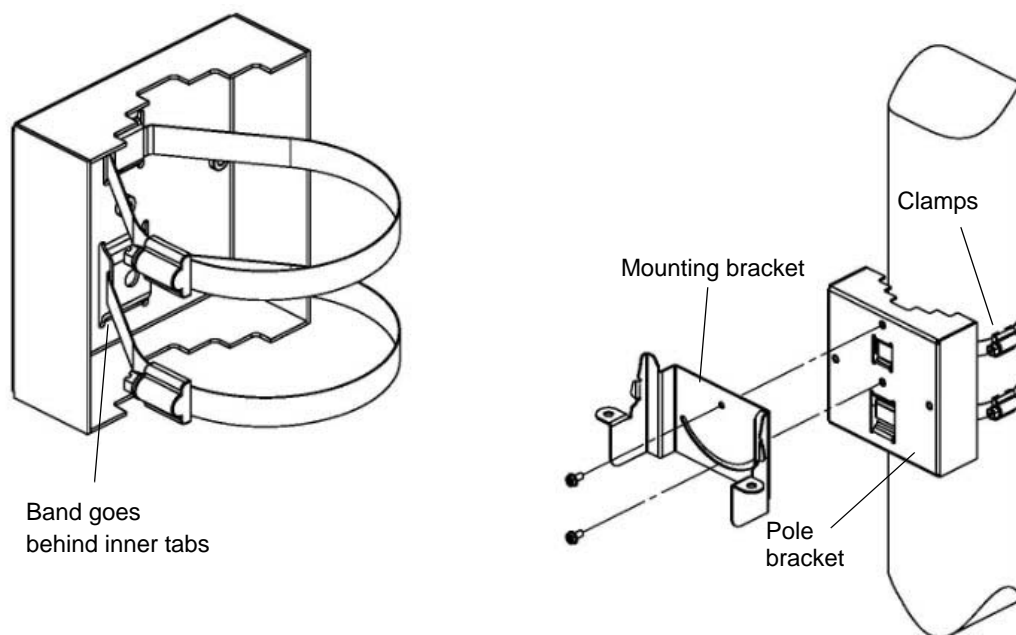
Pole
bracket

# Pole, Tower, and Streetlight Mounting Instructions

This section explains how to mount the router on a pole, tower, or streetlight. It is best to mount the router to aluminum or galvanized steel structures. The mounting brackets are designed to pierce any oxidation layers that are on the outside of the pole, thereby assuring good quality connection to the grounded structure.

Due to potential antenna obstruction issues, the router is not designed to be directly mounted on a building wall. If it is necessary to mount the router on a wall, follow the instructions for mounting on a wooden pole ("Wood Pole Mounting" on page 24), and attempt to mount the router with maximum possible clearance around the antennas.

ⓘ **Note**
*The router should always be mounted with the top of the router horizontal and level and with the antennas facing upward.*

ⓘ **Note**
*It is best to attach ground and data cables to the router before sliding the router into the mounting bracket, as explained in this section. Before mounting the router, review the wiring instructions in "Grounding the Router" on page 34 and "Connecting Data and Power Cables" on page 29 to determine the best strategy for the selected location.*
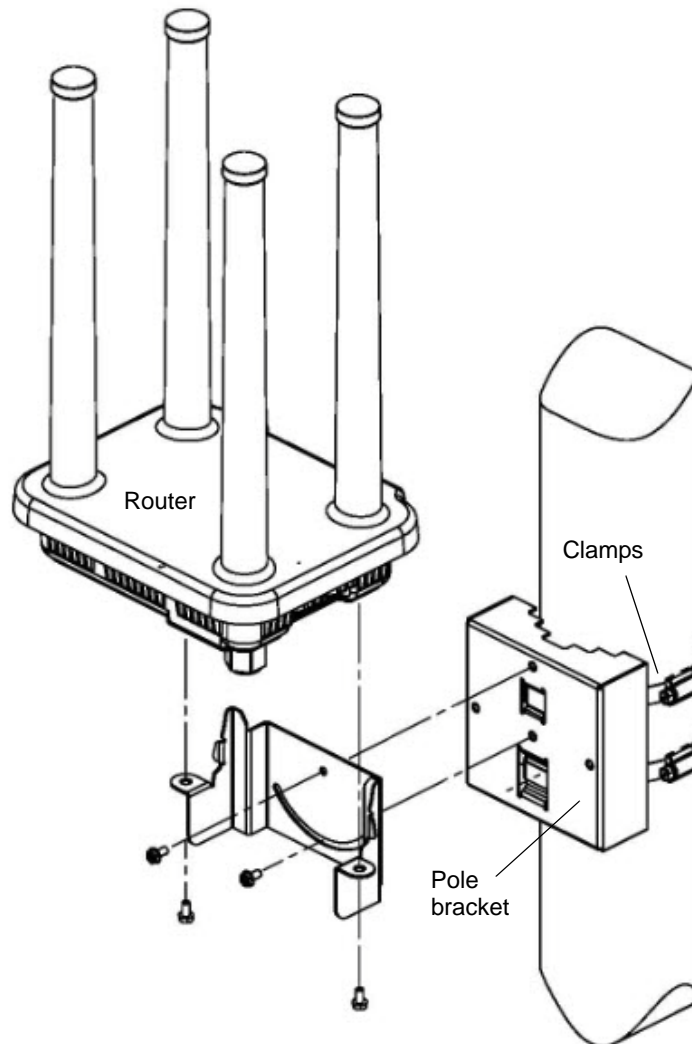
ⓘ **Note**
*Mounting to wood, concrete, or painted poles may require primary grounding for the unit. Check the national electrical codes in your area for specific rules.*

## Metal Pole Mounting

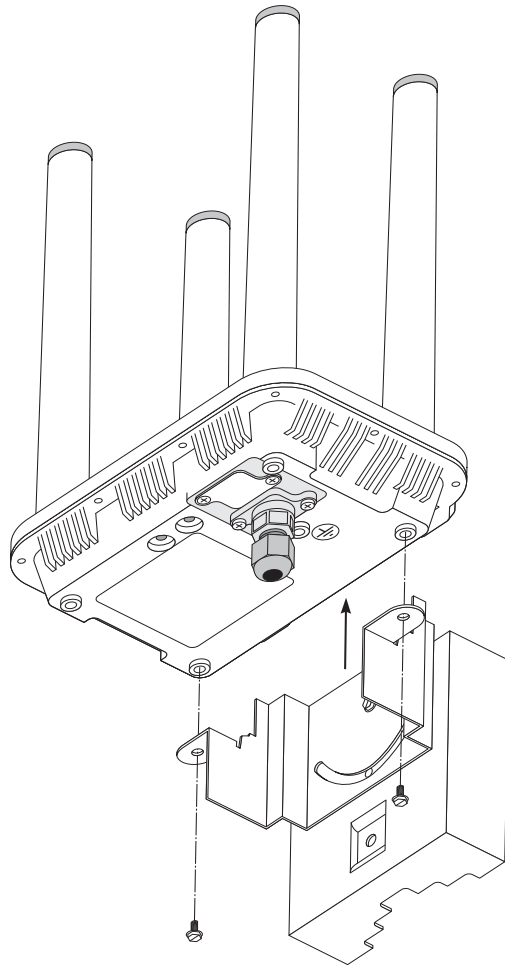Figure 4 illustrates proper mounting for an outdoor metal pole.

> ⓘ **Note**
> *Antennas must be clear of obstruction.*

FIGURE 4    Metal Pole Mounting

Mount the router on a metal pole

1. Select a mounting location. You can attach the router to any pipe or pole with diameter between 1 inch and 10 inches.

2. Slip the flat portion of each clamp under the inner slot of the pole bracket.

3. Use the clamps to attach the pole bracket to the pole, making sure that they are level. Depending upon the diameter of the pole, you may need to use small clamps, large clamps, or pairs of large clamps joined together to reach around the pole.

4. Attach the mounting bracket of the router to the pole bracket with two 5/16-inch machine screws (refer to Figure 4 for the correct orientation):

   — Insert one screw through the hole at the top of the mounting bracket to the hole at the top of the pole bracket.

   — Insert the other screw through the curved slot track in the mounting bracket to the hole in the middle of the pole bracket just above the clamp slots.

5. Level the mounting bracket by rotating the unit along the curved slot tracks. Tighten the screws.

6. Place the upright router onto the top of the mounting bracket, as shown in Figure 5. Secure the mounting bracket to the router by attaching two 5/16-inch machine screws through the holes in the mounting bracket tabs to corresponding holes on the bottom of the router.
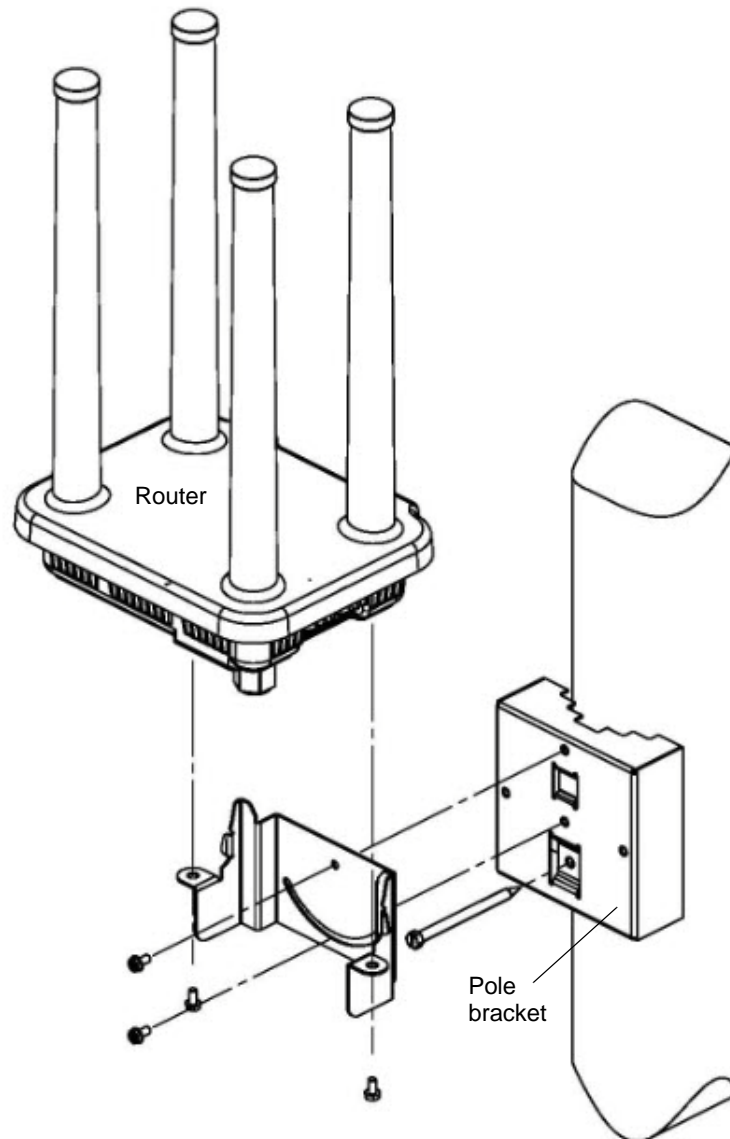
FIGURE 5    Placing the Router on the Mounting Assembly

To continue installing the router, see "Connecting Data and Power Cables" on page 29.

# Wood Pole Mounting

Figure 6 illustrates proper mounting for an outdoor wood pole.

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ⓘ **Note**
*Antennas must be clear of obstruction.*

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FIGURE 6    Wood Pole Mounting
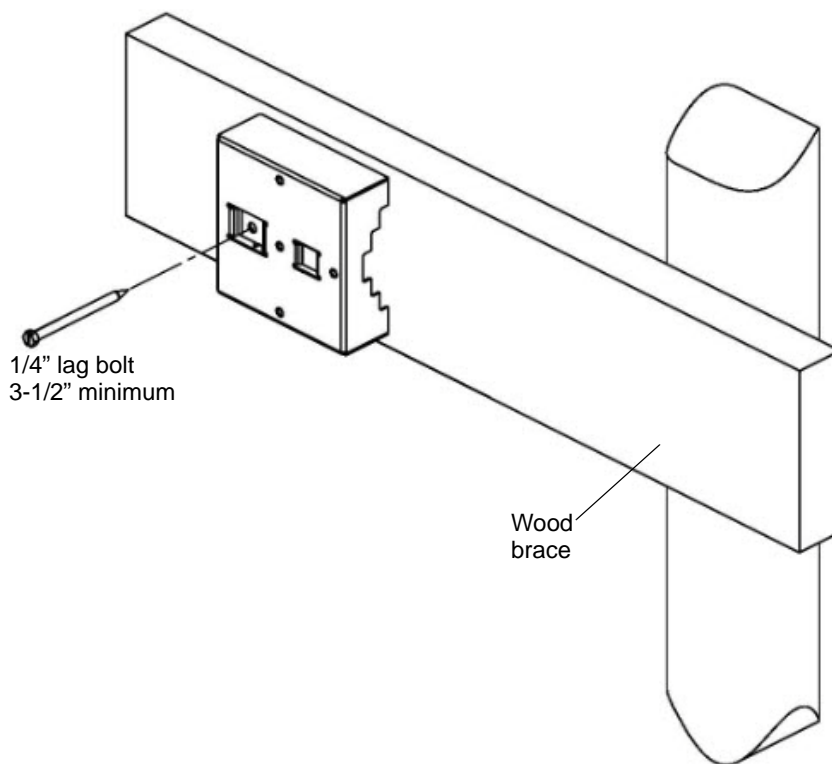
### Mount the router on a wood pole

1. Select a mounting location. You can attach the router to any outdoor wood pole of diameter at least 1 inch.

2. Attach the pole bracket to the pole by threading a 1/4-inch bolt through the hole in the lower clamp slot to the pole. The bolt should be at least 3 1/2 inches in length. Make sure that the bracket is level.

3. Attach the mounting bracket of the router to the pole bracket with two 5/16-inch machine screws (refer to Figure 4 for the correct orientation):

   — Insert one screw through the hole at the top of the mounting bracket to the hole at the top of the pole bracket.

   — Insert the other screw through the curved slot track in the mounting bracket to the hole in the middle of the pole bracket just above the clamp slot.

4. Level the mounting bracket by rotating the unit along the curved slot tracks. Tighten the screws.

5. Place the upright router onto the top of the mounting bracket, as shown in Figure 5 on page 23. Secure the mounting bracket to the router by attaching two 5/16-inch machine screws through the holes in the mounting bracket tabs to corresponding holes on the bottom of the router.

To continue installing the router, see "Connecting Data and Power Cables" on page 29.

## Wood Brace Mounting

You can mount the pole bracket directly on a wood brace without using clamps, as shown in Figure 7.

FIGURE 7    Wood Brace Mounting Option

1/4" lag bolt
3-1/2" minimum

Wood
brace

### Mount the router on a wood pole

1. Select a mounting location. You can attach the router to any wood brace.

2. Attach the pole bracket to the wood brace with two 1/4-inch lag bolts that are at least 3 1/2 inches in length, making sure that the wood brace is level.

3. Attach the mounting bracket of the router to the pole bracket with two 5/16-inch machine screws (refer to Figure 4 for the correct orientation):

   — Insert one screw through the hole at the top of the mounting bracket to the hole at the top of the pole bracket.

   — Insert the other screw through the curved slot track in the mounting bracket to the hole in the middle of the pole bracket just above the clamp slot.

4. Level the mounting bracket by rotating the unit along the curved slot tracks. Tighten the screws.

**5.** Place the upright router onto the top of the mounting bracket, as shown in Figure 5 on page 23. Secure the mounting bracket to the router by attaching two 5/16-inch machine screws through the holes in the mounting bracket tabs to corresponding holes on the bottom of the router.

To continue installing the router, see "Connecting Data and Power Cables" on page 29.
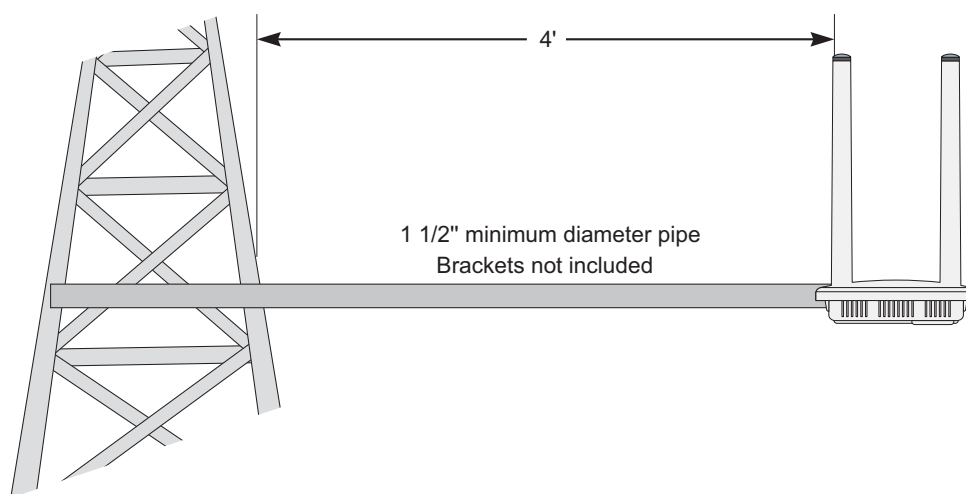
## Tower Mounting

You can mount the router on an outdoor tower.

(i) **Note**
*At the antenna level, the router must be free from metal obstruction within a 4-foot radius (Figure 8).*

FIGURE 8    Tower Mounting



1 1/2" minimum diameter pipe
Brackets not included

**Mount the Tropos router on a tower**

**1.** Remove the pole bracket from the mounting bracket, if they are attached.

**2.** Make a tower bracket by attaching the mounting bracket directly to any stainless steel or galvanized steel pipe.

**3.** Attach the mounting bracket to the tower arm so that the top of the shield is horizontal and level.

**4.** Tighten the mounting bolts.

**5.** Place the upright router onto the top of the mounting bracket, as shown in Figure 5 on page 23. Secure the mounting bracket to the router by attaching two 5/16-inch machine screws through the holes in the mounting bracket tabs to corresponding holes on the bottom of the router.

To continue installing the router, see "Connecting Data and Power Cables" on page 29.

## Streetlight Mounting

You can mount the router on the horizontal or angled arm of a streetlight. Figure 9 shows a typical streetlight mounting installation.

FIGURE 9    Streetlight Mounting
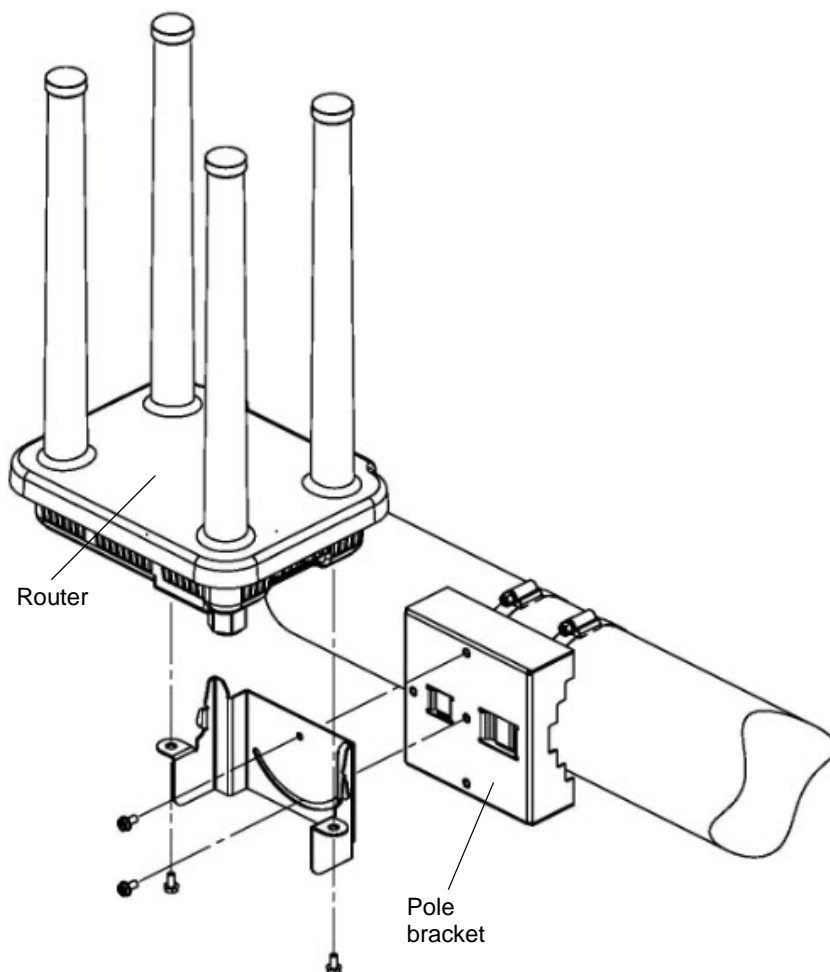


Mount the router on a streetlight

1.  Select a mounting location. You can attach the router to any streetlight arm with diameter 1" to 10".

2.  Slip the flat portion of each clamp under the inner slot of the pole bracket.

3.  Use the clamps to attach the pole bracket to the arm, making sure that they are level. Depending upon the diameter of the arm, you may need to use small clamps, large clamps, or pairs of large clamps joined together.

4. Attach the mounting bracket of the router to the pole bracket with two 5/16-inch machine screws (refer to Figure 4 for the correct orientation):

— Insert one screw through the hole at the top of the mounting bracket to the hole at the top of the pole bracket.

— Insert the other screw through the curved slot track in the mounting bracket to the hole in the middle of the pole bracket just above the clamp slot.

5. Level the mounting bracket by rotating the unit along the curved slot tracks. Tighten the screws.

6. Place the upright router onto the top of the mounting bracket, as shown in Figure 5 on page 23. Secure the mounting bracket to the router by attaching two 5/16-inch machine screws through the holes in the mounting bracket tabs to corresponding holes on the bottom of the router.

To continue installing the router, see the next section, "Connecting Data and Power Cables."

# Connecting Data and Power Cables

The router is equipped with two RJ45 ports.

■ LAN. The port labeled LAN is a 10/100/1000Base-T Ethernet port normally used for a network backhaul connection. The router can be powered over this port using industry-standard 802.3at PoE (Power over Ethernet) power (do not use any other form of PoE power on this port). This port can also be used to configure the router.

■ MGT. The port labeled MGT is one of two types, depending on the specific Tropos 6410 or 6420 model. See the model number descriptions in "Tropos 6410 Router Product Summary" on page 11 and "Tropos 6420 Router Product Summary" on page 12. If you have any questions about models or configuration, contact Tropos Customer Support (tropos.support@nam.abb.com).

— On some models the MGT port is a 10/100/1000Base-T Ethernet port used for configuration and for connecting a wired Ethernet client to the router.

— On some models the MGT port is a serial port that is capable of supporting RS-232 or RS-485 serial clients.

The router can be powered over the MGT port using DC power in the range 11-55VDC (see pin assignments on the RJ-45 connector in Table 3).

This section describes how to connect the Ethernet cables.

ⓘ **Note**
*The router is shipped pre-configured. For post-installation changes in configuration, you can communicate with the router by way of its wireless connection. For more information, see the Tropos Networks User Guide.*

( i ) **Note**
*Only use shielded Cat5, Cat5e, or Cat6 cable rated for outdoor use. 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.*

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

⚠ **Warning**
*DC voltage may be present on RJ45 pins 4,5 (+) and 7,8 (-).*

⚠ **Attention**
*Une tension continue peut être présente sur les broches RJ45 4, 5 (+) et 7, 8 (-).*

( i ) **Note**
*This is not a mid-span powered device. Never attempt to daisy-chain Power Over Ethernet devices.*

### Connecting the Ethernet cable through the watertight gland

Use the following procedure to connect an Ethernet cable and RJ-45 connector to either the LAN or MGT port. Use the pin assignments in Table 3.

1. Have the Ethernet data cable, nut, rubber boots, and cable gland available.
2. Remove the cable gland from the bottom of the router. Determine the port to use (see Figure 11).
3. Press the tab on the RJ45 connector down as you push the cable through the nut. Make sure that the orientation is consistent with Figure 10.
4. Separate the rubber boot as needed and slide the connector through the boot. Use the boot with the smaller diameter opening, unless the cable is too wide to permit the boot to close completely.
5. Slide the cable through the cable gland, as shown in Figure 10.

FIGURE 10    Routing the Data/Power Cable to the Router
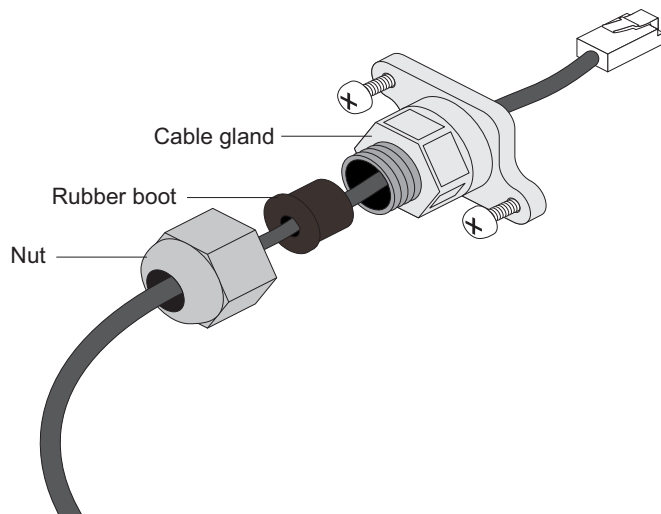


6. Plug the cable into the appropriate port on the router.

7. Screw the cable gland onto the bottom of the router, and then slide the nut over the rubber boot and screw both tightly to the cable gland. Tighten the nut to ensure a positive water seal. Figure 11 shows how the cable assembly is attached to the bottom of the router.

FIGURE 11    Data Port Connection
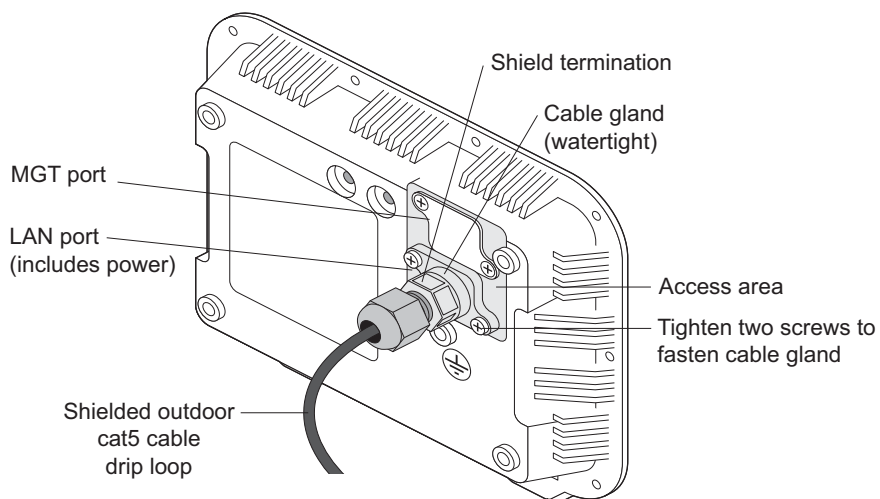
## Ethernet Ports

The pin assignments on the Ethernet ports (the LAN port on all models and the MGT port on models where the MGT port is an Ethernet port) are industry-standard. They are shown in the following table.

TABLE 3    Ethernet Port Pin Assignments

| Pin | LAN Port 10/100/1000Base-T | MGT Port 10/100Base-T |
|---|---|---|
| 1 | TxRx_A+ | Tx + |
| 2 | TxRx_A- | Tx - |
| 3 | TxRx_B+ | Rx + |
| 4 | TxRx_C+ | Power + |
| 5 | TxRx_C- | Power + |
| 6 | TxRx_B- | Rx - |
| 7 | TxRx_D+ | Power - |
| 8 | TxRx_D- | Power - |

**Note**
*Use Cat6 cable for Gigabit Ethernet.*

## Serial Ports

Tropos 6410 and 6420 routers that are equipped with serial ports can support serial clients on RS-232 or RS-485 interfaces. The serial port can also be used to power the router.

The router can support the following serial client scenarios. Before installation determine the installation scenario and the appropriate powering option for that scenario.

TABLE 4    Serial Client Scenarios

| Wired Serial Client Scenario | Recommended Wiring |
|---|---|
| one RS-232 serial client | • Connect the wired client to the MGT port on the router according to the pin assignments in Table 5.<br>• Provide power to the router on the MGT port according to the pin assignments in Table 5. |

TABLE 4    Serial Client Scenarios (*continued*)

| Wired Serial Client Scenario | Recommended Wiring |
|---|---|
| two RS-232 serial clients | • Connect the RS-232 serial clients to the MGT port on the router according to the pin assignments in Table 5.<br>• Provide power to the 1410 on the LAN port (note: in this scenario the power applied to the LAN port must be from a standard 802.3at power supply) |
| one RS-485 client | • Connect the RS-485 client to the MGT port on the router according to the pin assignments in Table 5. |
| one RS-232 serial client<br>one RS-485 serial client | • Connect the RS-232 and RS-485 clients to the MGT port on the router according to the pin assignments in Table 5.<br>• Provide power to the 1410 on the LAN port (note: in this scenario the power applied to the LAN port must be from a standard 802.3at power supply) |

The following are the pin assignments for the RJ-45 MGT port when used for serial clients.

TABLE 5    Pin Assignments for RJ-45 MGT Port - Serial Clients

| Pin | Option 1 (one serial port) | Option 2 (two serial ports) |
|---|---|---|
| 1 | RS232 TX or RS485 TXRX + | RS232 (port 1) TX or RS485 TXRX + |
| 2 | GND | GND |
| 3 | RS232 RX or RS485 TXRX - | RS232 (port 1) RX or RS485 TXRX - |
| 4 | Power + | not used |
| 5 | Power + | RS-232 (port 2) RX |
| 6 | not used | RS-232 (port 2) TX |
| 7 | Power - | not used |
| 8 | Power - | not used |

# Grounding the Router

<table>
<tr><td>⚠</td><td>

**Caution**
*You must install an external grounding wire if the router is installed on a non-metal pole or if the metal installation structure is not properly grounded. You must also ground the outdoor data protection device to a bonded pipe or ground rod. Make sure that grounding is complete before you connect power to the router.*

</td></tr>
</table>

The grounding arrangement for the router is shown in Figure 12.

FIGURE 12    Grounding Arrangement
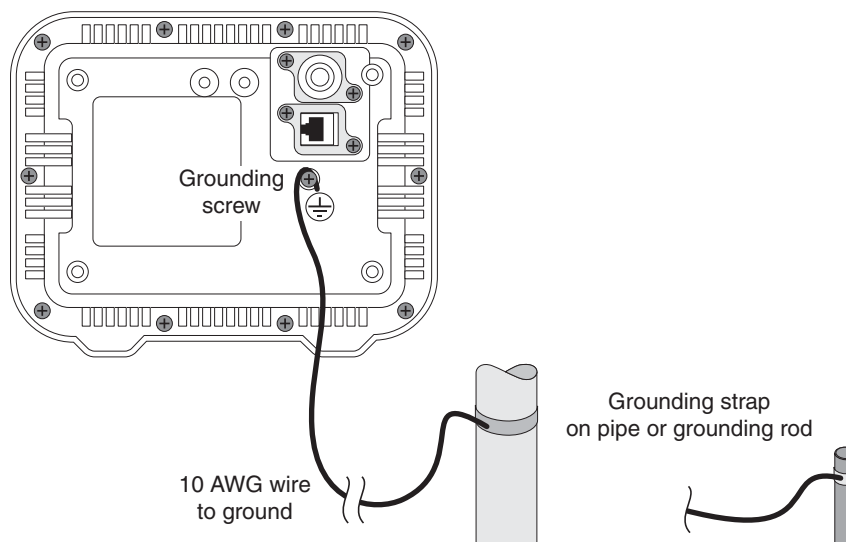


### Ground the router

**1.** Insert the grounding screw into the grounding screw hole on the bottom of the router.

**2.** Connect a length of #10 AWG bare copper wire to the grounding screw and tighten.

**3.** Connect the other end of the grounding wire to a grounding strap that is attached to a grounded surface or other earth ground, such as a grounding rod.

# Grounding the Data Protection Device

The grounding arrangement for an indoor data protection device is shown in Figure 13.

### Ground an indoor data protection device

1. Place the protection device as close to the building entrance as possible.

2. Connect a length of #10 AWG bare copper wire to the ground post on the data protection device.

3. Connect the other end of the grounding wire to the ground connection of an electrical outlet or a grounded water pipe.

FIGURE 13    Grounding the Indoor Network Protection Unit
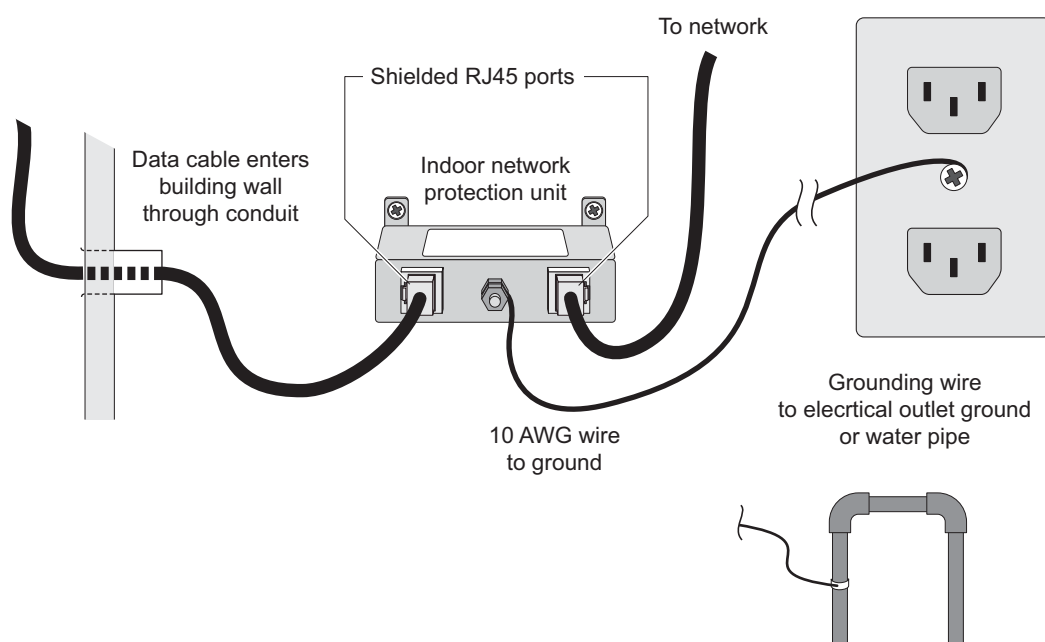
# Safety and Servicing Information

This section contains safety and servicing information.

## RF Exposure Information

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. The Tropos 6410 and 6420 routers meet the uncontrolled environmental limits found in OET-65 and ANSI C95.1, 1991. Proper operation of this device according to the instructions found in this manual and the hardware and software guides on the router results in user exposure that is substantially below the FCC recommended limits.

In order to meet the human RF exposure limits required by FCC and Industry Canada, the installer shall insure separation between transmitter antennas. All persons should maintain a minimum distance from the router as specified in Table 6.

TABLE 6    RF Exposure Information

| Model | Radios, RF Band | Antennas | Maximum EIRP | Minimum Distance |
|-------|-----------------|----------|--------------|------------------|
| 6410 | Single 2.4 GHz | Internal | 2.4 GHz EIRP, 34.5 dBm | 20 cm (8 in) |
| 6420 | Dual 2.4 GHz/5.8 GHz | Internal | 2.4 GHz EIRP, 34.5 dBm<br>5.8 GHz EIRP, 34 dBm | 22 cm (9 in) |

**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.*

## Safety Guidelines

Follow these guidelines to ensure safe operation of the router:
- Do not touch or move the antennas while the unit is transmitting or receiving.
- Do not hold any component containing a radio such that the antenna is very close to or touching any exposed parts of the body, especially the face or eyes, while transmitting.
- Do not operate the radio or attempt to transmit data unless the antenna is connected; otherwise, the radio may be damaged.

- Use in specific environments:
  — Do not operate a portable transmitter near unshielded blasting caps or in an explosive environment unless it is a type especially qualified for such use.
  — 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 on airplanes is governed by the Federal Aviation Administration (FAA).
  — The use of wireless devices in hospitals is restricted to the limits set forth by each hospital.

## Servicing the Router

The router has no user serviceable parts inside. For any service-related issues, contact Tropos Customer Support (support@tropos.com).

# 3    Installing Battery and Power Backup Accessories

This chapter describes how to install battery and power backup accessories:

## Introduction

The Tropos 6410 and 6420 routers are designed to operate from DC power sources. If DC power is not available, Tropos offers power solutions for the 6410 and 6420 for photocell and non-photocell applications and a battery backup unit that provides backup power for the routers. The following products are available.

### PS079001 - Outdoor PoE Injector, non-photocell

The PS079001 is used for all non-streetlight applications. AC power is provided to the PS079001 using a PT031006 (6 feet) or PT031030 (30 feet) Tropos power cable. For streetlight installations where a photocell can be used as the AC power source, Tropos offers the PT021004 (4 feet) and PT021020 (20 feet) power cables. These cables have a photocell tap at one end and a connector on the other end to plug into the PS079001.

The PS079001 can be mounted on the mounting bracket of the router or can be remotely mounted.

The PS079001 provides an Ethernet port that connects to the MGT port on the router, allowing the router to function as a gateway.

### BB063001 - External Battery Backup Unit

The BB063001 Battery Backup Unit (BBU) provides backup power for a Tropos 6410 or 6420 fixed router. The BB063001 requires the use of one of the two Tropos power supplies described above.

The BB063001 can be mounted on the mounting bracket of the router (when a TLP4820 or PS079001 is used) or can be remotely mounted.

The PS079001 provides an Ethernet port that connects to the MGT port on the router allowing the router to function as a gateway.

The deployment scenarios are shown in Figure 14. When using the BB063001 BBU, it should be mounted on the mounting bracket of the 6420/6410 router. When using the PS079001 PoE injector without the BB063011, it can be mounted on the mounting bracket of the 6420/6410 router. The PS079001must be remote mounted when used with the BB063001.

FIGURE 14    Deployment Scenarios
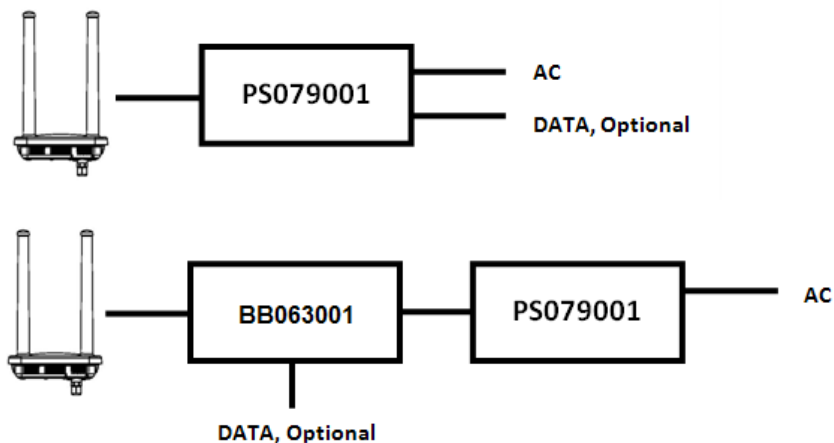


Table 7 lists ordering information.

TABLE 7    Ordering Information

| Part Number | Description | Required Components Ordered Separately |
| --- | --- | --- |
| PS079001 | Outdoor PoE Injector, non-photocell | Power cable, one of the following:<br>• PT021004 power cable, 4 feet, 2-wire, photocell<br>• PT021020 power cable, 20 feet, 2-wire, photocell<br>• PT031006 power cable, 6ft, 3-wire, watertight plug<br>• PT031030 power cable, 30ft, 3-wire, watertight plug,<br>MB008003 mounting bracket kit (if required) |
| BB063001 | External Battery Backup Unit | • Outdoor rated Ethernet cables<br>• PS079001 power supply |
| MB008003 | Kit, mounting bracket, PS079001/BBU063001 | |

# Installing the PS079001

Follow the guidelines in this section when installing the PS079001:

- ■ "Tools Required" on page 44
- ■ "Installation Procedures" on page 45

## Tools Required

- ■ Wrench, 1/2 inch or 13mm
- ■ 5/16 nut driver
- ■ Wrench, 9/16 inch but only when using 3/8" lag

## Installation Procedures

You can co-mount the PS079001 with the router or mount the PS079001 separately on a metal or wood pole. When used with the BB063001 Battery Backup Unit (BBU), the PS079001 should be mounted remotely.

### Co-mount the PS079001 with the router

1. Follow the instructions in Chapter 2, "Installing the Router," to secure the pole bracket to the pole.

2. Place the PS079001 mounting bracket between the pole bracket and the router mounting bracket. Secure with two each 10-32 screws (Figure 15).

3. Mount and secure the router to the mounting bracket with two each 10-32 screws.

4. Connect the PoE + LAN output cable to the BBU LAN output port.

5. Attach the PoE input cable to the PoE input port.

FIGURE 15    Co-Mounting the PS079001 with the Router
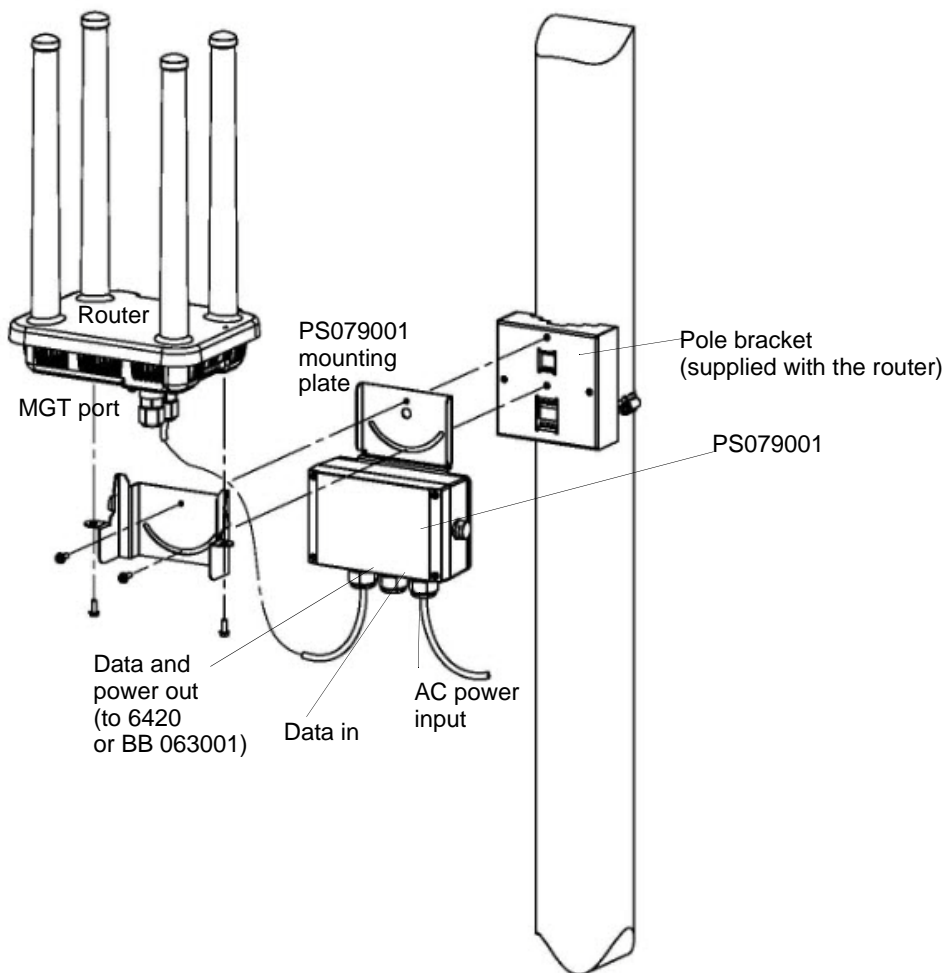
Remote mount the PS079001 on a metal pole

1. Use the hose clamp to secure the pole bracket to the pole, as shown in Figure 4 on page 21.

2. Secure the PS079001 mounting bracket to the pole bracket. Secure with two each 10-32 screws (Figure 16).

3. Connect the PoE + LAN output cable from the PS079001 LAN output port to the MGT port on the router.

4. Attach the PoE input cable to the PoE input port.

---

ⓘ **Note**
*When the PS079001 is remotely mounted, the data and power out cable supplied with the unit must be replaced with an outdoor-rated Ethernet cable of sufficient length.*

---

FIGURE 16    Mounting the PS079001 on a Metal Pole
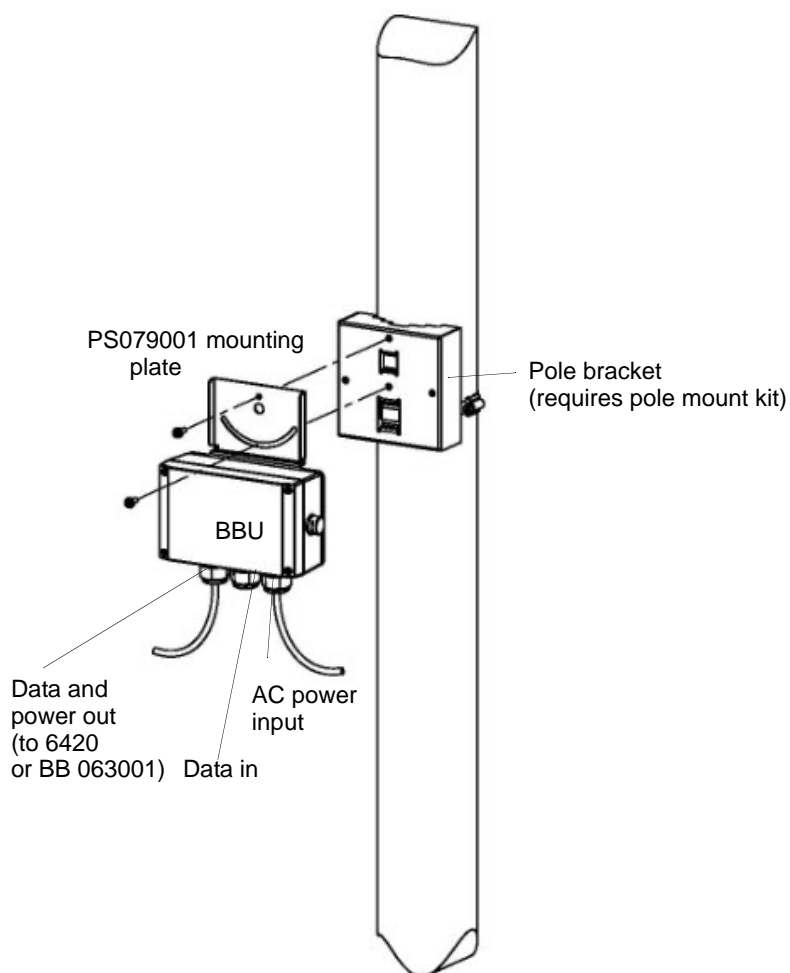
Remote mount the PS079001 on a wood pole

1.  Secure the PS079001 mounting plate to the pole by threading a 1/4-inch bolt through the hole in the clamp slot to the pole. The bolt should be at least 3 1/2 inches in length. Make sure that the bracket is level (Figure 17).

2.  Connect the PoE + LAN output cable from the PS079001 LAN output port to the MGT port on the router.

3.  Attach the PoE input cable to the PoE input port.

(i) **Note**

*When the PS079001 is remotely mounted, the data and power out cable supplied with the unit must be replaced with an outdoor-rated Ethernet cable of sufficient length.*

FIGURE 17    Mounting the PS079001 on a Wood Pole
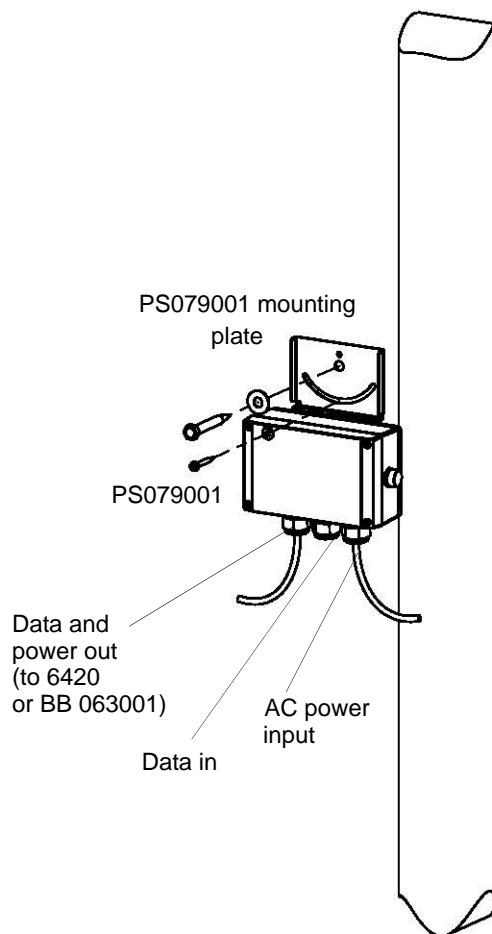
# Installing the Battery Backup Unit

Follow the guidelines in this section when installing the battery backup unit (BBU):

-
-

## Tools Required

- Wrench, 1/2 inch or 13mm
- 5/16 nut driver
- Wrench, 9/16 inch but only when using 3/8" lag

## Installation Procedures

You can co-mount the BBU with the router (preferred) or mount the BBU separately on a metal or wood pole. When using both the BBU063001 and the PS079001, the BBU must be co-mounted with the 6420 router and the PS079001 mounted on the pole or other surface.

### Co-mount the BBU with the router

1. Follow the instructions in Chapter 2, "Installing the Router," to secure the pole bracket to the pole.

2. Place the BBU mounting bracket between the pole bracket and the router mounting bracket. Secure with two each 10-32 screws (Figure 18).

3. Mount and secure the router to the mounting bracket with two each 10-32 screws.

4. Connect the PoE + LAN output cable to the BBU LAN output port.

5. Attach the PoE input cable to the PoE input port.

FIGURE 18    Co-Mounting the BBU with the Router
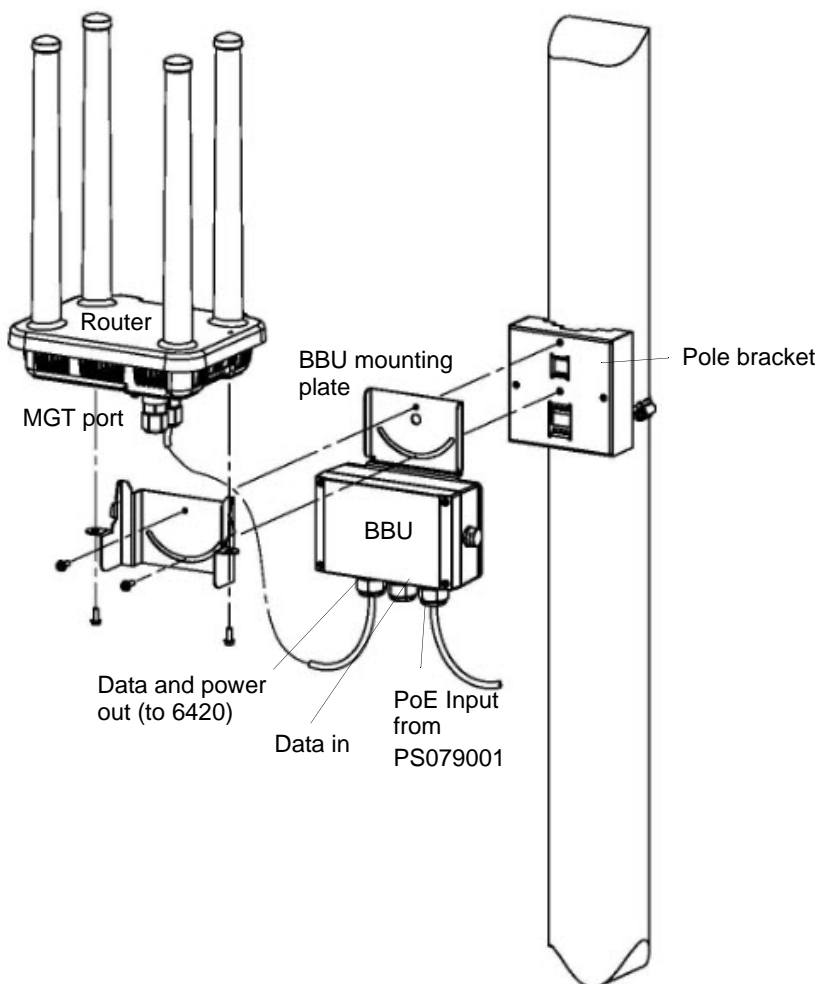
Remote mount the BBU on a metal pole

1. Use the hose clamp to secure the pole bracket to the pole, as shown in Figure 4 on page 21.

2. Secure the BBU mounting bracket to the pole bracket. Secure with two each 10-32 screws (Figure 19).

3. Connect the PoE + LAN output cable from the BBU LAN output port to the MGT port on the router.

4. Attach the PoE input cable to the PoE input port.

---

ⓘ **Note**
*When the PS079001 is remotely mounted, the data and power out cable supplied with the unit must be replaced with an outdoor-rated Ethernet cable of sufficient length.*

---

FIGURE 19    Remote Mounting the BBU on a Metal Pole
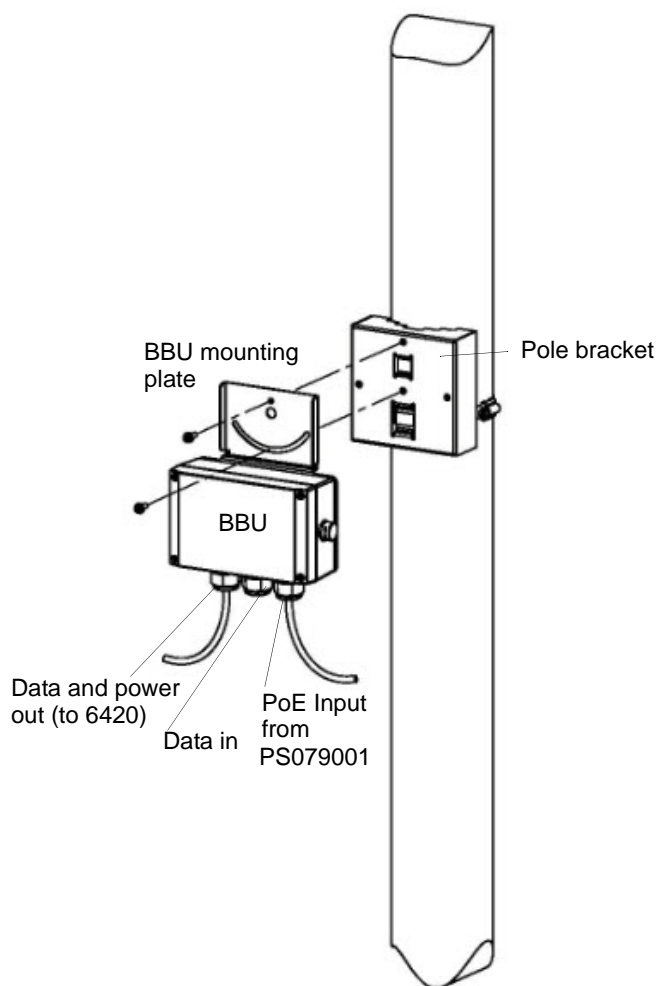
### Mount the BBU on a wood pole

1. Secure the BBU mounting plate to the pole by threading a 1/4-inch bolt through the hole in the clamp slot to the pole. The bolt should be at least 3 1/2 inches in length. Make sure that the bracket is level (Figure 20).

2. Connect the PoE + LAN output cable from the BBU LAN output port to the MGT port on the router.

3. Attach the PoE input cable to the PoE input port.

---

ⓘ **Note**

*When the PS079001 is remotely mounted, the data and power out cable supplied with the unit must be replaced with an outdoor-rated Ethernet cable of sufficient length.*

---

FIGURE 20    Mounting the BBU on a Wood Pole
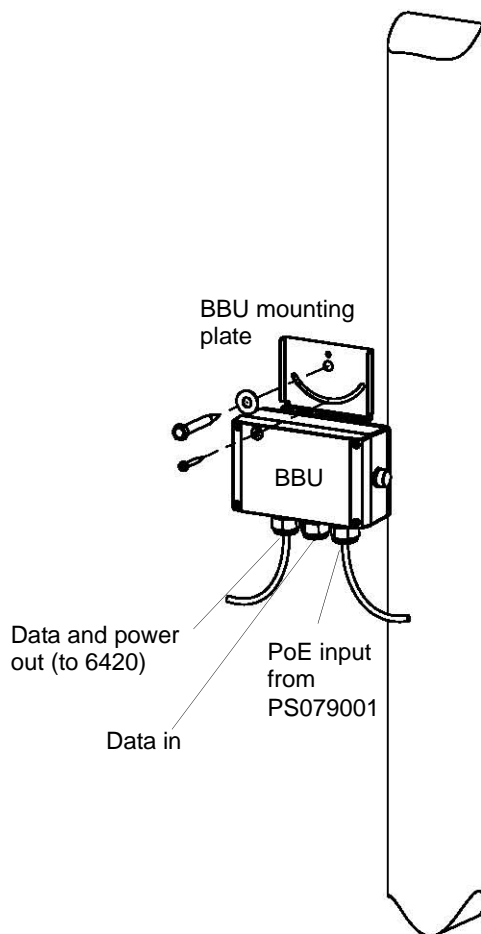
# 4     Power Consumption

The figures and tables in this chapter show router power consumption as a function of traffic load.
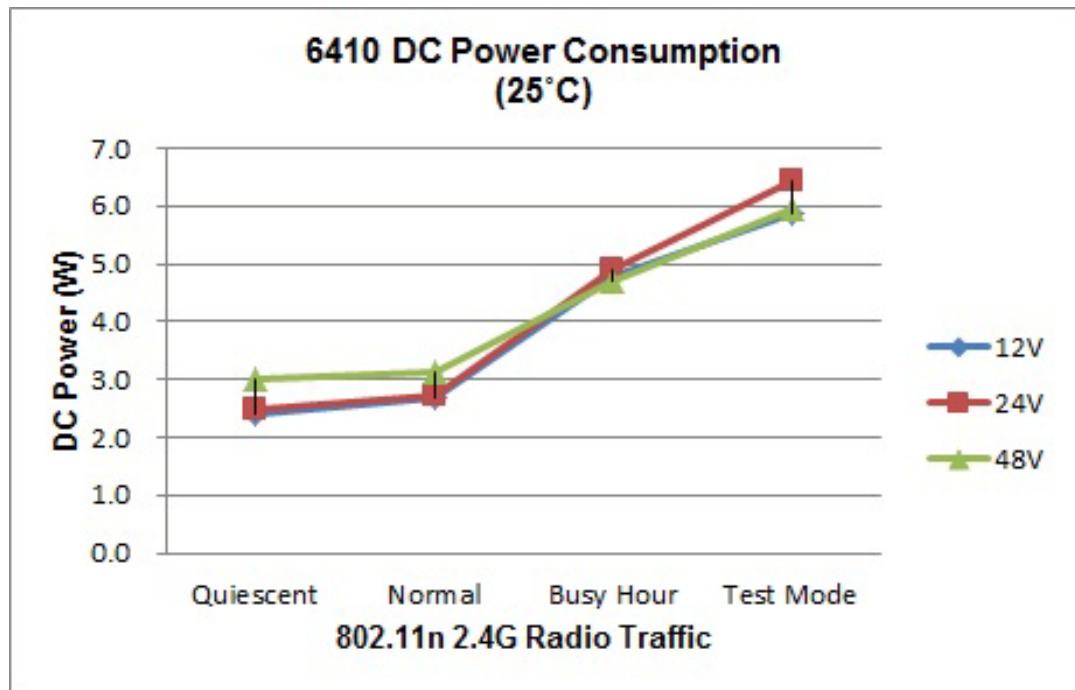
FIGURE 21     6410 Power Consumption



TABLE 8     6410 Power Consumption (Watts) at Specified Input Voltage

| Traffic level | Duty cycle | 12V | 24V | 48V |
|---|---|---|---|---|
| Quiescent (beacon only) | 0% | 2.4 | 2.5 | 3.0 |
| Normal | 10% | 2.7 | 2.7 | 3.1 |
| Busy hour | 30% | 4.8 | 4.9 | 4.7 |
| Maximum | 50% | 5.9 | 6.5 | 6.0 |

FIGURE 22    6420 Power Consumption
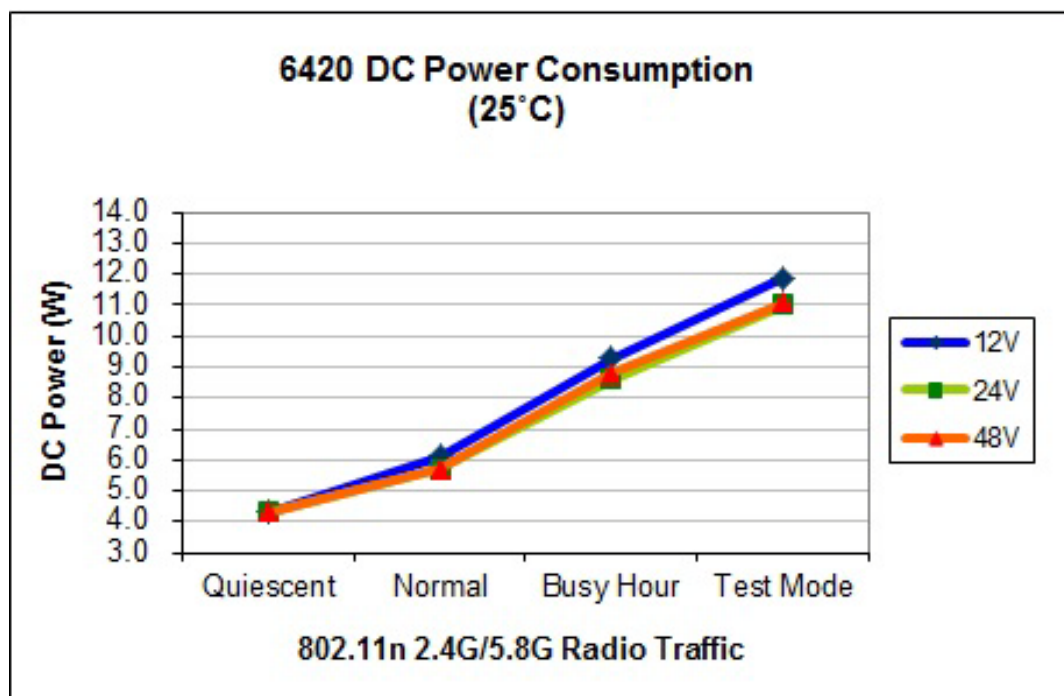


TABLE 9    6420 Power Consumption (Watts) at Specified Input Voltage

| Traffic level | Duty cycle | 12V | 24V | 48V |
|---|---|---|---|---|
| Quiescent (beacon only) | 0% | 4.3 | 4.3 | 4.3 |
| Normal | 10% | 6.1 | 5.7 | 5.7 |
| Busy hour | 30% | 9.3 | 8.6 | 8.8 |
| Maximum | 50% | 11.9 | 11.0 | 11.1 |

# 5    Product Specifications

The tables in this chapter contain specifications for the Tropos 6410 and 6420 routers:

■  "Physical Specifications" on page 50
■  "Interfaces" on page 52
■  "Power Options / Consumption" on page 54
■  "Certifications, Other" on page 54
■  "PS079001 - Outdoor PoE Injector, non-photocell" on page 55
■  "BB063001 - External Battery Backup Unit" on page 55

TABLE 10    Physical Specifications

| Specification | Value |
|---|---|
| **Physical Dimensions** | |
| Inches | Height: 2.5" (6.4cm) without antennas<br>Height: 14.25" (36.2cm) with antennas<br>Width: 8.75" (22.2cm)<br>Depth: 7.25" (18.4cm) |
| **Weight** | |
| lbs - maximum<br>kg - maximum | 4 lbs (1.8 kg)<br>5 lbs (2.3 kg) with mounting brackets |
| **Mounting** | |
| Mounting Pole Diameter | 1" to 10" |
| Mounting Hole Dimensions | 6 1/8" by 4" |
| **Temperature** | |
| Operating Range | Min: -40$^{o}$ C<br>Max: 55$^{o}$ C |
| Storage Range | Min: -40$^{o}$ C<br>Max: 85$^{o}$ C |
| **Weather** | |
| Weather Rating | IP67 weathertight |
| Wind Survivability | > 165 mph |

TABLE 10   Physical Specifications (*continued*)

| Specification | Value |
|---|---|
| Wind Loading (165 mph) | < 210 newtons |
| Projected Area | 0.7 sq. ft. (100 sq. in.) |
| Corrosion Resistance | ASTM B117 salt fog rust resistance compliant |
| **Color** | |
| Color | Unpainted metal/gray radome |
| **Shock and Vibration** | |
| Operational: | ETSI 300-19-2-4 specification T4.1E, class 4M3 |
| Transportation: | ISTA 2A |
| **Status Lamp** | |
| Indicators | Green/Red/Blue |

TABLE 11    Interfaces

| Specification | Value |
|---|---|
| **LAN Interface** | |
| IEEE 802.3 10/100/1000 BaseT | • Auto sensing<br>• Maximum Distance (ft):<br>      330 (10BaseT Duplex Setting)<br>      330 (100BaseT Duplex Setting)<br>      330 (1000BaseT Duplex Setting)<br>• RJ45 connector |
| **MGT Interface** | |
| IEEE 802.3 10/100Base T | • Auto sensing<br>• Maximum Distance (ft):<br>   330 (10BaseT Duplex Setting)<br>   330 (100BaseT Duplex Setting)<br>• RJ45 connector |
| **802.11b/g/n Wireless Interface** | |
| Standard | IEEE 802.11b/g/n Wi-Fi |
| Frequency Range | • 2400 to 2483 MHz ISM Band (CH 1-11) FCC Part 15<br>   Models: 641030X0, 642030X0<br>• 2400 to 2500 MHz (CH 1-13) ETSI/EU<br>   Models: 641030X2, 642030X2 |
| Modulation | 802.11g/n - OFDM (64-QAM, 16-QAM, QPSK, BPSK)<br>802.11b - DSSS (DBPSK, DQPSK, CCK) |
| Rx Sensitivity | -97dBm @ 1 Mbps          -95dBm @ 18 Mbps<br><br>-94dBm @ 5.5 Mbps       -92dBm @ 24 Mbps<br><br>-92dBm @ 11 Mbps        -89dBm @ 36 Mbps<br><br>-96dBm @ 6 Mbps          -85dBm @ 48 Mbps<br><br>-96dBm @ 12 Mbps        -84dBm @ 54 Mbps |
| Tx Power | ETSI/EU 5dBm-20dBm (EIRP) set in 1dB units<br>FCC/IC 20dBm-36dBm (EIRP) set in 1dB units |

TABLE 11  Interfaces (*continued*)

| Specification | Value |
|---|---|
| Rx Saturation Maximum Power at Antenna Port | -5dBm (1 Mbps) <br> -5dBm (2 Mbps) <br> -5dBm (5.5 Mbps) <br> -5dBm (11 Mbps) <br> -5dBm (6 Mbps) <br> -5dBm (9 Mbps) <br> -5dBm (12 Mbps) <br> -10dBm (18 Mbps) <br> -30dBm (24 Mbps) <br> -35dBm (36 Mbps) <br> -35dBm (48 Mbps) <br> -35dBm (54 Mbps) |
| Antennas | Multi-antenna system: 2 TX x 2 RX (2x2 MIMO) <br> 7.5dBi omnidirectional integrated antennas |
| **802.11a/n Wireless Interface** | |
| Standard | IEEE 802.11a/n Wi-Fi |
| Frequency Range | 5.725 - 5.850 GHz (FCC/IC) <br> 5.470 - 5.725 GHz (ETSI/EU) |
| Modulation | OFDM (64-QAM, 16-QAM) |
| Rx Sensitivity | -92dBm @ 6 Mbps      -84dBm @ 24 Mbps <br> -91dBm @ 9 Mbps      -81dBm @ 36 Mbps <br> -90dBm @ 12 Mbps      -77dBm @ 48 Mbps <br> -87dBm @ 18 Mbps      -75dBm @ 54 Mbps |
| Tx Power | ETSI/EU 15dBm-30dBm (EIRP) set in 1dB units <br> FCC/IC 19dBm-36dBm (EIRP) set in 1dB units |
| Rx Saturation Maximum Power at Antenna Port | -30dBm (6 Mbps) <br> -30dBm (9 Mbps) <br> -30dBm (12 Mbps) <br> -30dBm (18 Mbps) <br> -30dBm (24 Mbps) <br> -35dBm (36 Mbps) <br> -35dBm (48 Mbps) <br> -35dBm (54 Mbps) |
| Antennas | Multi-antenna system: 2 TX x 2 RX (2x2 MIMO) <br> 8dBi omnidirectional integrated antennas |

TABLE 12   Power Options / Consumption

| Specification | Value |
|---|---|
| Antenna Protection | <= 0.5μJ for 3kA @ 8/20μS Waveform<br>EN61000-4-2 Level 4 ESD Immunity<br>EN61000-4-5 Level 4 Surge Immunity |
| Data Port Protection | EN61000-4-2 Level 4 ESD Immunity<br>EN61000-4-5 Level 4 Surge Immunity |
| Power Input | 802.3at (LAN port)<br>11-55 VDC (MGT Port) |
| Power Consumption | 10 W typical |

TABLE 13   Certifications, Other

| Regulatory Domain | Specification |
|---|---|
| U.S. | CFR 47 FCC Part 15.C; Class B<br>UL579/IEC 60529 IP67 Rated for Outdoor Use<br>ISTA 2A |
| Europe | EN60950 cTUVus Listed I.T.E.<br>IEEE/ANSI C62.41 Category C AC Surge Immunity<br>EN61000-4-5 Level 4 AC Surge Immunity<br>EN61000-4-2 Level 4 ESD Immunity<br>EN61000-4-4 Level 4 EFT Burst Immunity<br>EN61000-4-3 EMC Field Immunity<br>ETSI EN 301 489-17<br>ETSI EN 300 328<br>EN 60950-1, IEC 60950-1<br>CISPR 22 Class B<br><br>CE ① |
| Canada | Industry Canada RSS210 |

TABLE 14   PS079001 - Outdoor PoE Injector, non-photocell

| Specification | Value |
|---|---|
| Input voltage | 120-240VAC 50/60Hz |
| Output voltage | 48VDC |
| Data input / output | 10/100Base-T |
| Connector | 3 x RJ45 |
| Dimensions | height: 4.92" / 125mm<br>width: 6.77" / 172mm<br>depth: 2.36" / 60mm |
| Weight | 2.5 lbs. / 1.1 kg |
| Operating temperature | -40$^{o}$F to +158$^{o}$F /<br>-40$^{o}$C to +70$^{o}$C |
| Storage temperature | -40$^{o}$F to +185$^{o}$F /<br>-40$^{o}$C to +85$^{o}$C |
| Weather rating | IP54 / NEMA4x |
| Wind loading | <300 Newtons @ 165MPH / 264kmph |
| Wind survivability | 165MPH / 264kmph |

TABLE 15   BB063001 - External Battery Backup Unit

| Specification | Value |
|---|---|
| Input voltage | 48VDC |
| Output voltage | 24VDC |
| Data input / output | 10/100Base-T |
| Connector | 3 x RJ45 |
| Dimensions | height: 4.92" / 125mm<br>width: 6.77" / 172mm<br>depth: 2.36" / 60mm |
| Weight | 2.5 lbs. / 1.1 kg |
| Battery type | Lithium ion |
| Battery voltage | 24VDC |
| Battery capacity | 62.4 Watt-hours (2.6A-hour) |

TABLE 15    BB063001 - External Battery Backup Unit (*continued*)

| Specification | Value |
|---|---|
| 6410/6420 operation on battery backup | 4 to 6 hours at 20$^o$C |
| Operating temperature | -40$^o$F to +140$^o$F / -40$^o$C to +60$^o$C |
| Storage temperature | -40$^o$F to +185$^o$F / -40$^o$C to +85$^o$C |
| Charging temperature | -40$^o$F to +113$^o$F / -40$^o$C to +45$^o$C |
| Weather loading | IP54 / NEMA4x |
| Wind loading | <300 Newtons @ 165MPH / 264kmph |
| Wind survivability | 165MPH / 264kmph |

# 6    Antenna Information

This chapter provides information on the integrated Tropos antennas:

- *"2.4 GHz Antennas"* on page 58
- *"5 GHz Antenna"* on page 59

# 2.4 GHz Antennas

Specifications for the 2.4 GHz antennas:

■ Integrated omni antenna

■ Length: 11.5" (29.2 cm)

■ Average gain azimuth: 5.2dBi

■ Gain: 7.5 dBi

■ Maximum efficiency: 79%

Antenna Patterns are shown in Figure 23.

FIGURE 23    2.4 GHz Antenna Patterns
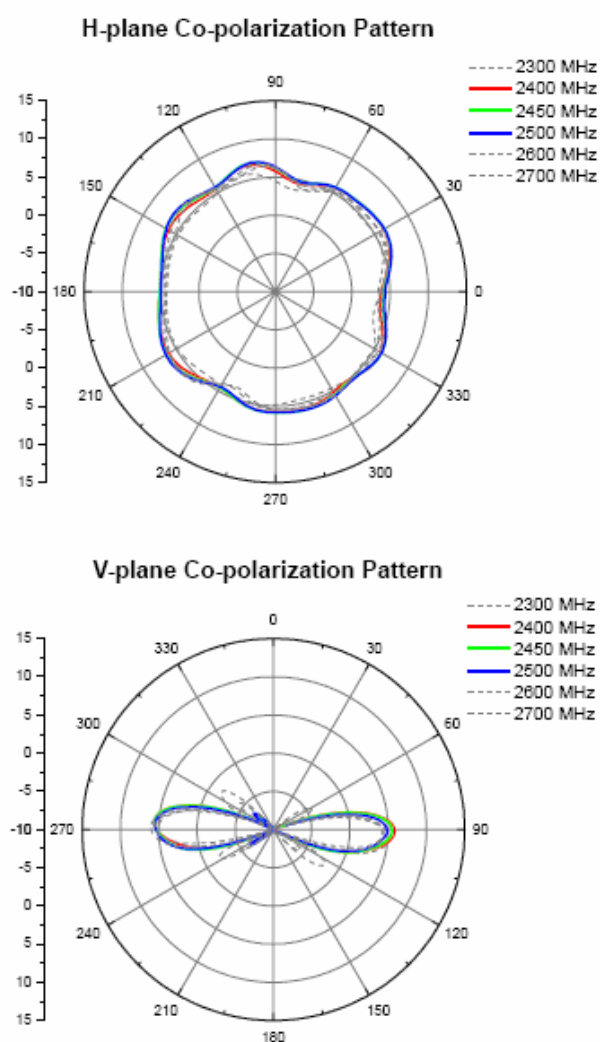
# 5 GHz Antenna

Specifications for the 5 GHz antenna:

- Integrated omni antenna
- Length: 10" (25.4 cm)
- Gain: 8.0 dBi
- Maximum efficiency: 73%

Antenna Patterns are shown in Figure 24.

FIGURE 24    5 GHz Antenna Patterns
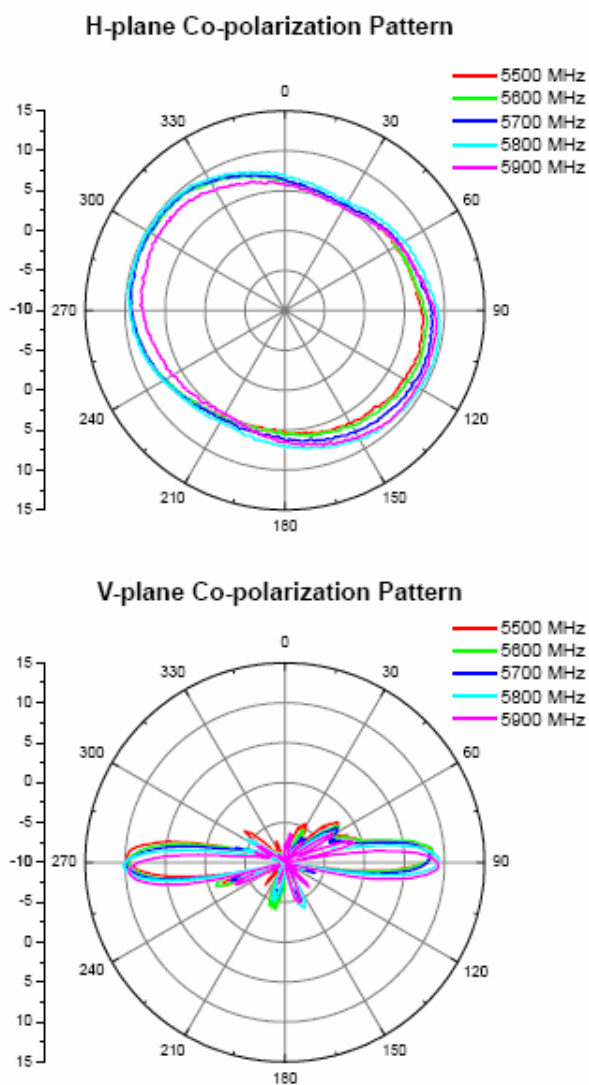
# Abbreviations

The following abbreviations are used in this document.

TABLE 16 **Abbreviations**

| | |
|---|---|
| 2P | Two-Phase or Split Phase |
| 2W | Two-Wire |
| 3W | Three-Wire |
| AASHTO | American Association of State Highway and Transportation Officials |
| AC | Alternating Current |
| ANSI | American National Standards Institute |
| AWG | American Wire Gauge |
| BBU | Battery Backup Unit |
| C | Celsius |
| CAT | Category |
| CCK | Complementary Code Keying |
| CE | Conformite Europeene |
| CFR | Code of Federal Regulations |
| CISPR | International Special Committee on Radio Interference |
| CSA | Canadian Standard Association |
| dB | Decibels |
| dBi | Decibels Relative to an Isotropic Radiator |
| dBm | Decibels Referred to 1 Milliwatt |
| DBPSK | Differential-Binary Phase-Shift Keying |

**TABLE 16   Abbreviations (*continued*)**

| | |
|---|---|
| DC | Direct Current |
| DGT | Directorate General of Telecommunications (Taiwan) |
| DQPSK | Differential-Quadrature Phase-Shift Keying |
| DSSS | Direct-Sequence Spread Spectrum |
| EFT | Electrically Fast Transients |
| EIRP | Effective Isotropic Radiated Power |
| EMC | Electromagnetic Compatibility |
| EN | IEC standard |
| ESD | Electrostatic Discharge |
| ETSI | European Telecommunications Standards Institute |
| EU | European Union |
| FCC | Federal Communications Commission |
| FHSS | Frequency Hopping Spread Spectrum |
| HFC | Hybrid Fiber Coax |
| Hz | Hertz |
| IEC | International Electrotechnical Commission |
| IEEE | Institute of Electrical and Electronics Engineers |
| IP67 | Ingress Protection Standard |
| ISM | Instrumentation, Scientific, and Medical band |
| ISTA | International Safe Transit Association |
| LAN | Local Area Network |
| Mbps | Megabits Per Second |
| MHz | Megahertz |
| MIL-STD | Military Standard |
| MPHPT | Ministry of Public Management, Home Affairs, Posts and Telecommunications (Japan) |
| MSO | Multiple Service Operator |
| MTBF | Mean Time Between Failure |

**TABLE 16   Abbreviations (*continued*)**

| | |
|---|---|
| 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 |
| UPS | Uninterruptible Power Supply |
| VAC | Voltage (Alternating Current) |
| VCCI | Voluntary Control Council for Interference (Japan) |
| VDC | Voltage (Direct Current) |
| VSWR | Voltage Standing Wave Ratio |
| W | Watts |

# Index