Tropos Networks MetroMesh Router Installation Guide

Model 5210
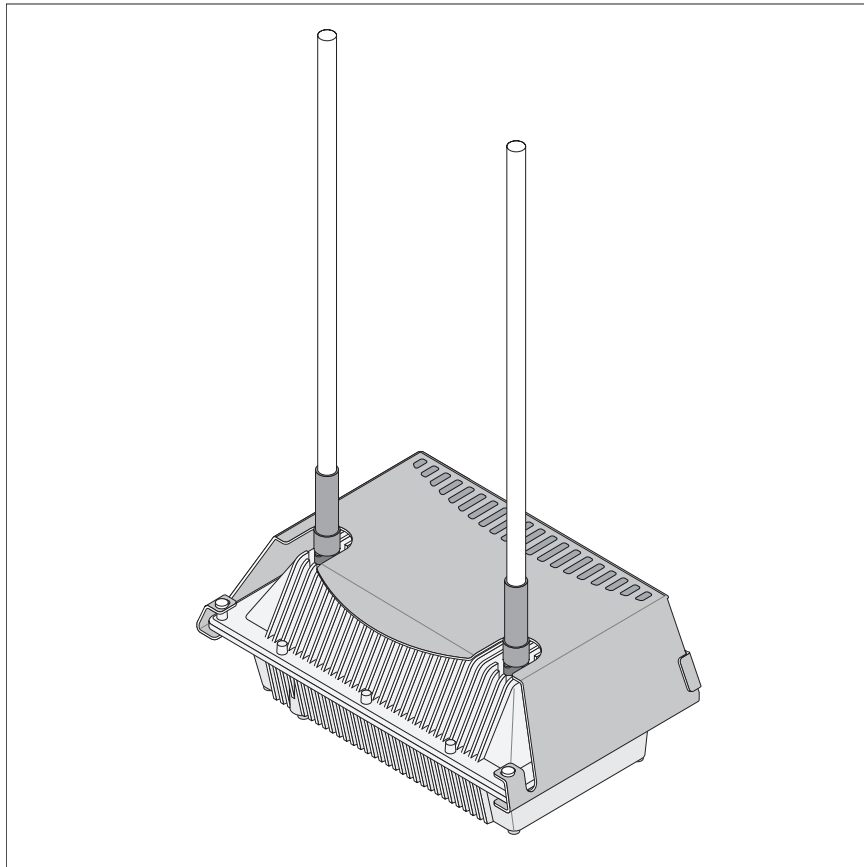
TROPOS networks

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Loctite is a registered trademark of Loctite Corporation, USA.

This product includes technology protected by U.S. Patents 6,704,301; 6,965,575; 7,016,328.

FCC Notice to Users and Operators

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.

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.

VCCI Notice to Users and Operators

この装置は、情報処理装置等電波障害自主規制協議会(VCCI)の基準に基づくクラスB情報技術装置です。この装置は、家庭環境で使用することを目的としていますが、この装置がラジオやテレビジョン受信機に近接して使用されると、受信障害を引き起こすことがあります。取扱説明書に従って正しい取り扱いをしてください。

Translation: This is a Class B product based on the standard of the Voluntary Control Council for Interference by Information Technology Equipment (VCCI). If this equipment is used in a Japanese domestic environment, radio disturbance may arise. When such trouble occurs, the user may be required to take corrective actions.

Taiwan DGT Telecommunications Act Notice to Users and Operators

低功率電波輻性電機管理辦法
第十四條經型式認證合格之低功率射頻電機,非經許可,公司、商號或使
用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。
第十七條低功率射頻電機之使用不得影響飛航安全及干擾合法通信;經發
現有干擾現象時,應立即停用,並改善至無干擾時方得繼續使用。
前項合法通信,指依電信規定作業之無線電信。低功率射頻電機須忍受合法通信
或工業、科學及醫療用電波輻射性電機設備之干擾。

⚠ **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 trained professional, value added reseller or systems integrator who is familiar with RF planning issues and the regulatory limits defined by the

Taiwan government "Telecommunications Act" for RF exposure, specifically those limits outlined in Telecom Technical Regulations RTTE01 and LP002.

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 *5210* overholder de væsentlige krav og øvrige relevante krav i direktiv 1999/5/EF
Dutch	Hierbij verklaart *Tropos Networks, Inc.* dat het toestel *5210* 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 *5210* voldoet aan de essentiële eisen en aan de overige relevante bepalingen van Richtlijn 1999/5/EC.
English	Hereby, *Tropos Networks, Inc.,* declares that this *5210* is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.
Finnish	*Tropos Networks, Inc.* vakuuttaa täten että *5210* 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 *5210* 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 *5210* 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 5210* 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 *5210* mit den grundlegenden Anforderungen und den anderen relevanten Festlegungen der Richtlinie 1999/5/EG. (Wien)
Greek	*ΜΕ ΤΗΝ ΠΑΡΟΥΣΑ Tropos Networks, Inc. ΔΗΛΩΝΕΙ ΟΤΙ 5210 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 *5210* è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 1999/5/CE.
Portuguese	*Tropos Networks, Inc.* declara que este *5210* 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 *5210* 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 *5210* 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 5210 MetroMesh Router may contain a lithium-ion battery. To avoid the possibility of an explosion, the Tropos 5210 MetroMesh Router should **NOT** be exposed to any temperatures higher than 85 degrees C.

The RJ45 connectors of your Tropos 5210 MetroMesh Router may source DC power on pins 4,5 and 7,8. The IEEE 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 Tropos Power Over Ethernet capability. If such problems occur, make sure that the unit is configured with the Power Over Ethernet capability set to Off (default setting). If problems persist, use Ethernet cables that have no connections to the unused pins 4,5 and 7,8.

The Tropos 5210 MetroMesh Router is installed in wet, outdoor locations. Make sure closure caps are installed and all cable connections are securely fastened and waterproofed.

The Tropos 5210 MetroMesh Router can only be used with approved antennas. See Appendix C, "Approved Antenna Configurations and Attenuation Settings" for further information.

Surfaces may become hot. Use caution when accessing the Tropos 5210 MetroMesh router.

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1   Installing the Tropos MetroMesh Router

This guide explains how to install the Tropos 5210 MetroMesh router safely and is intended for trained technical professionals. This chapter covers the following topics:

Preparing for Installation

The Tropos 5210 MetroMesh router 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 lists the required equipment and model numbers and explains how to prepare the installation site.

Model Numbers

An exploded view of the Tropos 5210 MetroMesh router assembly is shown in Figure 1.

(i) **Note**
Antenna(s) must be installed by a trained professional. 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. See "Approved Antenna Configurations and Attenuation Settings" on page 57 for a listing of antenna options.

⚠ **Warning**
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⚠ **Warning**
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Figure 1 Tropos MetroMesh Router Exploded View

Aux
Tx/Rx antenna

Main
Tx/Rx antenna

Pole bracket

Sun shield

Hose
clamps

#10-32
hex head 5/16"
machine screws
x5

Tropos 5210 Wi-Fi Cell

LED

Connector
access cover

AC input
power connector

Cable gland

Quick tie
anchors

10/100 BaseT
LAN cable

10/100 BaseT
Management cable

Connector
access cover
without
cable glands

Shielded outdoor
cat5 cable

Ground
bolt

Bottom view of
Tropos 5210 Wi-Fi Cell

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Installation Hardware and Tools

Tropos Networks provides the following accessories to install the Tropos 5210 MetroMesh router:

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

You must supply the following tools:

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

Site Planning

To ensure safe and durable wiring, installation of the Tropos 5210 MetroMesh router must follow appropriate electrical and building codes. Follow the National Electrical Code (NEC) requirements, unless local codes in your area take precedence over the NEC code.

The following distance limits apply to installations that have 10/100 Base-T Category 5 network cables attached to the Tropos 5210 MetroMesh router:

- 300 feet maximum between devices for 100BaseT operation
- 600 feet maximum for 10BaseT operation.

The Ethernet duplex and speed setting is configurable.

(i) **Note**
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

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device at the building entrance. Tropos Data Protection Device and Network Protection Units are UL497A secondary protection devices.

Location Guidelines

The Tropos 5210 MetroMesh router is a radio device 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 microwave ovens or other devices operating in the 2.4 GHz frequency range.

- Install the unit away from other possible sources of 2.4 GHz WLAN interference, such as cordless phones, home spy cameras, frequency hopping (FHSS) and DSSS LAN transceivers (non-802.11b), 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.

Antenna Options

You can purchase the Tropos 5210 MetroMesh router with an integrated omni-directional antenna, or use an approved external antenna. Omni-directional antennas are best for systems requiring a signal distribution in more than one direction. To comply with regulatory RF exposure limits, locate antennas a minimum distance of 7.9 inches (20cm) from people. For antenna model numbers, refer to "Approved Antenna Configurations and Attenuation Settings" on page 57.

> **(i) Note**
> Antenna(s) must be installed by a trained professional. 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. See "Approved Antenna Configurations and Attenuation Settings" on page 57 for a listing of antenna options.

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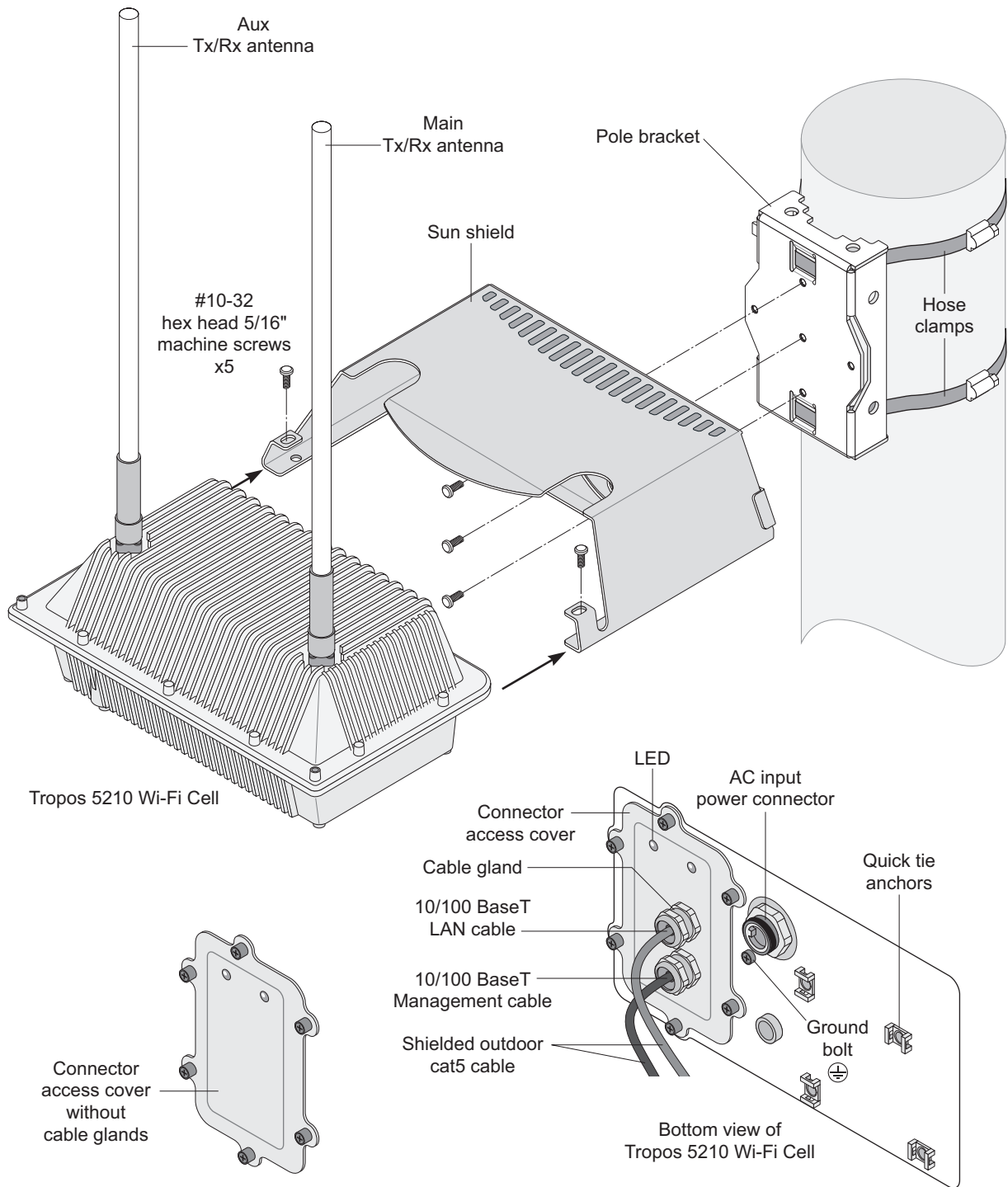
⚠ **Warning**

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Site Surveys

Due to variations in component configuration, placement, and physical environment, each installation is unique. Before installing the Tropos 5210 MetroMesh router, 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 type and placement—Proper antenna configuration 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.

- 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.

- Diversity—The Tropos 5210 MetroMesh router supports transmit and receive diversity, which requires two antennas.

Power Source

The Tropos 5210 MetroMesh router supports the following options for connecting to a power source:

- AC power source (3-wire service) — 3W(P+N+PE) or 3W(2P+PE); 100-480 VAC, 50/60 Hz
- NEMA plug, for streetlight photoelectric control power tap (2-wire service) —2W(2P) or 2W(P+N); 100-480 VAC 50/60 Hz
- In Europe, a suitably rated plug provided by the installer
- For Tropos 5210 HFC products, 40-90 V~, 50/60 Hz. 2.2A

Warning
Connect the AC powered outdoor system only to a rated power source. Do not connect to a power source of other voltage.

Caution
You must install an external grounding wire if the Tropos 5210 MetroMesh 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 Tropos 5210 MetroMesh router.

Caution
For Tropos HFC products: You must install an external grounding wire to the chassis grounding screw (Figure 21 on page 35). 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 Tropos 5210 HFC router. The unit must be properly grounded to the protective earth screw.

Safety

Installing the Tropos 5210 MetroMesh router 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 wiring

Mounting Strategies

When choosing mounting locations, consider the available mounting structures and antenna clearance. The Tropos 5210 MetroMesh 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 Tropos 5210 and 5210 HFC Routers" on page 26 and "Connecting a Data Port" on page 36 to determine the best strategy for the selected location.

ⓘ **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
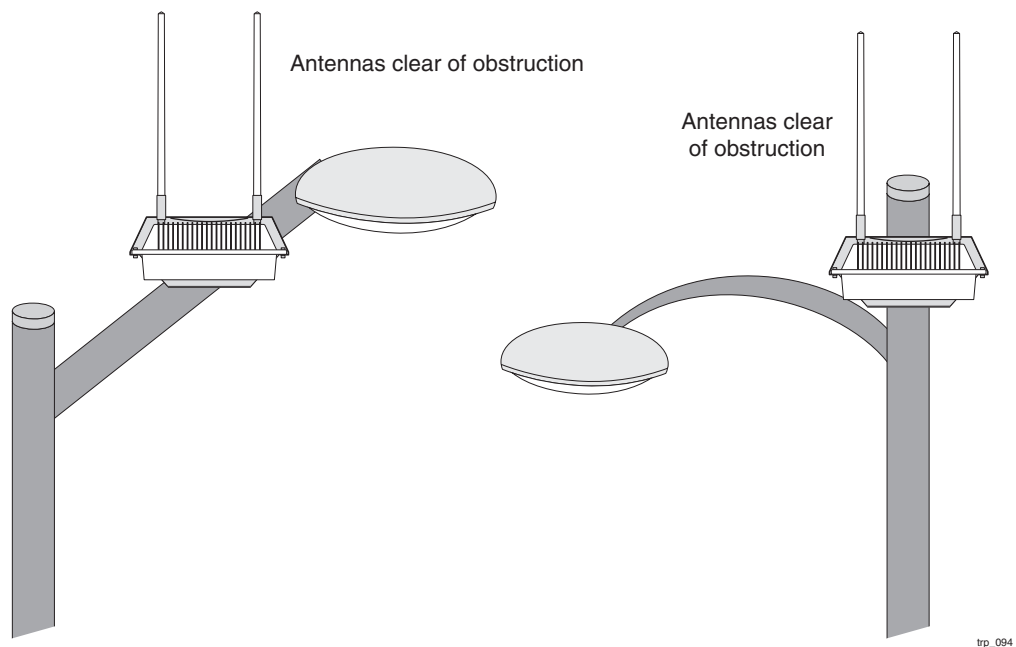
Proper Use of Hose Clamps

The mounting assembly for the Tropos 5210 MetroMesh router contains hose clamps to secure the router to the mounting structure. Figure 3 illustrates the proper use of the hose 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.

(i) **Note**
Hose clamps are not required to mount the router to a multiple service operator (MSO) wire rope, as explained in "Wire Rope Mounting Instructions for Multiple Service Operators" on page 19.

Figure 3 Proper Use of Hose Clamps
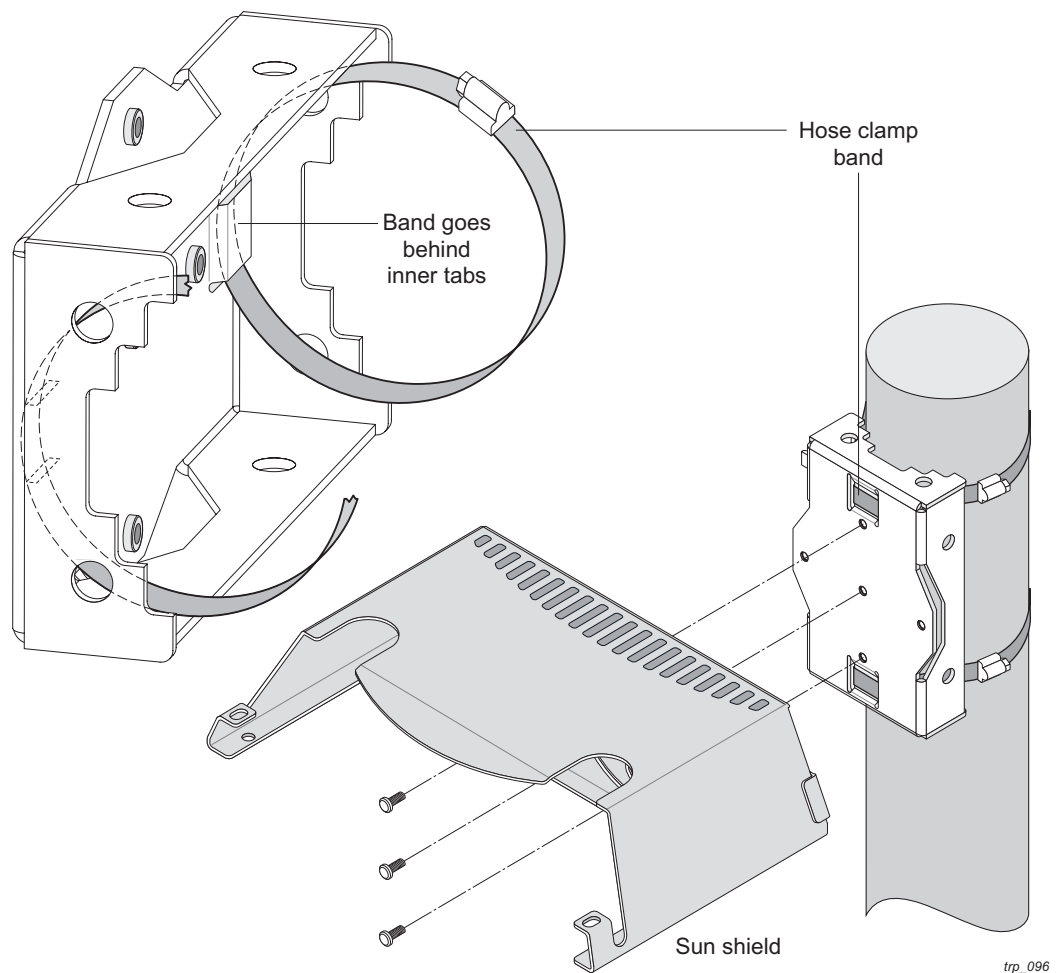
Pole, Tower, and Streetlight Mounting Instructions

This section explains how to mount the Tropos 5210 MetroMesh 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 13), and attempt to mount the router with maximum possible clearance around the antennas.

(i) **Note**
The Tropos 5210 MetroMesh router should always be mounted with the top of the router horizontal and level and with the antennas facing upward.


(i) **Note**
It is best to attach ground and data cables to the router before sliding the router into the mounted sun shield, as explained in this section. Before mounting the router, review the wiring instructions in "Grounding the Tropos 5210 and 5210 HFC Routers" on page 26 and "Connecting a Data Port" on page 36 to determine the best strategy for the selected location.

(i) **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 the proper method of mounting the Tropos 5210 MetroMesh router on an outdoor metal pole.

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

Figure 4 Metal Pole Mounting

Pole bracket
(rotated)

Sun shield

Tropos 5210 Wi-Fi Cell
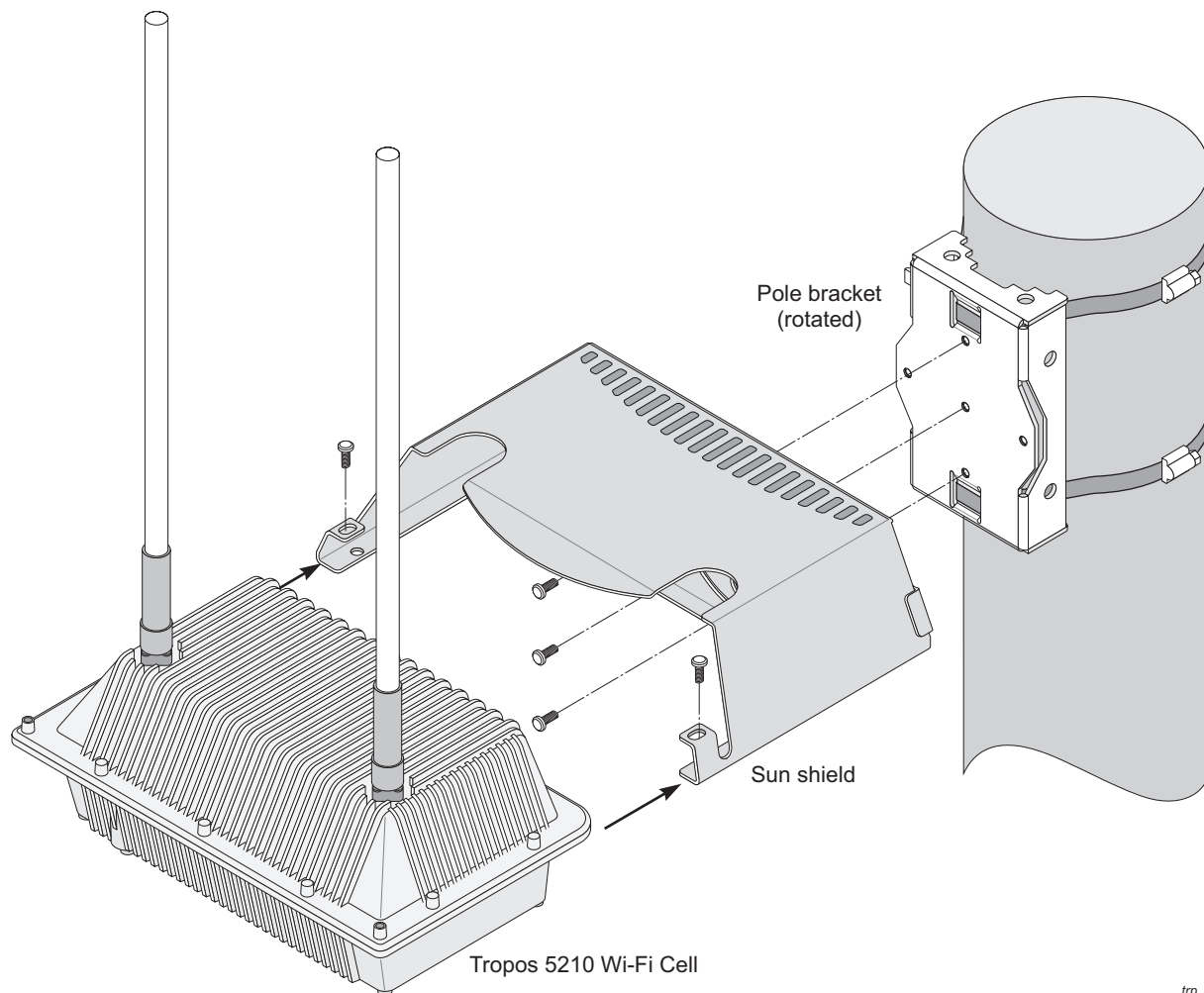
trp_097

Mount the Tropos 5210 MetroMesh 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 the hose clamps under the inner tabs or slots of the pole bracket.

3. Use the hose clamps to attach the pole bracket to the pole. Depending upon the diameter of the pole, you may need to use a single small clamp, single large clamp, or pair of large clamps joined together to reach around the pole.

4. Attach the sun shield of the router to the pole bracket with three 5/16-inch machine screws. Insert one screw through the hole in the center back of the sun shield and the other two screws through the curved slot tracks. Figure 5 shows the proper screw locations on the back of the sun shield.

> **ⓘ Note**
>
> Use anti-seize lubricant, such as Loctite 37230, when screwing the router into the sun shield.

5. Level the sun shield by rotating the unit along the curved slot tracks. A built-in level is located on the left side of the shield. Tighten the screws.

6. Slide the router into place with the antennas on top and secure it at the end with two #10-32 hex head machine screws.

To continue installing the router, see "Connecting Cable Attached Antennas" on page 22.

Figure 5 Sun Shield Connections
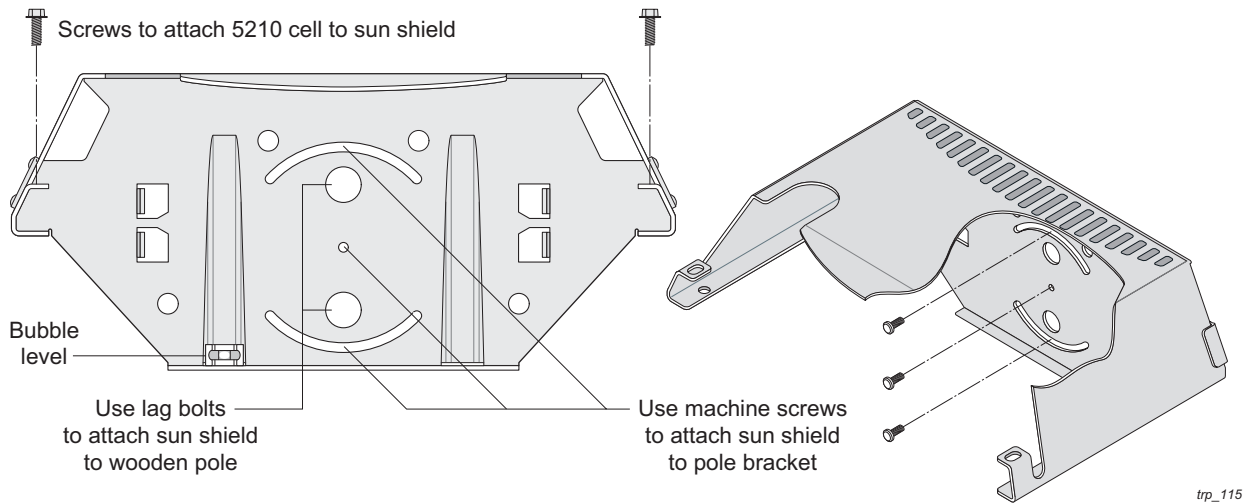
Wood Pole Mounting

Figure 6 shows a typical installation with the Tropos 5210 MetroMesh router mounted on an outdoor wood pole.

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

Figure 6 Wood Pole Mounting

Sun shield

Tropos 5210 Wi-Fi Cell
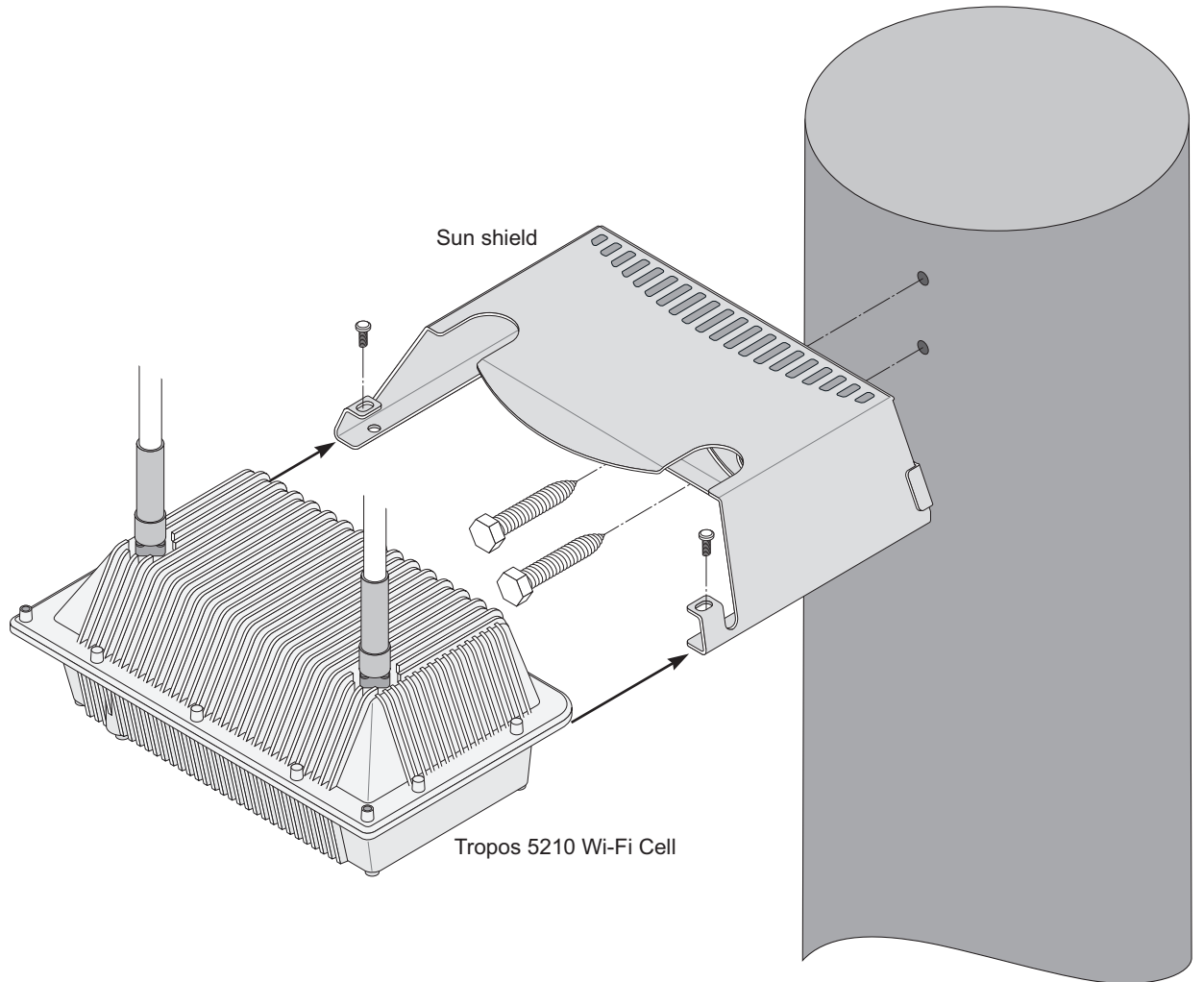
trp_098

Mount the Tropos 5210 MetroMesh 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 sun shield of the router to the pole with two 5/8-inch bolts, making sure that the shield is level. Figure 5 on page 12 shows the proper bolt locations on the back of the sun shield. The bolts should be at least 3 inches in length.

3. Slide the router into place and secure it at the end with two #10-32 hex head machine screws.

To continue installing the router, see "Connecting Cable Attached Antennas" on page 22.

Wood Brace Mounting

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

Figure 7 Wood Brace Mounting Option
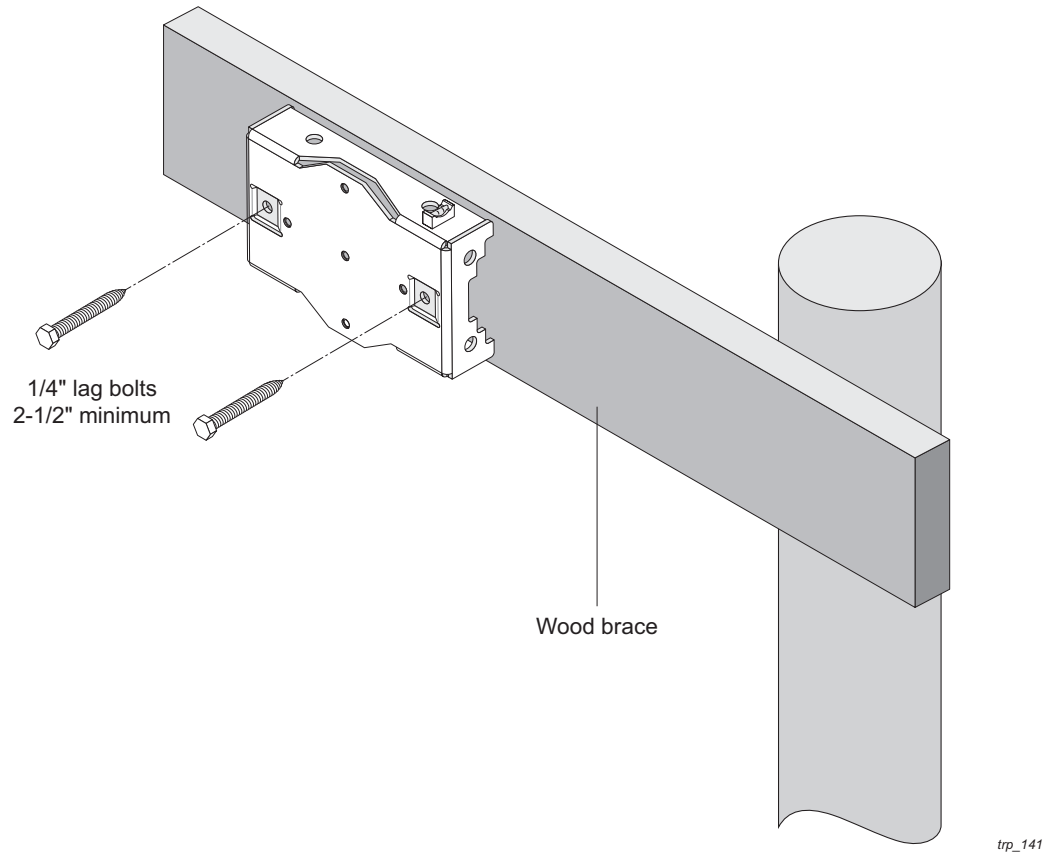
1/4" lag bolts
2-1/2" minimum

Wood brace

trp_141

Mount the Tropos 5210 MetroMesh 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 2 1/2 inches in length, making sure that the wood brace is level.

3. Attach the sun shield of the router to the pole bracket with three 5/16-inch machine screws. Insert one screw through the hole in the center back of the sun shield and the other two screws through the curved slot tracks. Figure 5 on page 12 shows the proper screw locations on the back of the sun shield.


(i) **Note**
Use thread lubricant, such as Loctite 37230, when screwing the router into the sun shield.

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4. Level the sun shield by rotating the unit along the curved slot tracks. A built-in level is located on the left side of the shield. Tighten the screws.

5. Slide the router into place with the antennas on top and secure it at the end with two #10-32 hex head machine screws.

To continue installing the router, see "Connecting Cable Attached Antennas" on page 22.

Tower Mounting

You can mount the Tropos 5210 MetroMesh router to an outdoor tower.

(i) **Note**

At the antenna level, the Tropos 5210 MetroMesh router must be free from metal obstruction within a 4-foot radius (Figure 8).

Figure 8 Tower Mounting
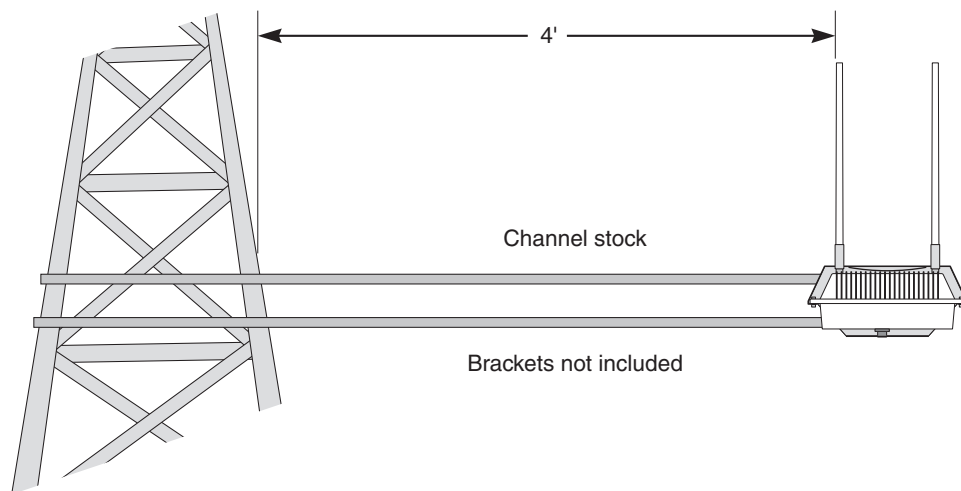
Mount the Tropos 5210 MetroMesh router on a tower

1. Remove the pole bracket from the sun shield.

2. Make a tower bracket by attaching the sun shield directly to any stainless steel or galvanized steel channel stock.

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

4. Tighten the mounting bolts.

5. Slide the router into place and secure it at the end with two #10-32 hex head machine screws.

To continue installing the router, see "Connecting Cable Attached Antennas" on page 22.

Streetlight Mounting

You can mount the Tropos 5210 MetroMesh router on the horizontal or angled arm of a streetlight. Figure 9 shows a typical streetlight mounting installation.

Figure 9 Streetlight Mounting

Pole bracket

Sun shield

Tropos 5210 Wi-Fi Cell
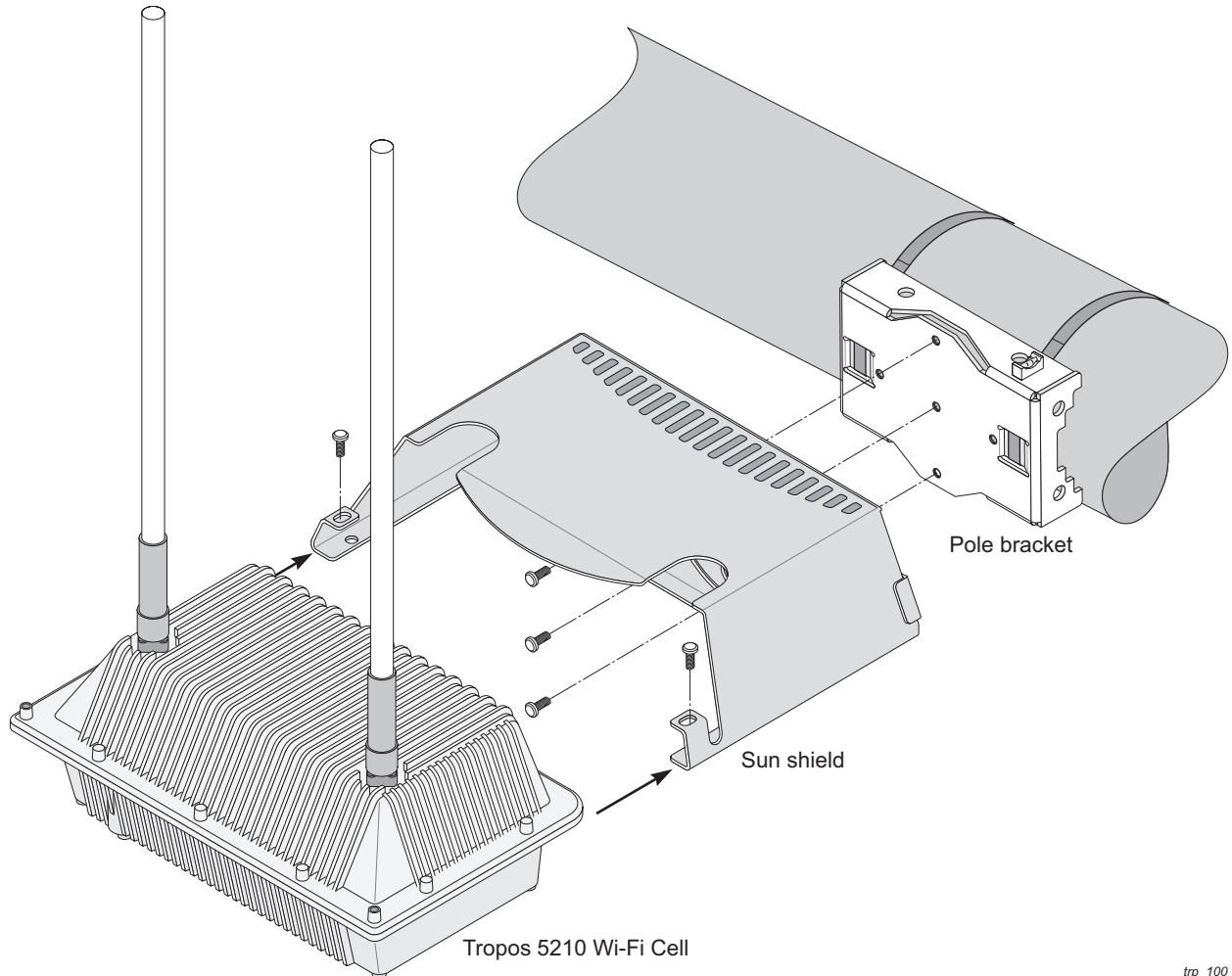
trp_100

Mount the Tropos 5210 MetroMesh 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 the hose clamp under the inside lip of the pole bracket.

3. Use the hose clamps to attach the pole bracket to the streetlight. Depending upon the diameter of the pole, you may need to use 2 small clamps, 2 large clamps, or 2 pairs of large clamps joined together to reach around the pole.

4. Attach the sun shield of the router to the structure with three 5/16-inch machine screws. Insert one screw through the hole in the center back of the sun shield and the other two screws through the curved slot tracks.

5. To level the assembly, slide the router loosely into the sun shield, but do not secure it. Level the sun shield by rotating the unit along the curved slot tracks. A built-in level is located on the left side of the shield. Maintain the level orientation while you slide the router out of the sun shield. Tighten the sun shield screws.

6. Slide the router into place and secure it at the end with two #10-32 hex head machine screws.

To continue installing the router, see

Wire Rope Mounting Instructions for Multiple Service Operators

This section explains how to mount the Tropos 5210 HFC router on steel wire rope used by multiple service operators (MSOs) to support coaxial cables for outdoor overhead transmission.

> (i) **Note**
> This mounting method applies only to Tropos 5210 HFC MetroMesh router, model 52104000.

Strand mounting bracketry is provided with the Tropos 5210 HFC router (Figure 10). The strand mounting bracketry kit includes the following items:

- Sun shield
- Strand mount bracketry parts: A, B, C, D, E
- 5 screws #10-32 x 1/2-inch
- 6 nuts 5/16 - 18
- 6 lockwashers 5/16-inch
- 6 washers 5/16-inch
- 4 cable clamps

The following tools are required:

- 1/2-inch or 13mm socket
- 5/16-inch nut driver and/or socket

Figure 10 Tropos 5210 HFC Strand Mount Bracketry (Exploded View)

Sun shield

5/16-18 nuts
with lock washers
and washers

Secure with
1/2" or 13mm
wrench

A

B

E

D

C

Uphill side
of bracket

Cable clamps

5 screws #10-32 x 1/2"
attach sun shield
to bracketry

Completed assembly

trp_149+
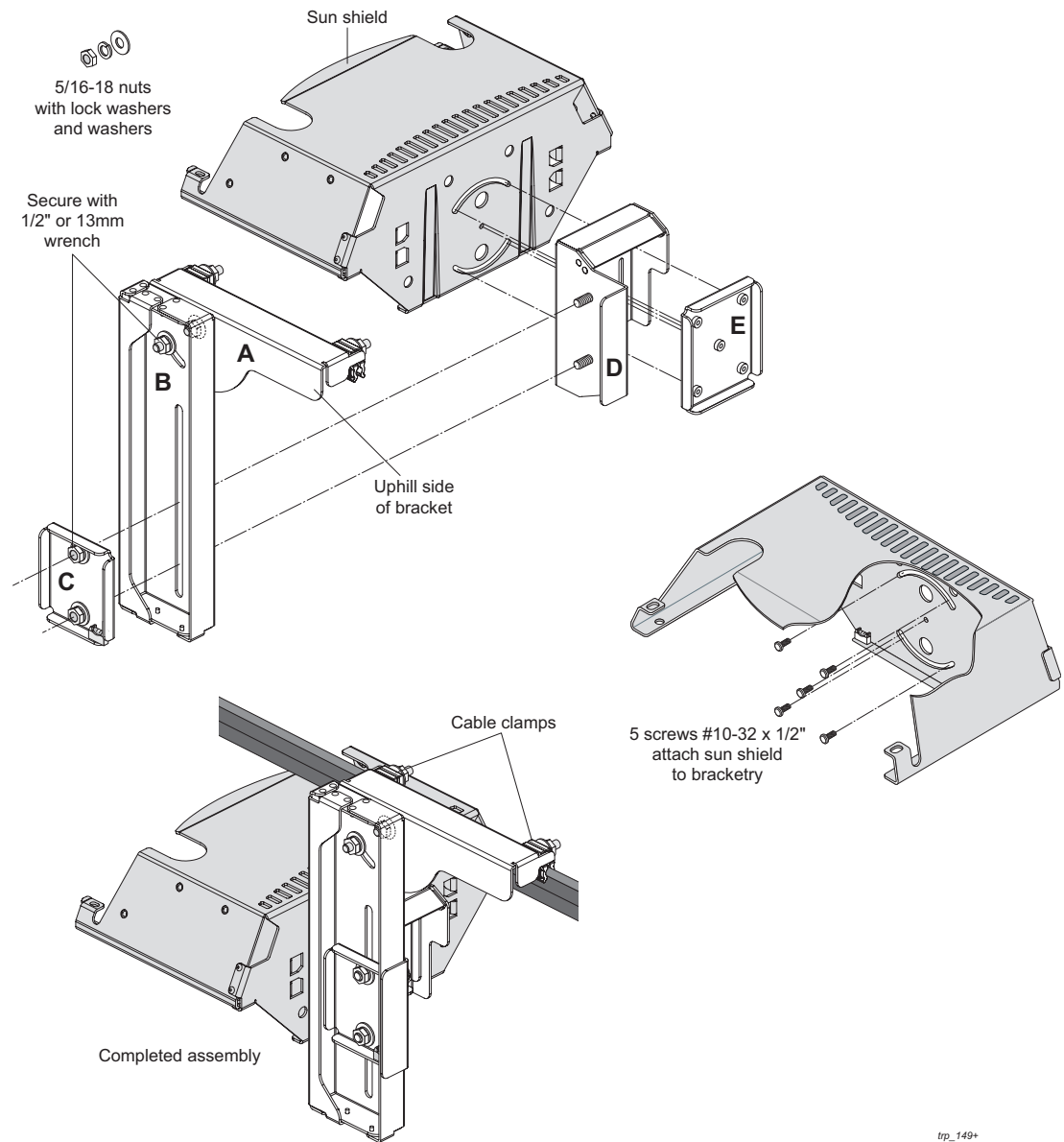
ⓘ **Note**
The bubble levels on the brackets and sun shield are for reference only and need not be used during the installation. It is acceptable to eye-ball the plumb and leveling of the antennas and bracket.

Mount the Tropos 5210 HFC router on an MSO wire rope

1. Select a mounting location on overhead 3/8-inch steel wire rope that is part of an MSO coaxial cable arrangement. The mounting location should be close to a hybrid fiber coax power source.

2. Install parts D and E on the sun shield (see Figure 10).

    ■ If the wire rope is fairly level, slide D and E toward the bottom of the sun shield.
    ■ If the wire rope is at an angle greater than 10 degrees, slide D and E toward the top of the sun shield.

3. Tighten with 5 #10-32 x 1/2-inch screws so that D and E are square with the sun shield.

4. Using C in Figure 10, attach the A and B assembly to D and E and the sun shield using two washers, lock washers, and nuts. Do not tighten.

5. To mount the strand mount bracketry on the wire rope, unscrew the clamps on the bracket and slide the bracket onto the wire rope (Figure 11). Make sure that the back of the bracket (the portion farthest from the sun shield) is pointing in the uphill direction, as the bracket assembly is adjustable only in one direction. Tighten the clamps onto the wire rope so that the bracket hangs straight.

Figure 11 Attaching Strand Mount Bracketry to Wire Rope

6. Slide the sun shield upward and as close to the wire rope and cables as possible without touching. This minimizes the effect of the wire rope on the router antennas. Tighten nuts on C (Figure 10).
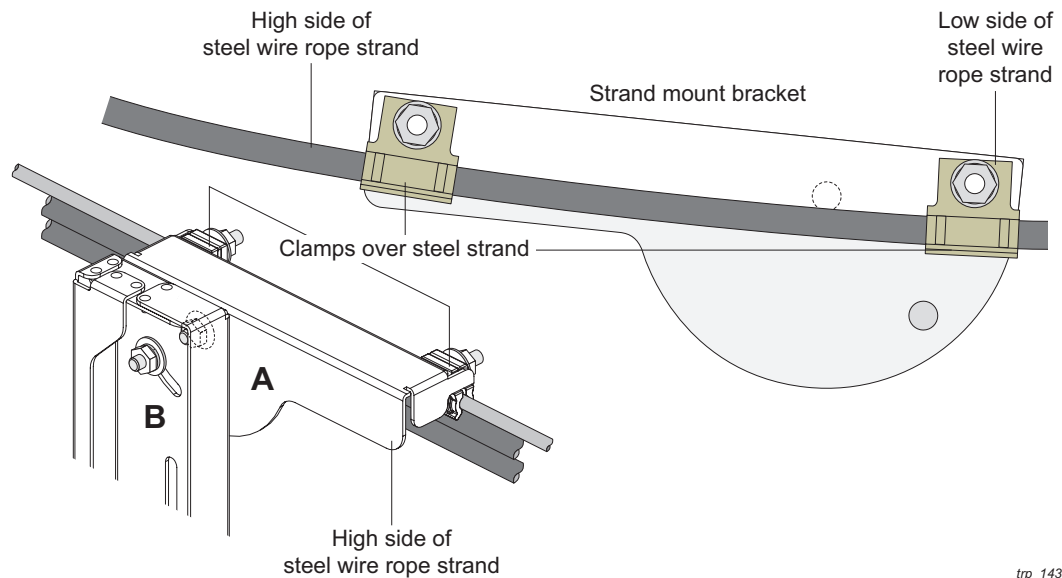
(i) **Note**

When the assembly is released from being held in the vertical position, the bracket may tilt to one side. This is expected.

---

7. Slide the Tropos 5210 HFC router into the sun shield and secure with two #10-32 x 1/2-inch screws.

8. Rotate bracket B until the antennas are vertically plumb. Tighten nuts on B using a 1/2-inch or 13mm wrench.

> ⓘ **Note**
> Levels are for reference only. The antennas need not be perfectly plumb and the bracket perfectly square. It is acceptable for the antennas to appear relatively square from a distance.

Hybrid fiber coax (HFC) is used to supply power to the router. For instructions on connecting power, see "Connecting to Hybrid Fiber Coax Power" on page 34. To continue installing the router, see "Connecting Cable Attached Antennas" on page 22.

Connecting Cable Attached Antennas

This section applies to external antennas used with the Tropos 5210 router. You can mount the antenna on a structure and then use cables to attach it to the router. After mounting, secure the antennas with ThreadLocker Loctite 242 and waterproof them using self-fusing EPR tape. (See "Installation Accessories" on page 71 for the correct part number.) Figure 12 shows an installation with external antenna cabling.

> ⚠ **Warning**
> Do not locate the antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they can cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (e.g. U.S.:NFPA 70, National Electrical Code, Article 810, in Canada: Canadian Electrical Code, Section 54).

Figure 12 Connecting External Antennas

Cables
from antennas
to unit

Aux
Tx/Rx antenna

Main
Tx/Rx antenna
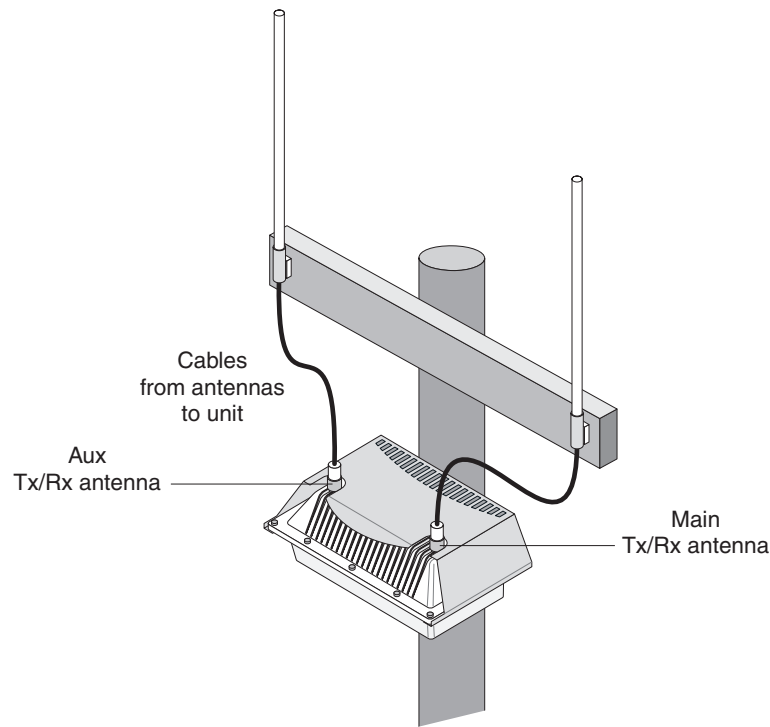
trp_101

Connect antenna cables

1. Mount the antennas in a suitable location, following the instructions supplied with the antennas.

2. Perform a trial installation of the antenna cables.

3. When you are satisfied with the trial placement of the antenna cables, remove the antenna connections from the Tropos 5210 MetroMesh router and apply two drops of ThreadLocker Loctite 242 to the antenna connector thread (Figure 13).

4. Install the antenna cables. Be sure to provide a drip loop to divert water away from the connector.

> **(i) Note**
> To ensure good electrical contact with the antenna, do not get Loctite on the center conductor pin of the antenna cable or outdoor system connector.

> **(i) Note**
> Antenna(s) must be installed by a trained professional. 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. See "Approved Antenna Configurations and Attenuation Settings" on page 57 for a listing of antenna options.

⚠️ **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 Taiwan DGT "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 Taiwan DGT "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.

Waterproofing Antenna Connections

Figure 13 illustrates how to waterproof the antenna connections after they are installed. Make sure that you waterproof the connections at both ends (cable-to-antenna and cable-to-router).

Waterproof the antenna connections

1. Locate the self-fusing EPR waterproofing tape included in the antenna installation kit.
2. Separate the liner from the tape.
3. Pre-stretch the tape and wrap it tightly around the connector.

Figure 13 Waterproofing Antenna Connections

Apply 2 drops of Loctite to threads

Apply tape around
RF cable joints
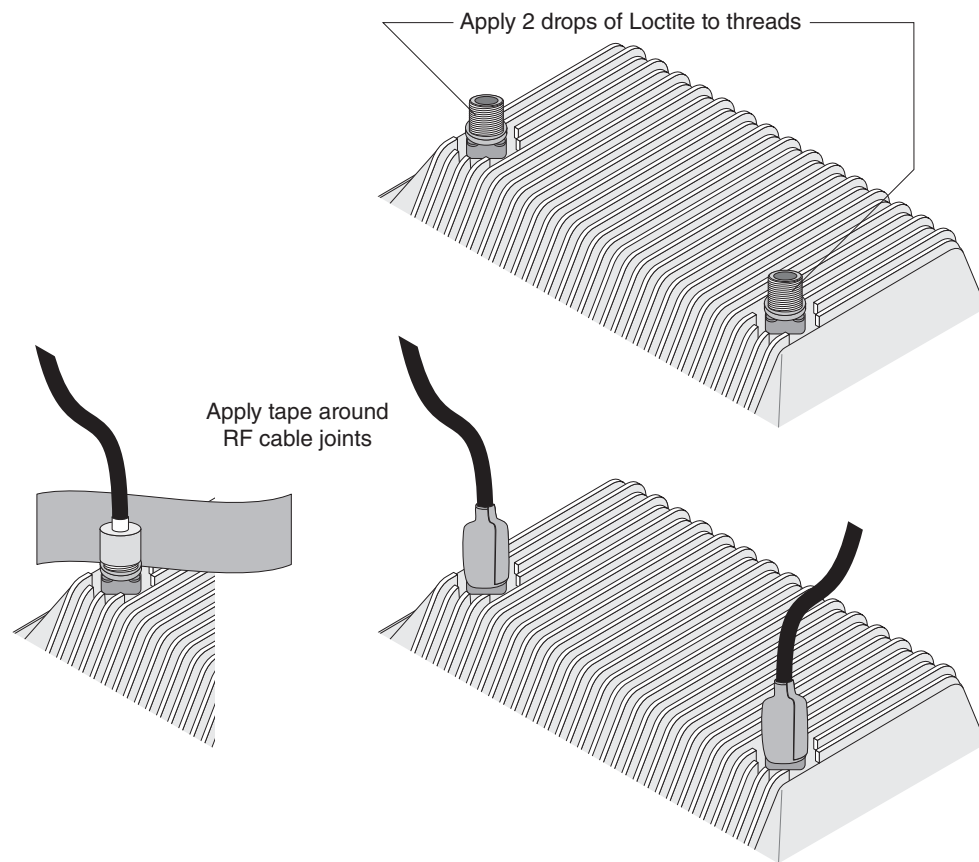
trp_102

Installing Customer-Provided Antennas

The following steps explain how to install customer-provided antennas that are attached directly to the Tropos 5210 MetroMesh router.

Replace the Tropos 5210 MetroMesh router antennas

1. Turn power off to the router.
2. Remove the screws that secure the router to the sun shield, and slide the router out from the sun shield.
3. Apply two drops of Loctite Threadlocker 242 to the antenna connector thread.
4. Screw the antennas onto the router, making the connection hand-tight.
5. Locate the self-fusing EPR waterproofing tape included in the antenna installation kit.
6. Separate the liner from the tape.
7. Pre-stretch the tape and wrap it tightly around the connector.

8. Slide the router back into the sun shield and secure it with screws.

Grounding the Tropos 5210 and 5210 HFC Routers

⚠ **Caution**
You must install an external grounding wire if the Tropos 5210 MetroMesh 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.

⚠ **Caution**
You must install an external grounding wire on the Tropos 5210 HFC router. 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.

The grounding arrangements for the Tropos 5210 and 5210 HFC routers are shown in Figure 14.

Figure 14 Ground Arrangement
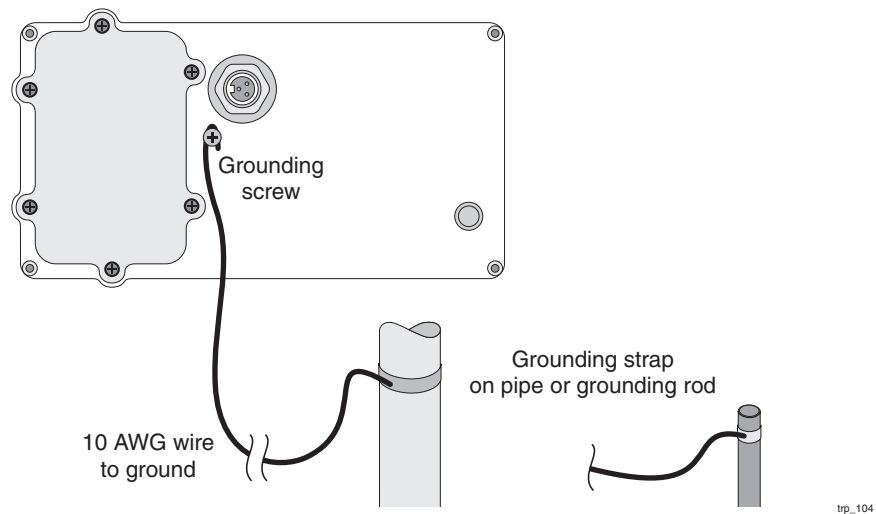
Ground the Tropos 5210 MetroMesh router

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 15.

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 15 Grounding the Indoor Network Protection Unit
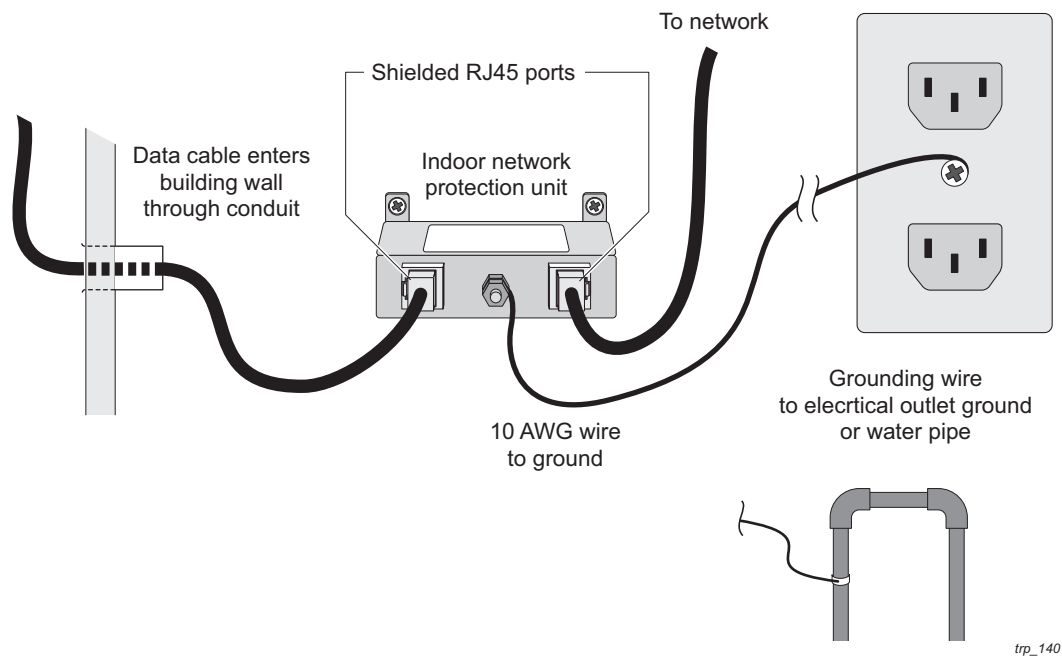
Connecting Power

> ⓘ **Note**
> The information in this section applies to the Tropos 5210 router. For information on connecting power for the Tropos 5210 HFC router, see "Wire Rope Mounting Instructions for Multiple Service Operators" on page 19).

This section explains the different categories of electrical power and provides procedures for connecting the outdoor system to power. There are two options for connecting the Tropos 5210 MetroMesh router to a power source:

- AC power source (3-wire service) — 3W(P+N+PE) or 3W(2P+PE); 100-480 VAC, 50/60 Hz
- NEMA plug, for streetlight photoelectric control power tap (2-wire service) —2W(2P) or 2W(P+N); 100-480 VAC 50/60 Hz
- For Tropos 5210 HFC products, 40-90 V~, 50/60 Hz. 2.2A

> ⚠ **Warning**
> Before you work on an electrical circuit, make sure the power is off. 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 install an external grounding wire if the Tropos 5210 MetroMesh 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.

Categories of Power

The IEEE/ANSI C62.41 standards (equivalent to the IEC Category IV standards) define Categories A-C. Equipment designed to a CAT C standard is resistant to much higher energy transients than one designed to CAT B or CAT A standards. Within a category, a higher voltage rating denotes a higher transient withstand rating.

Table 1 lists power types and Figure 16 shows hook-ups for the IEEE/ANSI C62.41 Power Categories power categories. Figure 17 shows the power hook-up for the Tropos 5210 HFC router.

Table 1 IEEE/ANSI C62.41 Power Categories

Category	Summary	Examples
CAT C	Outside and service entrance	• Service drop from pole to building entrance • Run between meter and distribution panel • Overhead line to detached buildings • Underground lines to well pumps
CAT B	Major feeders and short branch circuits	• Distribution panel devices • Bus and feeder systems in industrial plants • Heavy appliance outlets with "short" connections to the service entrance • Lightning systems in commercial buildings
CAT A	Outlets and long branch circuits	• All outlets at more than 10 m (30 ft) from Category B with wires #14-10 • All outlets at more than 20 m (60 ft) from Category C with wires #14-10

Figure 16 IEEE/ANSI C62.41 Power Categories

Outdoor units powered from distribution panel are in Overvoltage Installation Category B

Category C

Category A

Category B

Outdoor units powered from electrical meter are in Overvoltage Installation Category C
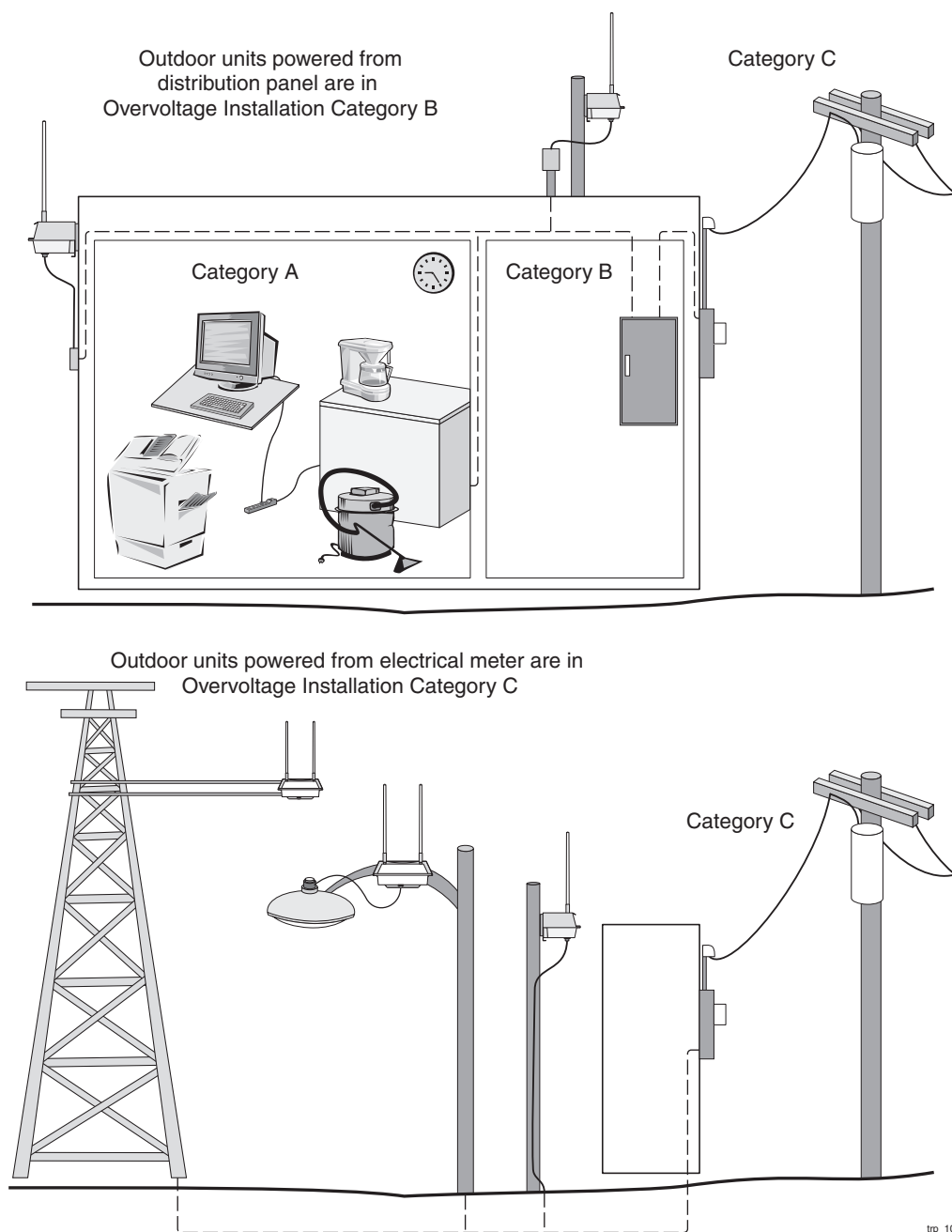
Category C

trp_105

Figure 17 Hybrid Fiber Coax Power for Tropos 5210 HFC Router

AC power
Category C

AC power
to HFC
power supply

Outdoor units powered from
co-axial cable are in
Overvoltage Installation Category HFC

trp_147
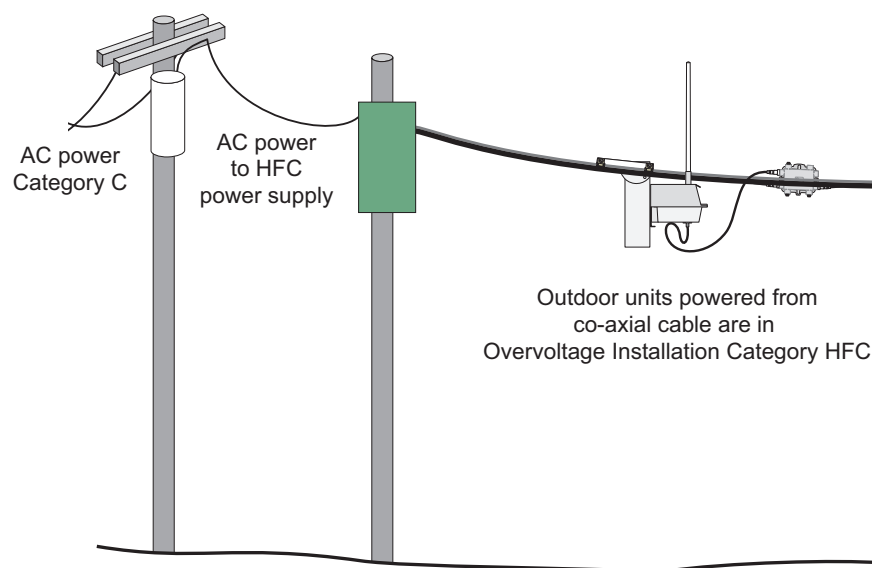
Connecting to AC Power (Category C)

The AC power connections for a Category C AC power source are shown in Figure 18.

Figure 18 Connecting Category C AC Power
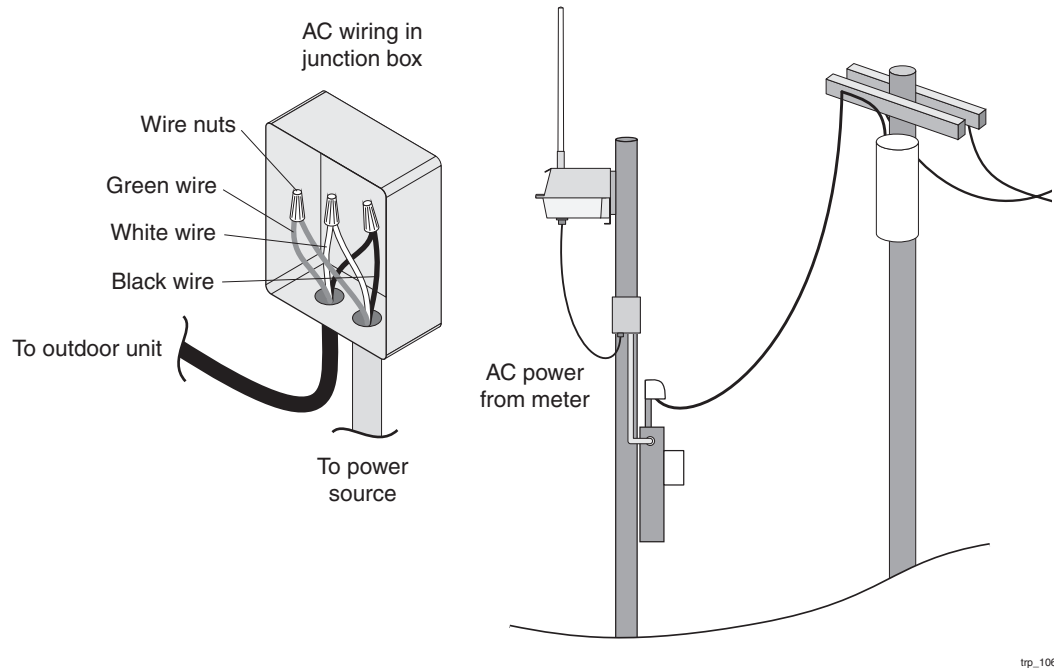
Connect an AC power source

1. Verify that the service voltage is 100-480 VAC 50/60 Hz.

2. Verify that power is turned off on the designated circuits.

3. Install 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.

> (i) **Note**
> Data and power must never be enclosed in the same conduit.

6. Connect the AC cable to the router and tighten the nut hand-tight. See Figure 19.

7. Connect the Tropos 5210 MetroMesh router to a 100-480 VAC 50/60 Hz CAT C power source.

8. Reenergize the circuit and confirm that power to the router comes on.

(i) **Note**
The Tropos 5210 MetroMesh router is equipped with additional AC surge protection and dual fuse branch circuit protection. Additional ISA branch circuit protection is not required in the upstream power distribution.

Figure 19 Connecting the AC Power Cable

Tighten nut to secure power connection
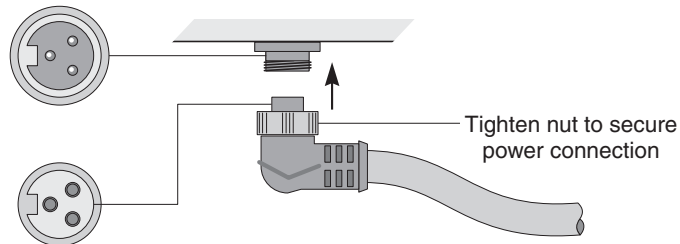
trp_107

Connecting to Streetlight Power (Category C)

The power connections for Category C streetlight power are shown in Figure 20. Use the 3-prong NEMA twist-lock adapter with twist-lock style photoelectric controls for outdoor lighting commonly used by utilities. The NEMA twist-lock adapter can be used only with UL 773 listed outdoor lighting controls rated for and operated at 100-480 VAC 50/60 Hz.

⚠ **Warning**
Be extremely careful when connecting to Category C streetlight power.

Figure 20 Connecting Streetlight Power

AC power from power adapter on photosensor

AC power from power adapter on photosensor
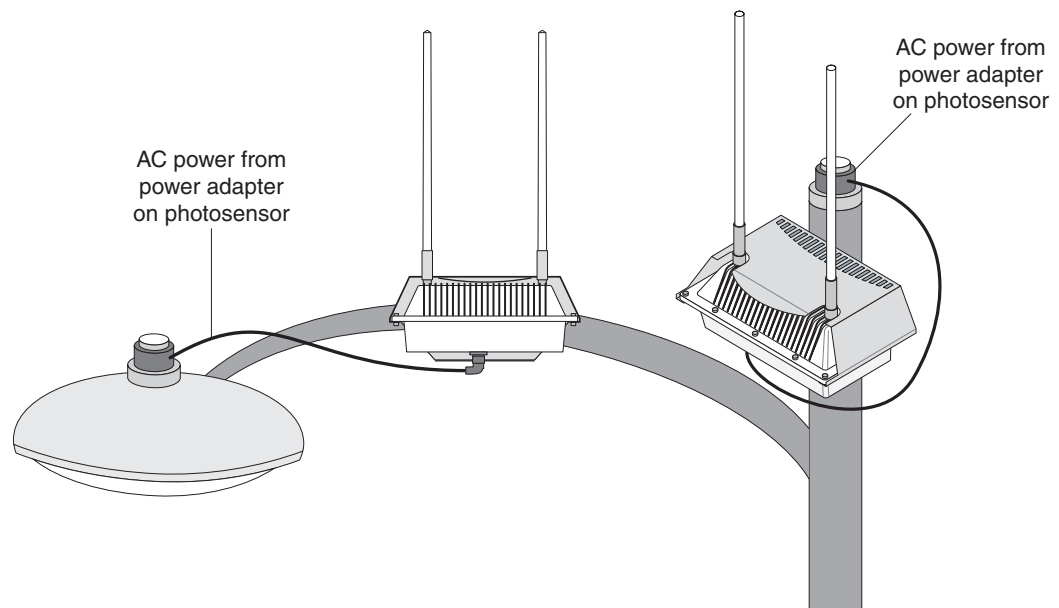
⚠ **Warning**
Connect the outdoor system only to a twist-lock style outdoor lighting control powered by 100-480 VAC 50/60 Hz. Do not connect it to twist-lock style outdoor lighting controls powered by higher voltage.

Connect a streetlight power source

1. Verify that the service voltage is 100-480 VAC 50/60 Hz.

2. Verify that power is turned off on the designated circuits.

3. Remove the photosensor from the streetlight.

4. Connect the NEMA 3 prong plug from the Tropos 5210 MetroMesh router to the photosensor connector on the street light.

5. Connect the photosensor to the top of the NEMA 3 prong plug.

6. Connect the AC plug to the router and tighten hand-tight.

7. Reenergize the circuit and confirm that power to the router comes on.

ⓘ **Note**
The Tropos 5210 MetroMesh router is equipped with additional AC surge protection and dual fuse branch circuit protection. Additional ISA branch circuit protection is not required in the upstream power distribution.

ⓘ **Note**
Do not leave connectors open to the environment. Connectors should be covered with closure caps when not in use. Closure caps should be tightened to be snug.

Connecting to Hybrid Fiber Coax Power

Hybrid fiber coax (HFC) is used to supply power to the Tropos 5210 HFC router. Figure 21 shows the router power connections, and Figure 22 shows the connection to HFC power.

ⓘ **Note**
Connect the coaxial cable to the router before connecting it to the MSO HFC power tap device. When attached to power, the exposed center conductor carries current and can cause a shock if touched.

Figure 21 Connecting Power to the Tropos 5210 HFC Router
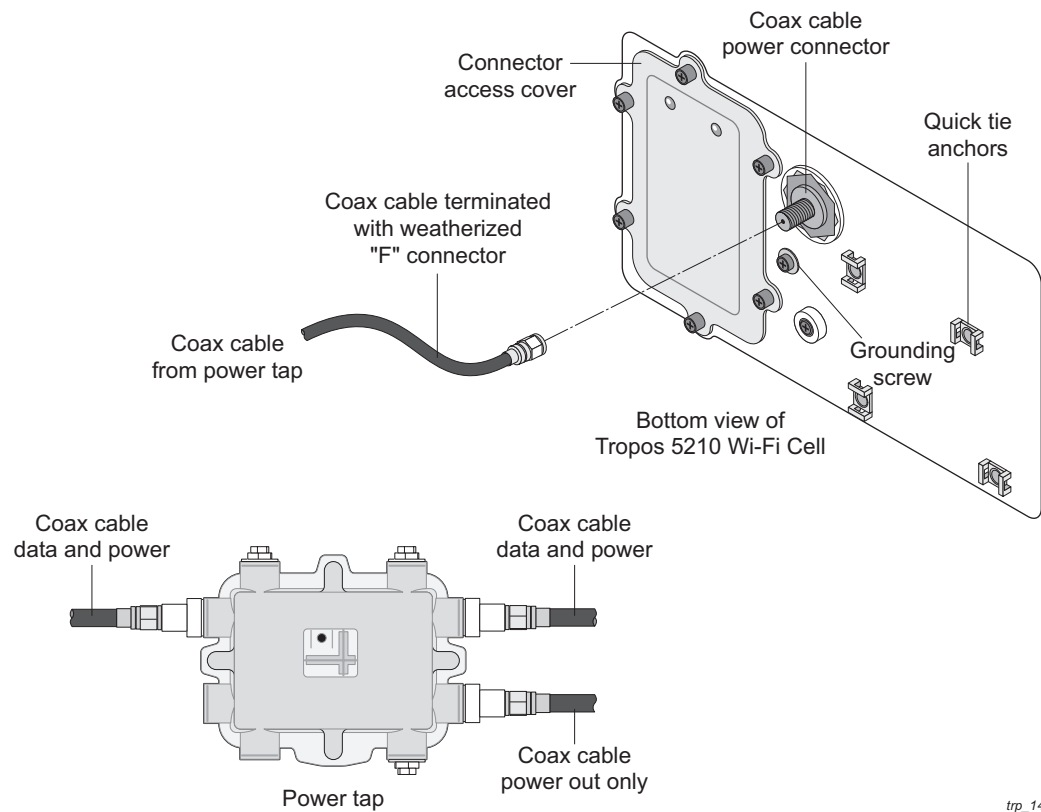
Connect HFC power

1. Attach a coaxial cable terminated with appropriate weatherized F connectors to the connector on the bottom of the router (Figure 21).

2. Attach the other end of the coaxial cable to the MSO power tap device.

Figure 22 Connecting Hybrid Fiber Coax Power

40-90 V~, 50-60 Hz, 2.2 A power
on co-ax cable
from power tap

Strand mount
bracketry

Drip loop

trp_148
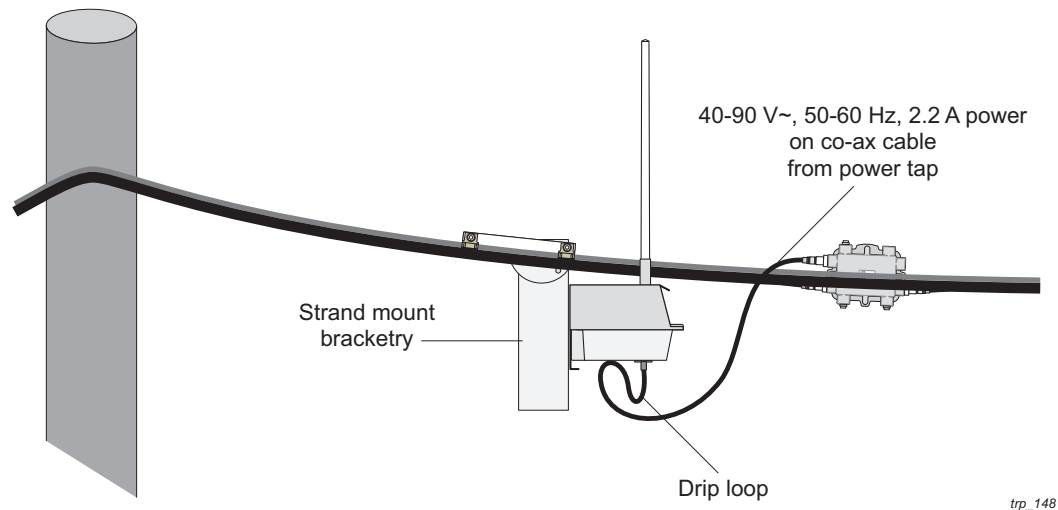
Connecting a Data Port

The Tropos 5210 MetroMesh router is equipped with two Ethernet ports that support RJ45 connectors.

> (i) **Note**
> The Tropos 5210 MetroMesh 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 Configuration Guide*.

> (i) **Note**
> Only use shielded Cat5 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 RJ-45 pins 4,5 (+) and 7,8 (-)

⚠ **Attention**

Une tension continue peut être présente sur les broches RJ-45 4, 5 (+) et 7, 8 (-).

ⓘ **Note**

This is not a mid-span powered device. Never attempt to daisy-chain Power Over Ethernet devices.

Figure 23 illustrates the method for routing cables to the Tropos 5210 MetroMesh router. Use the RJ45 jacks for port connection.

Figure 23 Options for Connecting a Data Port

Watertight access cover cable glands

Shield termination

Cable terminated with RJ45 jack for port connection

trp_111
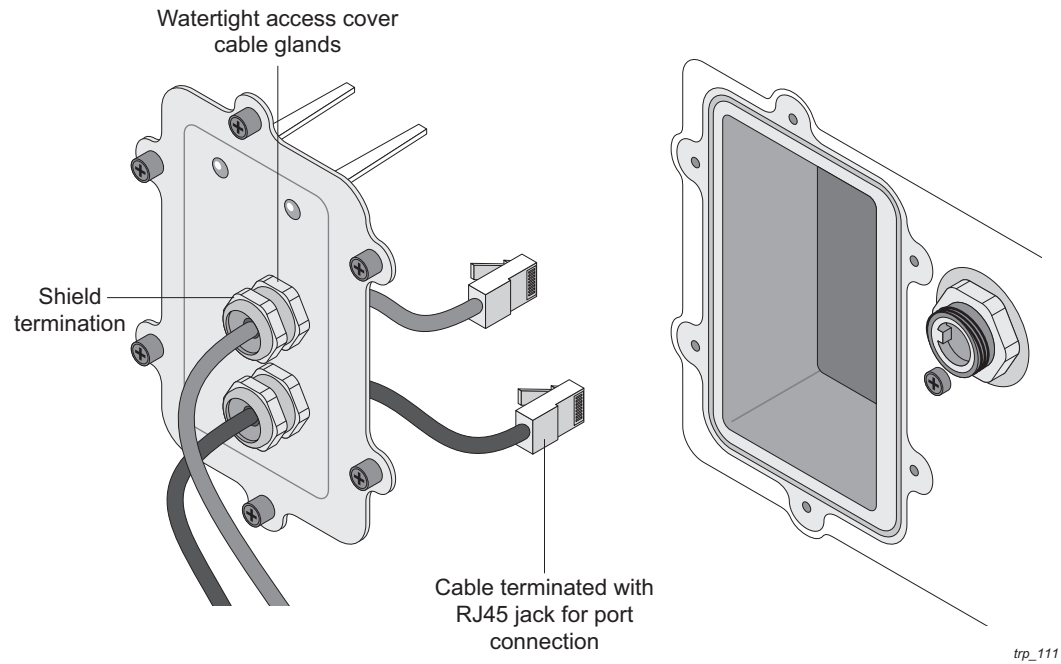
Figure 24 shows the layered shield and jacket for the data cable, which must be removed to expose the inner cable and twisted pairs.

Figure 24 Data Cable Detail
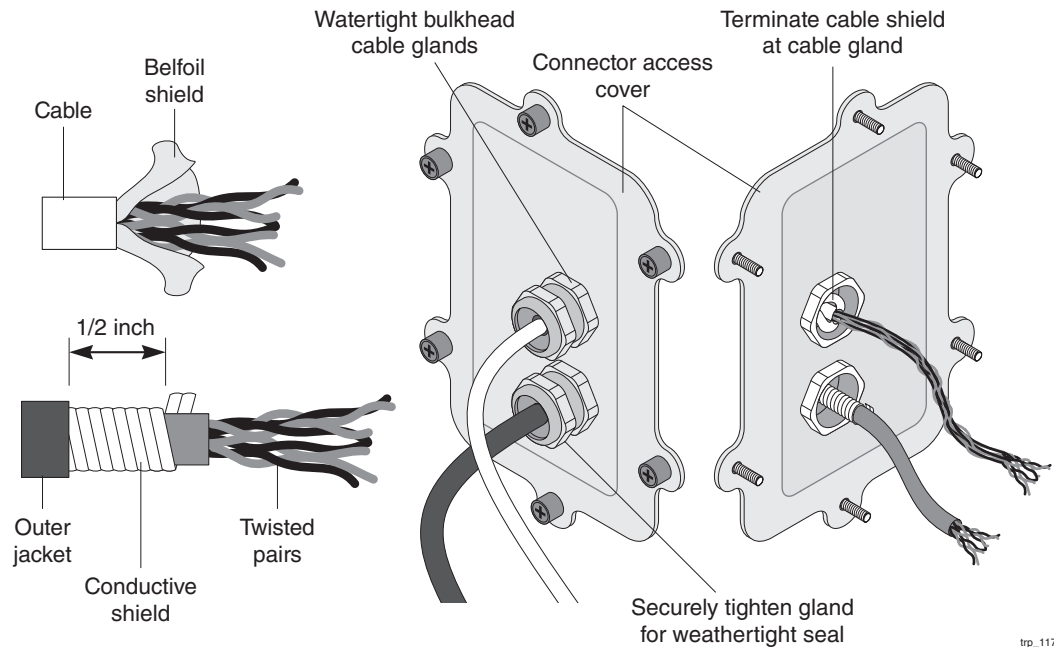
> **(i) Note**
> Attach ground and data cables to the router before sliding it into the sun shield.

Connect to the data port

1. Verify that power is turned off on the designated circuits.

2. Run shielded Category 5 Ethernet cable appropriate for outdoor use from a data protection unit to the Tropos 5210 MetroMesh router.

3. Connect one end of the Category 5 cable to the protection unit.

4. Remove the connector access cover on the bottom of the router.

5. Run raw cables for the Management or LAN port, or both, through the bulk head openings, allowing sufficient length to terminate the cables without causing crowding in the connection area. See Figure 25.

Figure 25 Data Port Connection
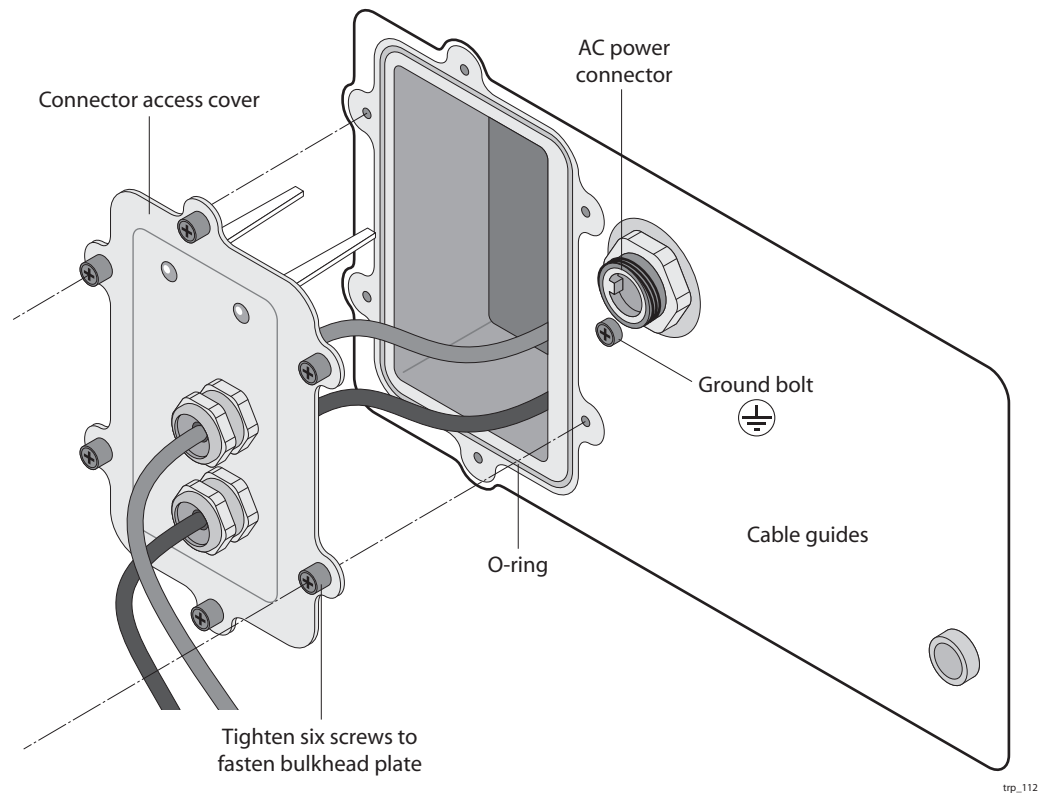
6. Connect the cable ends that were routed through the connector access cover to the LAN and Management ports on the router. Use an appropriate RJ45 8-pin modular plug to terminate the cables at the desired lengths. The outer jacket and conductive shield must be stripped to expose the twisted pairs for attachment, as shown in Figure 24. The proper location of the connections on the circuit board is shown in Figure 26.

7. Verify that the protection unit is properly grounded.

Figure 26 Circuit Board Connection Locations

O-ring gasket

Screw holes
for access cover

LED

Reset

Management   LAN
port   port

Threaded hole for
grounding bolt

AC power
connector
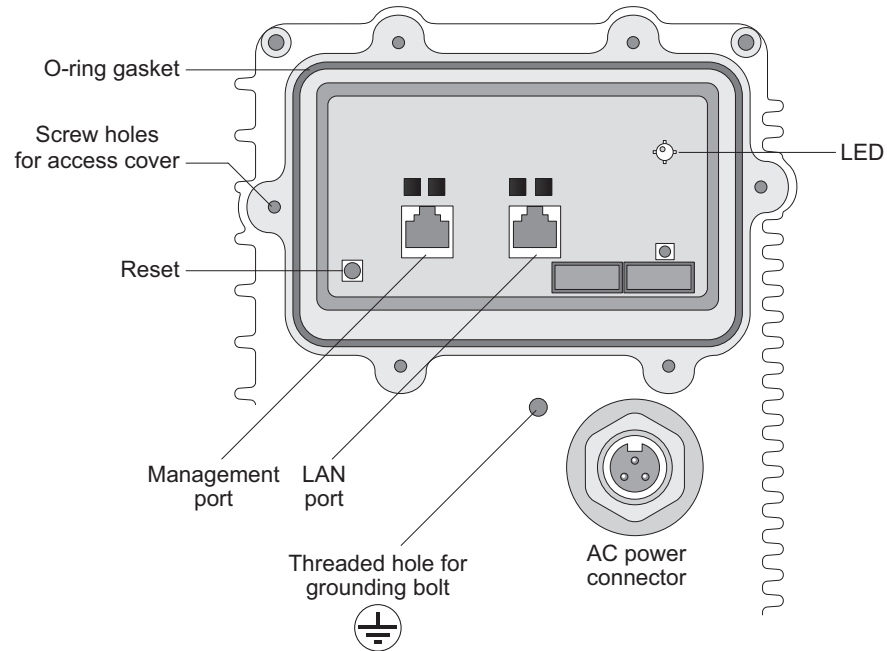
trp_110

Resetting the Router

You can use the Reset button on the circuit board to reset the hardware and software and to turn the router off if it is operating on battery power.

Perform a hardware reset

1. Remove the connector access cover on the bottom of the router.

2. Press the Reset button for one second.

Turn the battery-powered router off

Follow these steps if AC power is off and the router is running on battery power:

1. Remove the connector access cover on the bottom of the router.

2. Press and hold the Reset button for 3-5 seconds.

Connecting Peripherals

The Tropos 5210 MetroMesh router can be configured to source DC power on the Ethernet connector pins 4,5 and 7,8, This capability allows the router to power remote peripherals such as backhaul point-to-point radios, video cameras, or fiber optic transceivers. The Tropos Power over Ethernet (PoE) power sourcing capability is a fully isolated supply and can be used to power either positive or negative polarity peripherals.

The Tropos PoE power sourcing capability differs from the IEEE 802.3af standard in the following ways:

■ Tropos PoE includes support for multiple voltages; the 802.3af standard supports only 48V operation.

■ Tropos PoE does not include support for auto-discovery.

Many IEEE 802.3af-compliant power devices (PDs) will operate using the Tropos power sourcing equipment capabilities.

The Tropos 5210 MetroMesh router can supply up to a total of 14W of DC power distributed to the LAN port, Management port, or both. Each port must be configured for the same voltage. To configure the voltage, use the Tropos Configuration Utility (see the *Tropos Networks User Guide)* or an element management system such as Tropos Control (see the *Tropos Control EMS Installation and User Guide*). The DC output voltage can be configured to 12Vdc, 24Vdc, 48Vdc, or to the Off state (0Vdc). Table 2 lists the maximum power output as a function of voltage.

Table 2 PoE Power Sourcing Power Output

Voltage	Max PoE Power Output	Max Enhanced PoE Power Output
12Vdc	14W	30W
24Vdc	12W	30W
48Vdc	10W	30W

In the event of an over-current or short-circuit fault event, the Tropos 5210 MetroMesh router will remove PoE output for three to five seconds before attempting to resume sourcing power to the peripheral device.

(i) **Note**
When the software restarts following a software upgrade, the PoE output will experience a disruption for the period of the restart.

If the battery backup capability is installed, PoE output power is unaffected by the temporary loss of AC power. The power sourcing feature continues to function during battery backup operation (see "Battery Backup Operation" on page 44).

Figure 27 shows the pin locations for the RJ45 connector, and Table 3 shows the associated pin descriptions.

Figure 27 RJ45 Pin Locations
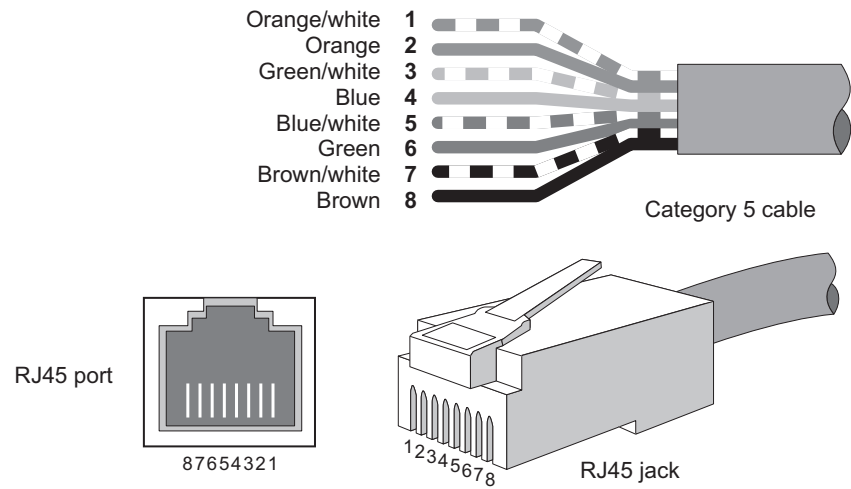
Table 3 RJ45 Pin Descriptions for Data Connection

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, 0, 12, 24, 48 Vdc (+)
5	T	PoE+	Blue-White	Power output, 0, 12, 24, 48 Vdc (+)
6	R	RXD-	Green	RX Data 10/100BaseT
7	T	PoE-	Brown-White	Power output, 0, 12, 24, 48 Vdc (-)
8	R	PoE-	Brown	Power output, 0, 12, 24, 48 Vdc (-)

ⓘ **Note**
Only use shielded Cat5 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.

Battery Backup Operation

The Tropos 5210 MetroMesh router may contain an automatically recharging battery, which provides an integrated uninterruptible power supply (UPS). The available backup time depends upon the level of network traffic serviced by the router and the ambient temperature. Figure 29 shows the relationship between average throughput and battery uptime. The Tropos 5210 router will typically recharge the UPS in approximately 10 hours.

(i) **Note**
The internal battery is not field replaceable.

Figure 28 Average Battery Backup Time
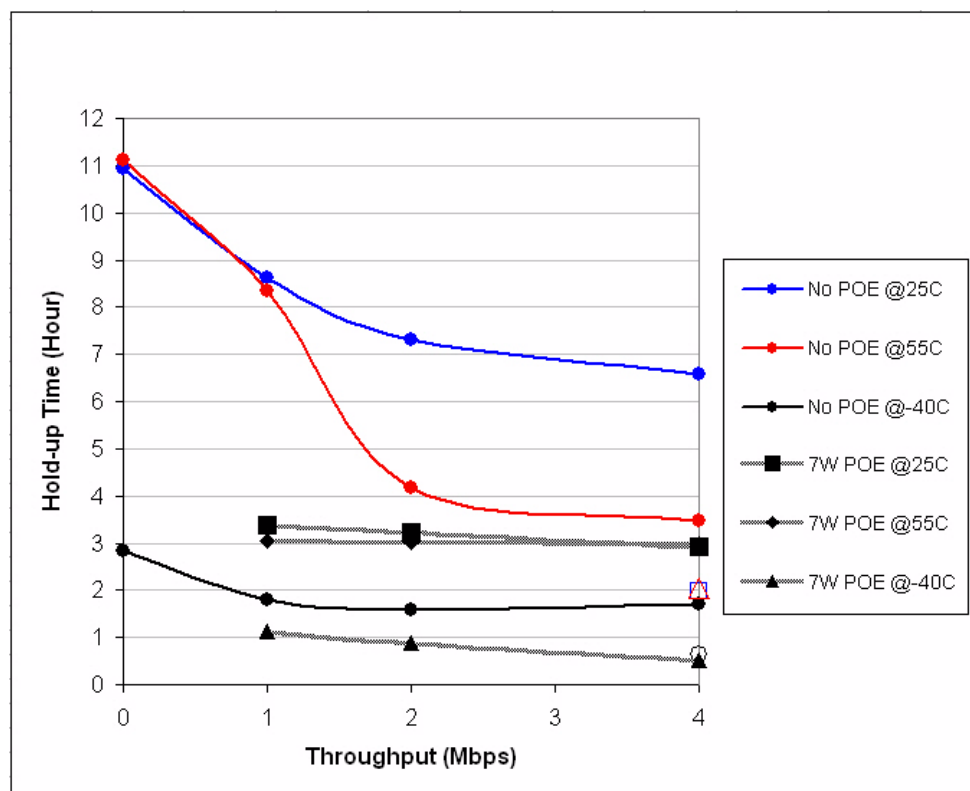
The battery is equipped with a small internal heater that enhances battery life in very cold operating conditions. When the ambient temperature of the unit approaches -12 degrees C, the internal heater is activated. An active internal battery heater consumes power; therefore, the average power consumption of the Tropos 5210 MetroMesh router increases slightly in extremely cold weather conditions. Figure 29 shows the battery discharge hold time as a function of ambient temperature.

Figure 29 Average Battery Backup Time vs. Temperature
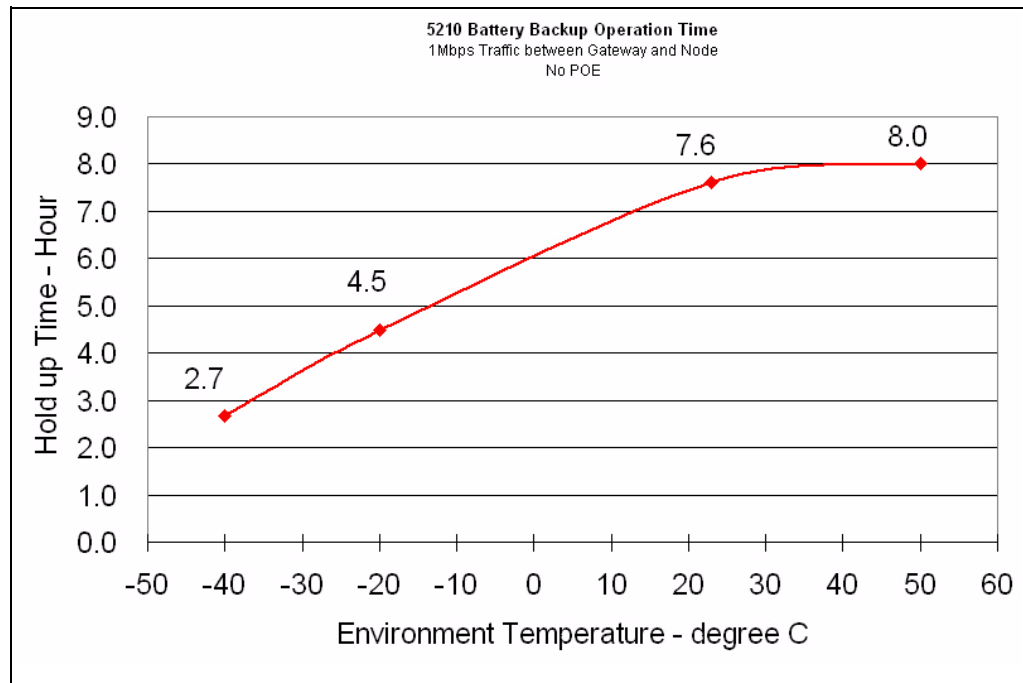
Safety Information for the Tropos MetroMesh Router

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 5210 products meet the uncontrolled environmental limits found in OET-65 and ANSI C95.1, 1991. Proper operation of this radio according to the instructions found in this manual and the hardware and software guides on the Tropos 5210 MetroMesh routers result in user exposure that is substantially below the FCC recommended limits.

Follow these guidelines to ensure safe operation of the Tropos 5210 MetroMesh routers:

- Do not touch or move the antenna(s) 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.
- Antenna use:
  - The Tropos 5210 MetroMesh routers must be used only with Tropos-approved components and antennas. See "Approved Antenna Configurations and Attenuation Settings" on page 57 for details.
  - In order to comply with FCC RF exposure limits, dipole antennas should be located at a minimum distance of 7.9 inches (20 cm) or more from the body of all persons.
  - High-gain, wall-mount or mast-mount antennas are designed to be professionally installed and should be located at a minimum distance of 12 inches (30 cm) or more from the body of all persons. Please contact your professional installer, VAR, or antenna manufacturer for proper installation requirements.
- Battery backup:
  - The Tropos 5210 MetroMesh router may contain a lithium-ion battery. To avoid the possibility of an explosion, the Tropos 5210 MetroMesh router should **not** be exposed to any temperatures higher than 85 degrees C.

Service Instructions

This section contains service information for the Tropos 5210 MetroMesh routers. The Tropos 5210 MetroMesh routers have no user serviceable parts inside. The information in this section is intended for trained service personnel only.

Clock Battery

The Tropos 5210 MetroMesh routers have a real-time clock which is powered by a small lithium rechargeable battery. If the real-time clock fails, return the unit to Tropos Networks for servicing.

⚠ **Caution**
There is a danger of explosion if the battery is incorrectly replaced. Replace the battery with only the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

⚠ **Caution**
There is a risk of explosion if the battery is replaced by an incorrect type.

⚠ **Caution**
Dispose of batteries according to the manufacturer's instructions.

2 Power Consumption

Several factors influence the power consumption at any given time, including the level of network traffic and whether a powered peripheral device is connected to the LAN or Management port of the Tropos 5210 MetroMesh Router. Temperature may also influence the power consumption for units configured with battery backup, due to the internal freeze protection capability associated with the internal battery module. Figure 30 shows the basic relationship between throughput and AC power consumption at normal temperatures.

Figure 30 AC Power Consumption vs. Throughput with PoE Output Disabled
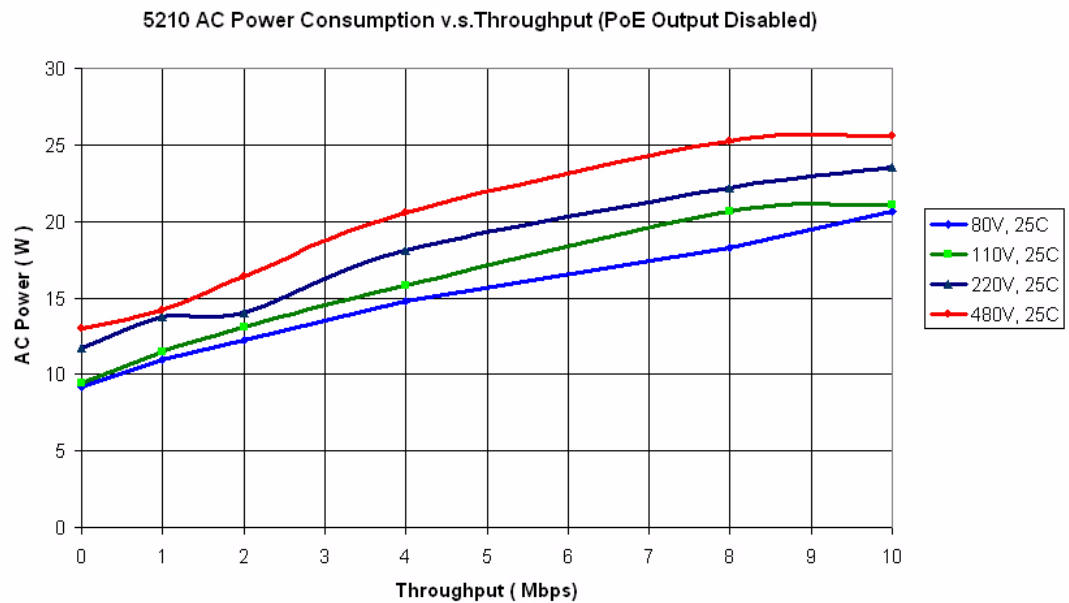
When a Tropos 5210 MetroMesh Router is equipped with a battery and the router is exposed to cold temperatures (below -12 degrees C), the internal heater associated with the battery is activated. This causes the router to draw additional AC power, as shown in Figure 31.

Figure 31 AC Power Consumption vs. Throughput (Battery Backup, -40º C)

5210 AC Power Consumption vs Throughput (Battery Backup Installed, Operation at -40C)
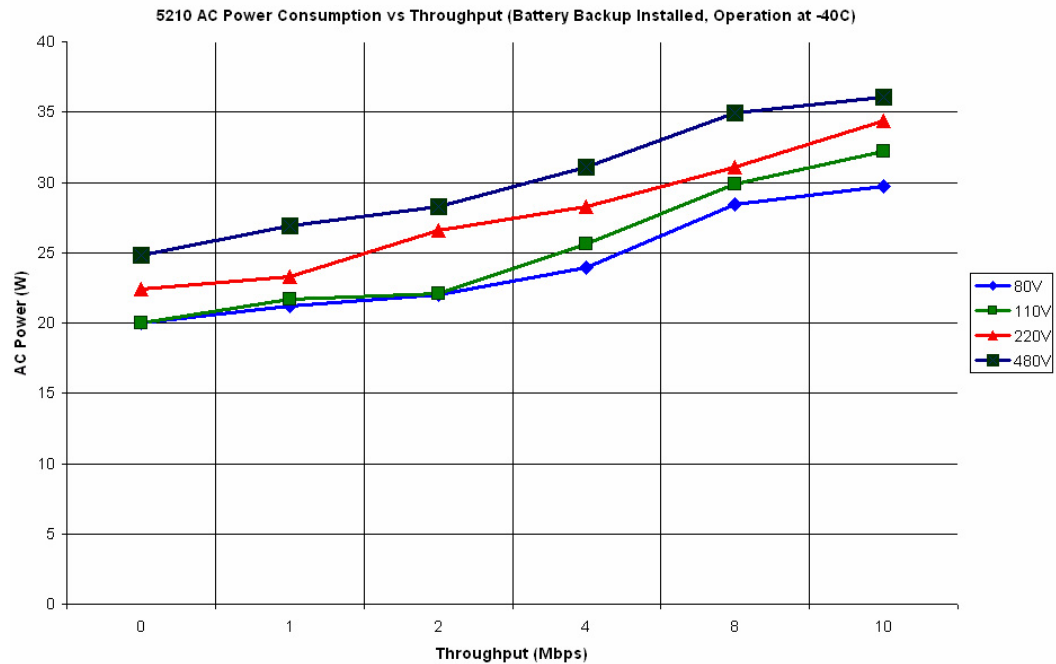
3 Product Specifications

The tables in this chapter contain specifications for the Tropos 5210 and 5210 HFC MetroMesh Routers:

(i) Note

Table 10 on page 56 and Table 11 on page 56 list specifications that apply only to the Tropos 5210 HFC router.

Table 4 Physical Specifications - Tropos 5210 Router

Physical Dimensions	Height	Width	Depth
Inches	5.3	13.2	7.9
Centimeters	13.5	33.5	20.1
Weight			
lbs - maximum	14	Includes all brackets and sun shields	
Kg - maximum	6.35		
Mounting Pole Diameter	1" to 10"		
Temperature	**Min**	**Max**	
AC Powered Operating Range	-40º C	55C	
Storage Range	-45º C	85C	
Weather			
Weather Rating	UL579/IEC 60529 IP67		
Wind Survivability	> 165 mph		
Wind Loading (165 mph)	< 294 newtons		

Table 4 Physical Specifications - Tropos 5210 Router (*continued*)

Projected Area	0.59 sq. ft. (85.4 sq. in.)
Corrosion Resistance	MIL-STD-810F 509.4 Salt Fog
Color	
Color	Gloss white
Shock and Vibration	
Operational:	ETSI 300-19-2-4 Specification T41.E, class 4M3
Transportation:	ISTA 2A Random Bounce Random Vibration 6 Corner Drop Test
Reliability	
Reliability (MTBF):	400,000 hours demonstrated Field failure rate 1%

Table 5 Interfaces

Data Interface	Maximum Distance (ft)	Connector
IEEE 802.3 10/100BaseT	600 (10BaseT Duplex Setting) 300 (100BaseT Duplex Setting)	RJ45
Management Interface	**Maximum Distance (ft)**	**Connector**
IEEE 802.3 10/100Base T	600 (10BaseT Duplex Setting) 300 (100BaseT Duplex Setting)	RJ45
Wireless Interface		
Standard	IEEE 802.11b/g Wi-Fi	
Frequency Range	2400 to 2485 MHz ISM Band	
Modulation	DSSS; DBPSK @ 1 Mbps, DQPSK @ 2 Mbps, CCK @ 5.5 and 11 Mbps OFDM @ 54, 48, 36, 24, 18, 12, 6	

Table 5 Interfaces (*continued*)

Rx Sensitivity	-100dBm (1 Mbps)
	-95dBm (2 Mbps)
	-93dBm (5.5 Mbps)
	-91dBm (11 Mbps)
	-94dBm (6 Mbps)
	-93dBm (9 Mbps)
	-92dBm (12 Mbps)
	-89dBm (18 Mbps)
	-86dBm (24 Mbps)
	-83dBm (36 Mbps)
	-78dBm (48 Mbps)
	-76dBm (54 Mbps)
Rx Saturation Maximum Power at Antenna Port	-5dBm (1 Mbps)
	-5dBm (2 Mbps)
	-5dBm (5.5 Mbps)
	-5dBm (11 Mbps)
	-5dBm (6 Mbps)
	-5dBm (9 Mbps)
	-5dBm (12 Mbps)
	-10dBm (18 Mbps)
	-30dBm (24 Mbps)
	-35dBm (36 Mbps)
	-35dBm (48 Mbps)
	-35dBm (54 Mbps)
Antennas	
Antennas	External
Antenna Diversity	Transmit/Receive
Impedance	50 ohms
VSWR	1.5 : 1
Connectors (two)	N (female)
Indicator - Status Lamp	Red/Green

Table 6 Power Options / Consumption

Single Phase VAC	100-480 VAC 50/60 Hz IEEE/ANSI C62.41 CAT C Power Source IEC Category IV Power Source	23W/60W	typical/max
Protection Circuits			
Antenna Protection	<= 0.5μJ for 3kA @ 8/20μS Waveform EN61000-4-2 Level 4 ESD Immunity EN61000-4-5 Level 4 Surge Immunity		
AC Input Protection	IEEE/ANSI C62.41 Category C 10kA @ 8/20uS Waveform; 36kA per phase L-L, L-N, L-PEWh EN61000-4-2 Level 4 ESD Immunity EN61000-4-5 Level 4 Surge Immunity EN61000-4-4 Level 4 EFT Immunity Integrated Branch Circuit Protection Class CC-Fuse: Littlefuse KLDR Time-Delay 20A		
Data Port Protection	EN61000-4-2 Level 4 ESD Immunity EN61000-4-5 Level 4 Surge Immunity		

Table 7 Standard Power Over Ethernet - Power Sourcing[a]

LAN and/or Management Port	+ on pins 4,5; - on pins 7,8		
DC Output Voltages	0 (Off), 12, 24, 48 Vdc		
Output Power	Total power on LAN and/or Management ports	**Voltage**	**Max Power Output**
		12Vdc	14W
		24Vdc	12W
		48Vdc	10W
Over-Current Protection	1.6A Resettable fuse		
Over-Voltage Protection	90Vdc surge		
Output Isolation	2000Vdc		

a.Models 52103000, 52102100, 52102200, 52103100, 52102505, 52102605, 52102501, and 52102601.

Table 8 Enhanced Power Over Ethernet - Power Sourcing[a]

LAN and/or Management Port	+ on pins 4,5; - on pins 7,8		
DC Output Voltages	0 (Off), 12, 24, 48 Vdc		
Output Power	Total power on LAN and/or Management ports	**Voltage**	**Max Power Output**
		12Vdc	30W
		24Vdc	30W
		48Vdc	30W
Over-Current Protection			
Over-Voltage Protection	90Vdc surge		
Output Isolation	2000Vdc		

a.Models 52102130, 52102230, 52103030, 52103130, 52102531, 52102631, 52102535, and 52102635.

Table 9 Certifications, Other

U.S.	CFR 47 FCC Part 15.C; Class B UL579/IEC 60529 IP67 Rated for Outdoor Use ISTA 2A
Europe	EN60950 cTUVus Listed I.T.E. IEEE/ANSI C62.41 Category C AC Surge Immunity EN61000-4-5 Level 4 AC Surge Immunity EN61000-4-2 Level 4 ESD Immunity EN61000-4-4 Level 4 EFT Burst Immunity EN61000-4-3 EMC Field Immunity ETSI EN 301 489-17 ETSI EN 300 328 EN 60950-1, IEC 60950-1 CISPR 22 Class B CE ①
Canada	Industry Canada RSS210
Australia	ACMA
China	SRMC
Japan	MPHPT VCCI Class B
Korea	MIC
Taiwan	DGT

Tropos 5210 HFC Router Specifications - Model 52104000

Table 10 Physical Specifications - Tropos 5210 HFC Router

Physical Dimensions	Height	Width	Depth
Inches	13.0	13.2	17.0
Centimeters	33.0	33.5	43.2
Weight			
lbs - maximum	14.3	Includes all bracketry, antennas, and sun shield, but not external wiring	
Kg - maximum	6.36		

Table 11 Power Options / Consumption - Tropos 5210 HFC Router

Hybrid Fiber Coax Power (Ferro-Resonant Power Supply)	40-90 VAC Quasi-Square Wave IEEE/ANSI C62.41 CAT B3 Circuit Protection
Input Power Connector	F Coax Connector
Protection Circuits	
Electrical Protection	IEEE/ANSI C62.41 Category B3 6KV/3KA 8/20μS Waveform EN61000-4-2 Level 4 ESD Immunity EN61000-4-5 Level 4 AC Surge Immunity EN61000-4-4 Level 4 EFT Burst Immunity EN61000-4-3 EMC Field Immunity

Table 12 Certifications - Tropos 5210 HFC Router

U.S.	CFR 47 FCC Part 15; Class B CFR 47 FCC Part 76 UL60065
Canada	Industry Canada RSS 210 CSA 22.2 No. 60065
Europe	EN60065 IEC 60065

4 Approved Antenna Configurations and Attenuation Settings

This chapter lists approved antenna configurations and ordering information and attenuation settings:

High Power Product Antennas

U.S., Canada, Australia, Brazil, Argentina, Taiwan

- Antenna configurations: Table 13
- Antenna ordering numbers: Table 14
- Antenna gain and attenuation settings: Table 15

Table 13 Antenna Configurations

Model Number	Product Description	Peak Conducted Tx Output Power	Certified Antenna Configurations EIRP with 7.4dBi Omni: AN074088
52102100 (14W PoE)	Tropos 5210 (-40 to 55 deg C) N connectors, bracketry	28dBm	35.4dBm EIRP
52102130 (30W PoE)	Tropos 5210 (-40 to 55 deg C) N connectors, bracketry	28dBm	35.4dBm EIRP
52102200 (14W PoE)	Tropos 5210 (-40 to 55 deg C) Battery backup, N connectors	28dBm	35.4dBm EIRP
52102230 (30W PoE)	Tropos 5210 (-40 to 55 deg C) Battery backup, N connectors	28dBm	35.4dBm EIRP

Table 14 Antenna Ordering Numbers

Part Number	Description
AN074077	One outdoor 7.4dBi omni unit-mounted antenna; N connector
AN074088	One outdoor 7.4dBi omni mast-mounted antenna; N connector; bracketry
AN120022	One outdoor 12.0dBi 90° sector; N connector with pole-mount bracketry; Sealing Materials (RF cable not included)
AN100022	One outdoor 9.9dBi omni mast-mounted antenna; N connector; Mounting Bracket; Sealing Materials

Attenuation with External Antennas

If external antennas are used, it is necessary to adjust the transmit power attenuation to provide the correct power level for the router. Use the following formula to compute the required attenuation level:

```
Attenuation setting = Antenna gain (dBi) - 7.4 dBi - Cable loss
```

The attenuation setting cannot be negative; therefore, a positive attenuation setting is only required if the antenna gain is greater than 7.4dBi. Table 15 shows the proper attenuation settings, assuming that low-loss cable is used (1dBi). The attenuation should be rounded to the nearest half-integer value.

Table 15 Gain and Attenuation

Model Number	Antenna Gain	Tx Attenuation Setting (dB):	Peak Conducted Power	EIRP
AN074077	7.4dBi, omni	0	28dBm	35.4dBm
AN074088	7.4dBi, omni	0	28dBm	35.4dBm
AN100022	9.9dBi, omni	2	26dBm	35.9dBm
AN120022	12.0dBi, directional	4	24dBm	36.0dBm

Republic of Korea

- Antenna configurations: Table 16
- Antenna ordering numbers: Table 17
- Antenna gain and attenuation settings: Table 18

Table 16 Antenna Configurations

Model Number	Product Description	Average Conducted Tx Output Power
52102100 (14W PoE)	Tropos 5210 (-10 to 50 deg C) N connectors, bracketry	10mW/MHz
52102130 (30W PoE)	Tropos 5210 (-10 to 50 deg C) N connectors, bracketry	10mW/MHz
52102200 (14W PoE)	Tropos 5210 (-10 to 50 deg C) Battery backup, N connectors	10mW/MHz
52102230 (30W PoE)	Tropos 5210 (-10 to 50 deg C) Battery backup, N connectors	10mW/MHz

Table 17 Antenna Ordering Numbers

Part Number	Description
AN060077	One outdoor 6.0dBi omni unit-mounted antenna; N connector

Attenuation Settings

It is necessary to adjust the transmit power attenuation to provide the correct power level for the router. Table 18 lists the proper attenuation settings.

Table 18 Gain and Attenuation

Model Number	Antenna Gain	Tx Attenuation Setting (dB):	Average Conducted Power	Mode
AN060077	6.0dBi, omni	3	10mW/MHz	b mode
AN060077	6.0dBi, omni	8	10mW/MHz	g mode

Standard Power Product Antenna Configurations, Ordering Information

Europe

The approved European countries are Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom.

- Antenna configurations: Table 19
- Antenna ordering numbers: Table 20
- Antenna gain and attenuation settings: Table 21

Table 19 Antenna Configurations

Model Number	Product Description	Average Conducted Tx Output Power	Certified Antenna Configurations	
			EIRP with Unit-Mounted 7.4dBi Omni: AN074077	EIRP with Mast-Mounted Cable Attached Sector 12dBi: AN120022
52102701 (14W PoE)	Tropos 5210 (-40 to 55 deg C) N-connectors, bracketry; for use with directional antennas	6.0dBm	18.4dBm	18.0dBm
52102731 (30W PoE)	Tropos 5210 (-40 to 55 deg C) N-connectors, bracketry; for use with directional antennas	6.0dBm	18.4dBm	18.0dBm
5212801 (14W PoE)	Tropos 5210 (-40 to 55 deg C) Battery backup N-connectors, bracketry; for use with directional antennas	6.0dBm	18.4dBm	18.0dBm
5212831 (30W PoE)	Tropos 5210 (-40 to 55 deg C) Battery backup N-connectors, bracketry; for use with directional antennas	6.0dBm	18.4dBm	18.0dBm

Table 20 Antenna Ordering Numbers

Part Number	Description
AN074077	One outdoor 7.4dBi omni unit-mounted antenna; N-connector

Table 20 Antenna Ordering Numbers (*continued*)

Part Number	Description
AN074088	One outdoor 7.4dBi omni mast-mounted antenna; N-connector; bracketry
AN120022	One outdoor 12.0dBi 90° sector antenna; N-connector with pole-mount bracketry; Sealing Materials (RF cable not included)

Attenuation with External Antennas

If external antennas are used, it is necessary to adjust the transmit power attenuation to provide the correct power level for the router. Use the following formula to compute the required attenuation level:

```
Antenna gain (dBi) - 7.4 dBi - Cable loss = Attenuation setting
```

The attenuation setting cannot be negative; therefore, a positive attenuation setting is only required if the antenna gain is greater than 7.4dBi. Table 21 shows the proper attenuation settings, assuming that low-loss cable is used (1dBi). The attenuation should be rounded to the nearest half-integer value.

Table 21 Gain and Attenuation

Model Number	Antenna Gain	Tx Attenuation Setting (dB):	Peak Conducted Power	EIRP
AN074077	7.4dBi, omni	11	11dBm	18.4dBm
AN074088	7.4dBi, omni	11	11dBm	18.4dBm
AN120022	12.0dBi, directional	16	6dBm	18.0dBm

Japan

- Antenna configurations: Table 22
- Antenna ordering numbers: Table 23

Table 22 Antenna Configurations

Model Number	Product Description	Average Conducted Tx Output Power	Certified Antenna Configurations	
			EIRP with Unit-Mounted 7.4dBi Omni (8.2dBi peak): AN074077	EIRP with Mast-Mounted Cable Attached Sector 12dBi (13.5dBi peak, 1dB cable loss): AN120022
52102701 (14W PoE)	Tropos 5210 (-40 to 55 deg C) N-connectors, bracketry; for use with directional antennas	16dBm	12dBm/MHz	18.3dBm/MHz
52102731 (30W PoE)	Tropos 5210 (-40 to 55 deg C) N-connectors, bracketry; for use with directional antennas	16dBm	12dBm/MHz	18.3dBm/MHz
5212801 (14W PoE)	Tropos 5210 (-40 to 55 deg C) Battery backup N-connectors, bracketry; for use with directional antennas	16dBm	12dBm/MHz	18.3dBm/MHz
5212831 (30W PoE)	Tropos 5210 (-40 to 55 deg C) Battery backup N-connectors, bracketry; for use with directional antennas	16dBm	12dBm/MHz	18.3dBm/MHz

Table 23 Antenna Ordering Numbers

Model Number	Description
AN074077	One outdoor 7.4dBi omni unit-mounted antenna; N connector
AN074088	One outdoor 7.4dBi omni mast-mounted antenna; N connector; bracketry
AN120022	One outdoor 12.0dBi 90° sector antenna; N connector with pole-mount bracketry; Sealing Materials (RF cable not included)

People's Republic of China

- Antenna configurations: Table 24
- Antenna gain and attenuation settings: Table 25

Table 24 Antenna Configurations

Model Number	Product Description	Average Conducted Tx Output Power
52102505	Tropos 5210 (-10 to 50 deg C) 7.4 dBi omni unit attached antennas	18.5dBm
52102506	Tropos 5210 (-10 to 50 deg C) 7.4 dBi omni unit attached antennas; Battery backup	18.5dBm

Note

Antennas in the People's Republic of China are required to be unit-attached. The assembly model numbers listed in Table 24 include the antennas; there is no separate antenna ordering list.

Attenuation Settings

It is necessary to adjust the transmit power attenuation to provide the correct power level for the router. Table 25 lists the proper attenuation settings.
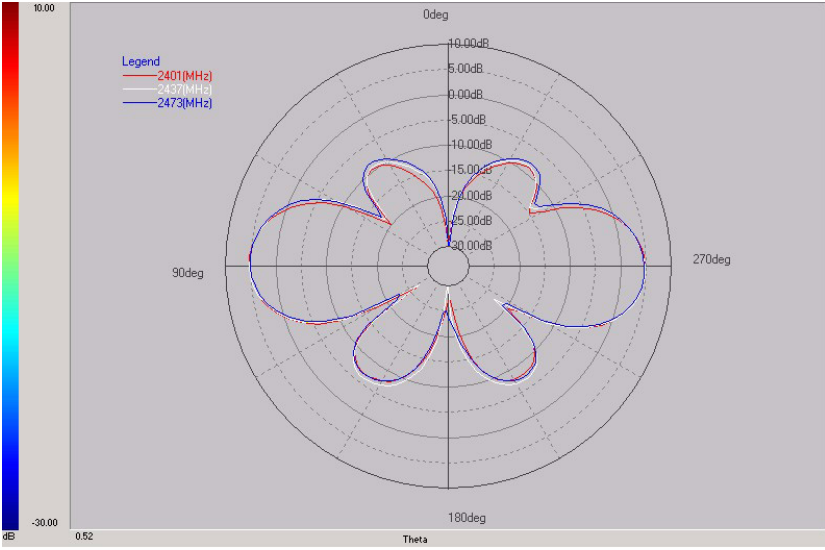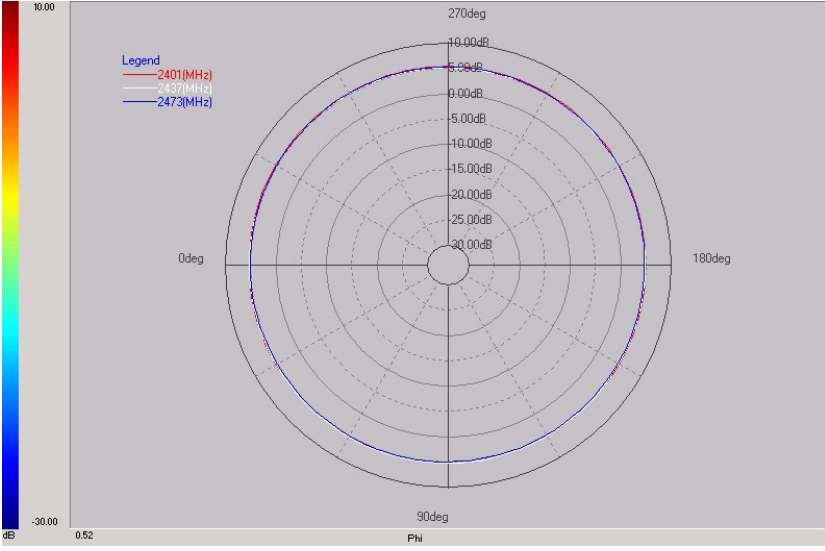
Table 25 Gain and Attenuation

Antenna Gain	Tx Attenuation Setting (dB):	Average Conducted Power	Mode
7.4dBi, omni	4	18.5dBm	b mode
7.4dBi, omni	4	18.5dBm	g mode

5 Antenna Specifications and Patterns

Table 26 provides antenna specifications and patterns for the Tropos-supplied antennas.

Table 26 Antenna Specifications and Patterns

Part Number	Specifications	Pattern
AN060077	One outdoor 6.0dBi omni unit-mounted antenna; N connector • Length: 11.9 in (30.3 cm) • Weight: 4.4 oz (.125 kg) • Color: White • Measured peak gain: 5.3dBi • Connector type: N male	**Elevation** **Azimuth**

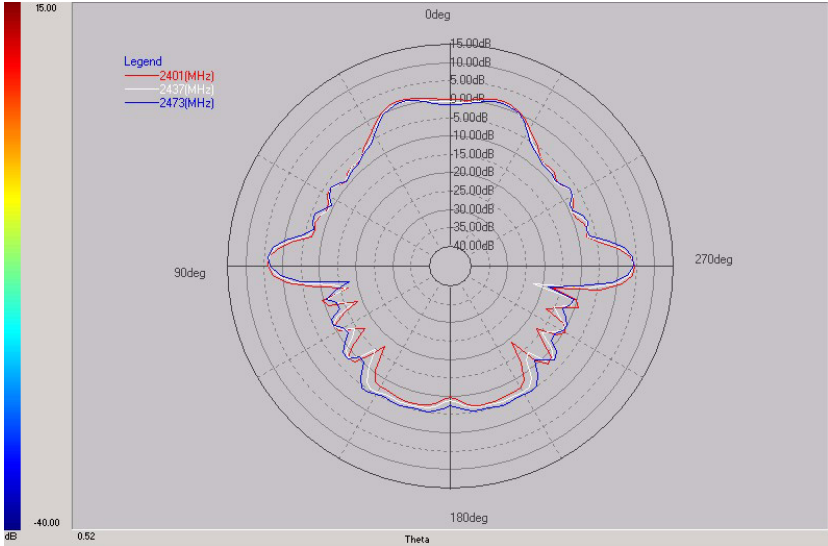**Table 26 Antenna Specifications and Patterns (*continued*)**

Part Number	Specifications	Pattern
AN074077	One outdoor 7.4dBi omni unit-mounted antenna; N connector • Length: 19 in (48.3 cm) • Weight: 4.7 oz (.133 kg) • Color: White • Measured peak gain: 7.1dBi • Connector type: N male	**Elevation**
AN074088	One outdoor 7.4dBi omni mast-mounted antenna; N connector; bracketry • Length: 19 in (48.3 cm) • Weight: 4.7 oz (.133 kg) • Color: White • Measured peak gain: 7.1dBi • Connector type: N male	**Azimuth**

Table 26 Antenna Specifications and Patterns (*continued*)
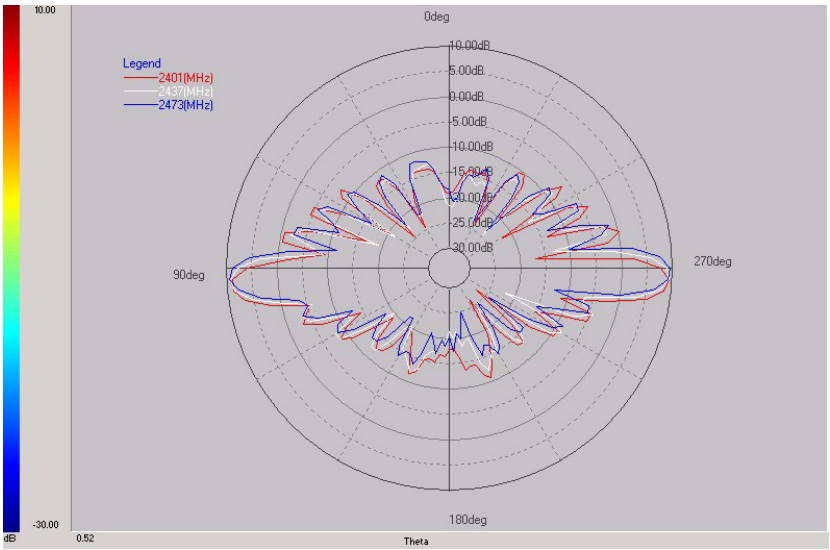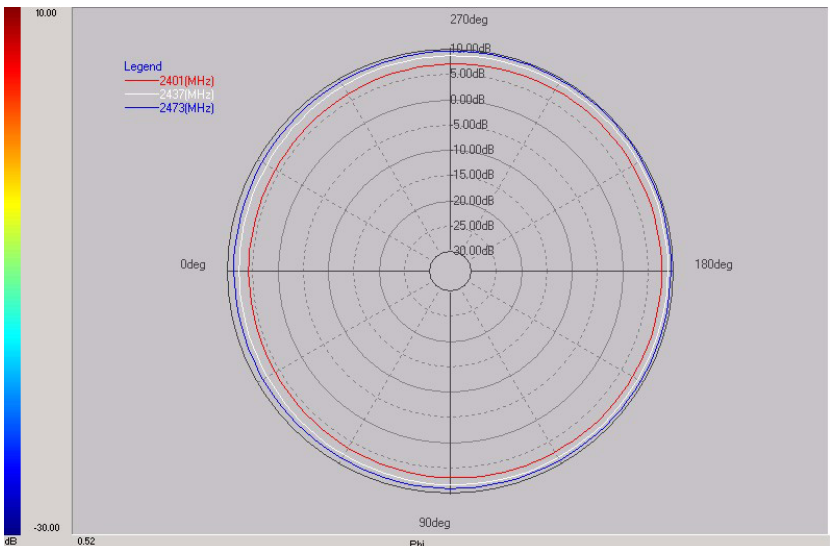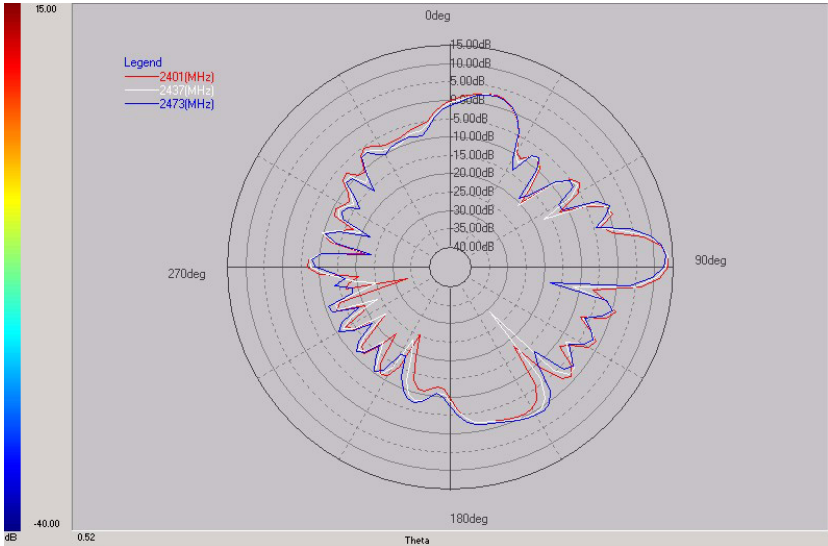
Part Number	Specifications	Pattern
AN100022	One outdoor 9.9dBi omni mast-mounted antenna; N connector; bracketry • Length: 45 in (114.3 cm) • Weight: 20 oz (.57 kg) • Color: White • Measure peak gain: 9.9dBi • Connector type: N female	**Elevation** **Azimuth**

Table 26 Antenna Specifications and Patterns (*continued*)

Part Number	Specifications	Pattern
AN120022	One outdoor 12.0dBi 90° sector antenna; N connector; bracketry • Length: 34 in (86.4 cm) • Width: 3 in (7.6 cm) • Depth: 1.2 in (3.0cm) • Weight: 25.6 oz (.73 kg) • Color: Gray • Measured peak gain: 13.0dBi • Connector type: N female	**Elevation (Phi=0°)** **Elevation (Phi=90°)**

Table 26 Antenna Specifications and Patterns (*continued*)

Part Number	Specifications	Pattern
AN120022 (continued)	Outdoor 12.0dBi 90° sector antenna (continued)	**Azimuth**

6 Installation Accessories

This chapter contains accessory ordering information:

-
-

Table 27 Installation Accessories

Description	Manufacturer	Part Number	Distributor	Contact Information	Order Number
Outdoor CAT5 4-Pair Data Cable	Belden	7929A	Anixter	www.anixter.com	
	Belden	7921A (recommended)	Anixter	www.anixter.com	
	Superior Essex	BBDG	Anixter	www.anixter.com	
Cable, CAT5, 8 Conductor, Harsh Environment	Madison Cable	08KFK00013	Tyco	www.xgsgroup.com	
Self-Fusing EPR Tape	3M	Scotch 23 Rubber Splicing Tape	McMaster Carr	www.mcmaster.com	7682A65
			Alameda Electric Distributors	www.alamedaelectric.com	
ThreadLocker LocTite 242 0.5 ml (0.017oz)	LocTite	242	McMaster Carr	www.mcmaster.com	91458A24
3 pin AC Male Plug (cord end) - 115 VAC 15A	Leviton	14W47-B	Alameda Electric Distributors	www.alamedaelectric.com	
3 pin AC Female Receptacle 115 VAC 15A	Leviton	15W47	Alameda Electric Distributors	www.alamedaelectric.com	
3 pin AC Plug Female (cord end) - Tropos 5210 router	Remke	50982	DSC Technical Sales	www.dsctechnicalsales.com	
Data Protection Device	Polyphase	IX-2H1DC48/W	Electro-Comm	www.electro-comm.com	
	Hyperlink	HGLN-CAT5-1		www.hyperlinktech.com	

Table 27 Installation Accessories

Description	Manufacturer	Part Number	Distributor	Contact Information	Order Number
Yellow 3-Pin Mini-Link AC Plug Female Pig Tail Unterminated 12 ft.	McMaster-Carr	321K16		www.mcmastercarr.com	
Anti-seize lubricant	Loctite	37230	McMaster Carr	www.mcmaster.com	
Universal remote control	Universal Remote	MX-500		www.universalremote.com	

Table 28 Tropos Antennas, Cables, and Related Ordering Numbers

Part Number	Description
AN060077	One outdoor 6.0dBi omni unit-mounted antenna; N connector
AN074077	One outdoor 7.4dBi omni unit-mounted antenna; N connector
AN074088	One outdoor 7.4dBi omni mast-mounted antenna; N connector; bracketry
AN100022	One outdoor 9.9dBi omni mast-mounted antenna; N connector; Mounting Bracket; Sealing Materials
AN120022	One outdoor 12.0dBi 90° sector antenna; N connector with pole-mount bracketry; Sealing Materials (RF cable not included)
RC003400	3' N (male) to N (male) cable - LMR 400 DB
RC006400	6' N (male) to N (male) cable - LMR 400 DB
RC005000	50 ohm terminator - N (male); Sealing Materials
RC008000	Sealing Kit - Loctite242, EPR Rubber Splicing Tape
RC008100	N connector cover/cap, outdoor, water tight
RC009000	N adapter for 7.4dBi Mast-mounted antenna to N (male) cable
SA006801	Indoor Cat 5 data cable surge protector
SA006802	Indoor Cat5 data cable surge protector for unshielded cable
PT021004	5210 input power cable - photo-electric cell adaptor; 2-wire; 4 ft.
PT021020	5210 input power cable - photo-electric cell adaptor; 2-wire; 20 ft.
PT021006	5210 input power cable - watertight plug; 3-wire; 6 ft.
PT021030	5210 input power cable - watertight plug; 3-wire; 30 ft.

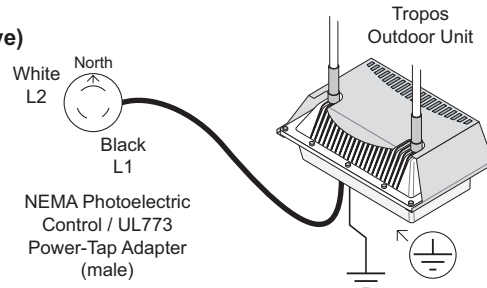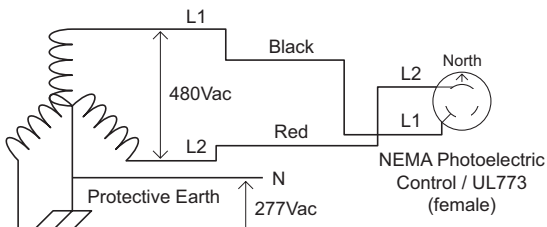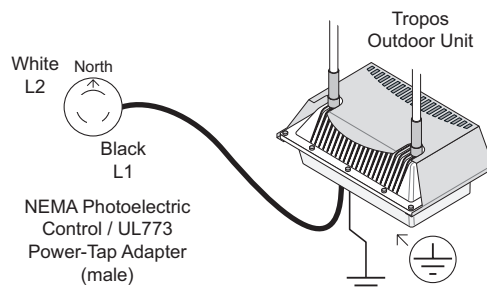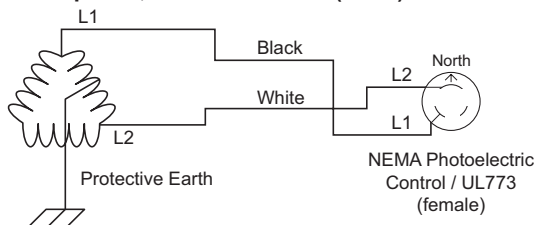**Table 28 Tropos Antennas, Cables, and Related Ordering Numbers**

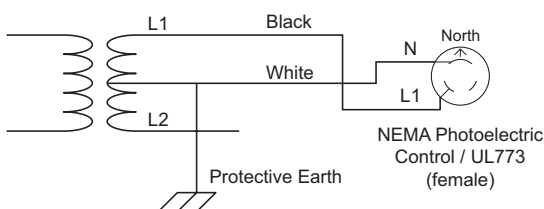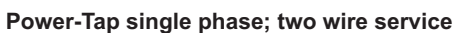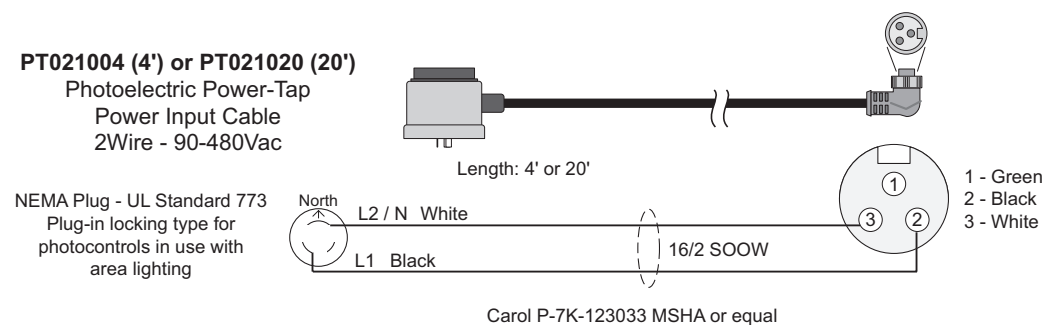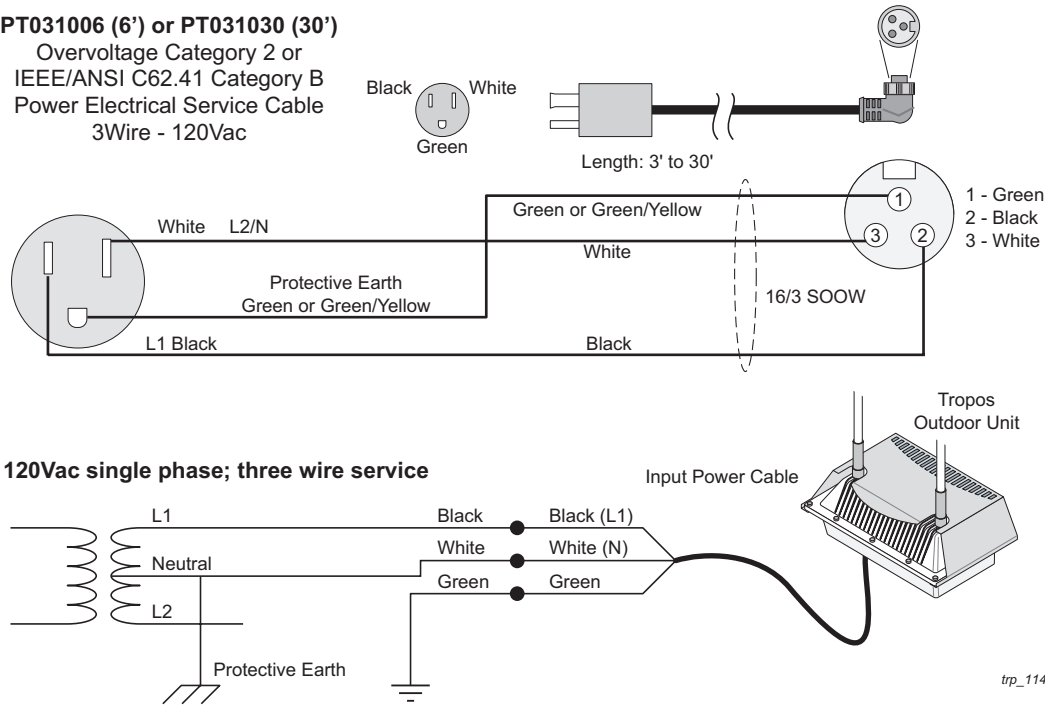| Part Number	Description
EC003500	5210 weathertight gateway connector kit
EC003600	5210 weathertight field-installable cable gland
EC003704	5210 weathertight RJ45 data cable, crossover, 4 ft (requires EC003500 gateway connector kit)
EC003708	5210 weathertight RJ45 data cable, crossover, 8 ft (requires EC003500 gateway connector kit)
MB0044300	5210 unit-attached mounting pole for Canopy SM; bracket and cable
MB005210	Pole mounting kit, 5210 HFC

7 AC Wiring Diagrams

This chapter contains wiring diagrams for AC power:

- "AC Wiring — Photoelectric Power Tap" on page 75
- "AC Wiring Power Cable 120VAC, 15A Plug" on page 76

Figure 32 AC Wiring — Photoelectric Power Tap

PT021004 (4') or PT021020 (20')
Photoelectric Power-Tap
Power Input Cable
2Wire - 90-480Vac

NEMA Plug - UL Standard 773
Plug-in locking type for
photocontrols in use with
area lighting

Length: 4' or 20'

1 - Green
2 - Black
3 - White

North
L2 / N   White
L1   Black
16/2 SOOW

Carol P-7K-123033 MSHA or equal

Power-Tap single phase; two wire service

L1   Black
White
N   North
L1
L2
Protective Earth
NEMA Photoelectric
Control / UL773
(female)

White
N   North
Black
L1
NEMA Photoelectric
Control / UL773
Power-Tap Adapter
(male)

Tropos
Outdoor Unit

Power-Tap single phase; two wire service

L1   Black
L2   North
L1
L2   Red
Protective Earth
NEMA Photoelectric
Control / UL773
(female)

White
L2   North
Black
L1
NEMA Photoelectric
Control / UL773
Power-Tap Adapter
(male)

Tropos
Outdoor Unit

Three phase; two wire service (Delta)

L1
Black
L2   North
White
L1
L2
Protective Earth
NEMA Photoelectric
Control / UL773
(female)

White
L2   North
Black
L1
NEMA Photoelectric
Control / UL773
Power-Tap Adapter
(male)

Tropos
Outdoor Unit

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

L1
Black
L2   North
480Vac
L1
L2   Red
Protective Earth
N
277Vac
NEMA Photoelectric
Control / UL773
(female)

White
L2   North
Black
L1
NEMA Photoelectric
Control / UL773
Power-Tap Adapter
(male)

Tropos
Outdoor Unit

Figure 33 AC Wiring Power Cable 120VAC, 15A Plug

PT031006 (6') or PT031030 (30')
Overvoltage Category 2 or
IEEE/ANSI C62.41 Category B
Power Electrical Service Cable
3Wire - 120Vac

Black   White

Green

Length: 3' to 30'

1
3   2

1 - Green
2 - Black
3 - White

White   L2/N

Green or Green/Yellow

White

Protective Earth
Green or Green/Yellow

16/3 SOOW

L1 Black

Black

Tropos
Outdoor Unit

120Vac single phase; three wire service

Input Power Cable

L1

Black   Black (L1)

Neutral

White   White (N)

L2

Green   Green

Protective Earth

trp_114

8   Wind Loading Considerations

The American Association of State Highway and Transportation Officials (AASHTO) standards manual, "Standard Specifications for Structural Supports for Signs, Luminaires and Traffic Signals," governs most structural support issues related to traffic lighting and controls. Many state and city public works departments site the AASHTO standard as the guide for their requirements. Local municipalities in coastal states, which experience frequent hurricanes, etc., may have exceptions to the AASHTO standard that require higher design limits for wind velocity or dead load.

Numerous pole and mast arm assemblies are used for traffic controls and traffic lighting. Each assembly and installation is unique and worthy of an evaluation of the static and dynamic load bearing capabilities; however, in most cases, the assembly will include a pole with a single 6', 9' or 12' mast arm holding a single luminaire. Many of these mast arms are typically designed to hold hundreds of pounds of static load and to carry several square meters of sail area in 80mph winds. The typical mast arm is capable of supporting a single traffic control (typically weighing around 160 lbs) and a single traffic sign (typically presenting a few square meters of sail area). A single luminaire typically weighs about 60 lbs and presents about 3 square feet of sail area.

> (i) **Note**
> Each assembly and installation is unique and worthy of an evaluation of the static and dynamic load bearing capabilities. It is your responsibility to evaluate the load bearing capabilities of the structure.

The Tropos 5210 MetroMesh Router weighs approximately 14 lbs, including all mounting hardware. The Tropos 5210 MetroMesh Router may be mounted to either the pole portion of the streetlight or to the mast arm portion.

When the Tropos 5210 MetroMesh Router is mounted to the pole or mast arm, most of the unit is hidden by the pole or mast arm and therefore presents minimal additional sail area to the structure. When the Tropos 5210 MetroMesh Router is mounted to the pole portion of the structure, the sail area of the router is approximately 1 square foot. Pole manufacturers have advised Tropos Networks that small communications devices such as the Tropos 5210 MetroMesh Router do not present any significant static or dynamic load to these structures.

9 Canopy Installation Instructions

The 5210 Canopy Subscriber Module and Bracket kit allows you to attach a third-party radio, the Motorola Canopy Subscriber Module, to the Tropos 5210 MetroMesh Router.
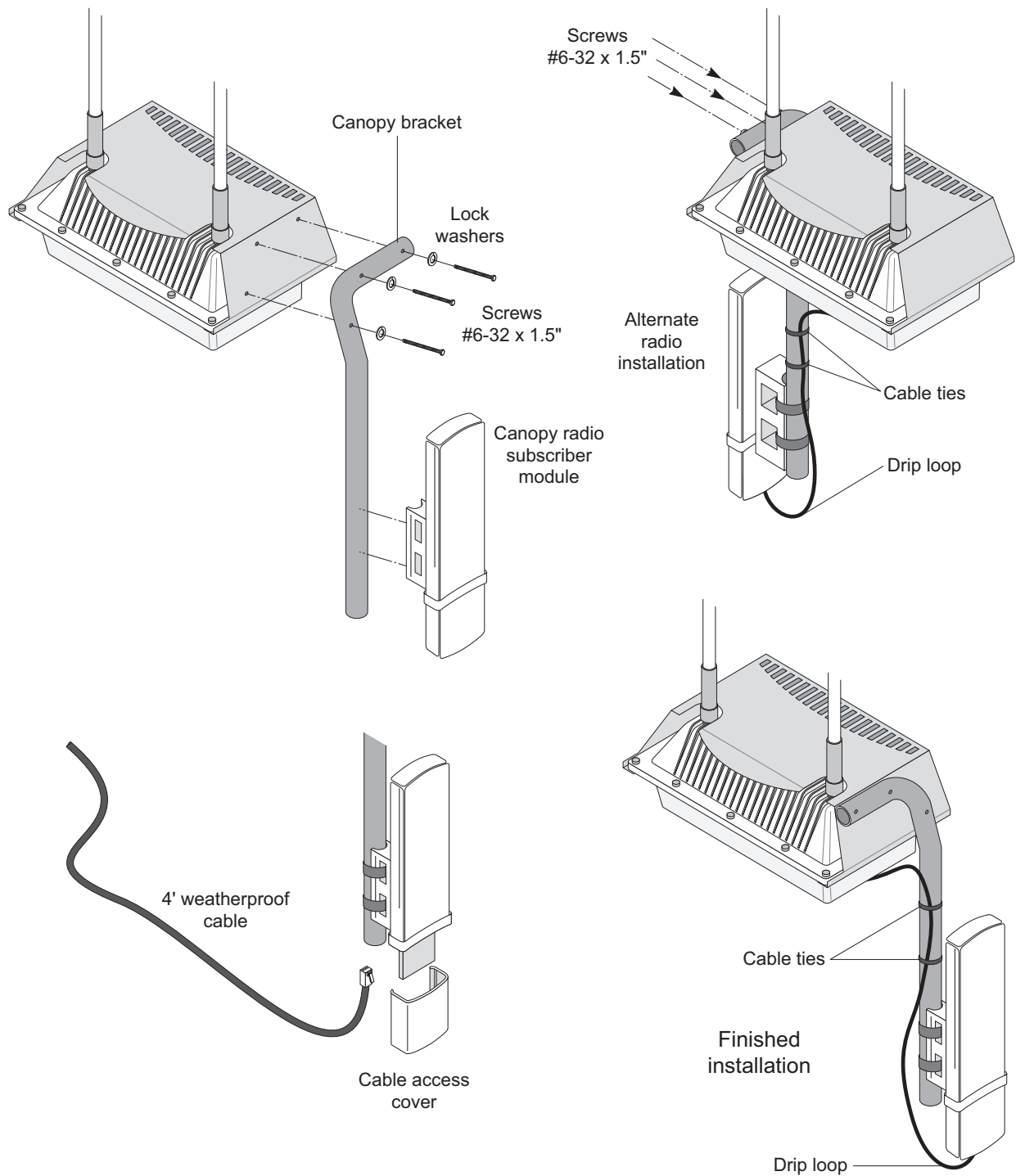
The kit includes the following items:

- Outdoor CAT5 weatherproof cable
- Bracket (metal pole)
- Screws #6-32 x 1.5"
- Lockwashers
- Cable ties

Follow these steps to install the canopy (refer to Figure 34):

1. Align the bracket and attach it using the three screws included in the kit.

2. Attach your radio subscriber module to the end of the bracket. Direct the Canopy Subscriber Module toward the canopy base station.

3. Remove the cable access cover on the Canopy Subscriber Module so that you can attach the RJ45 end of the data cable to the module. (The cover slides off.) Put the cable access cover back in place.

Figure 34 Canopy Assembly

Canopy bracket

Lock washers

Screws #6-32 x 1.5"

Canopy radio subscriber module

Screws #6-32 x 1.5"

Alternate radio installation

Cable ties

Drip loop

4' weatherproof cable

Cable access cover

Cable ties

Finished installation

Drip loop

trp_121

4. Unscrew the 6 screws around the Tropos 5210 access cover (Figure 35). Replace the access cover of the 5210 unit with the access cover provided with the Canopy Subscriber Module cable.

5. Connect cable to the LAN port inside the 5210 unit.

Figure 35 Cable Connections
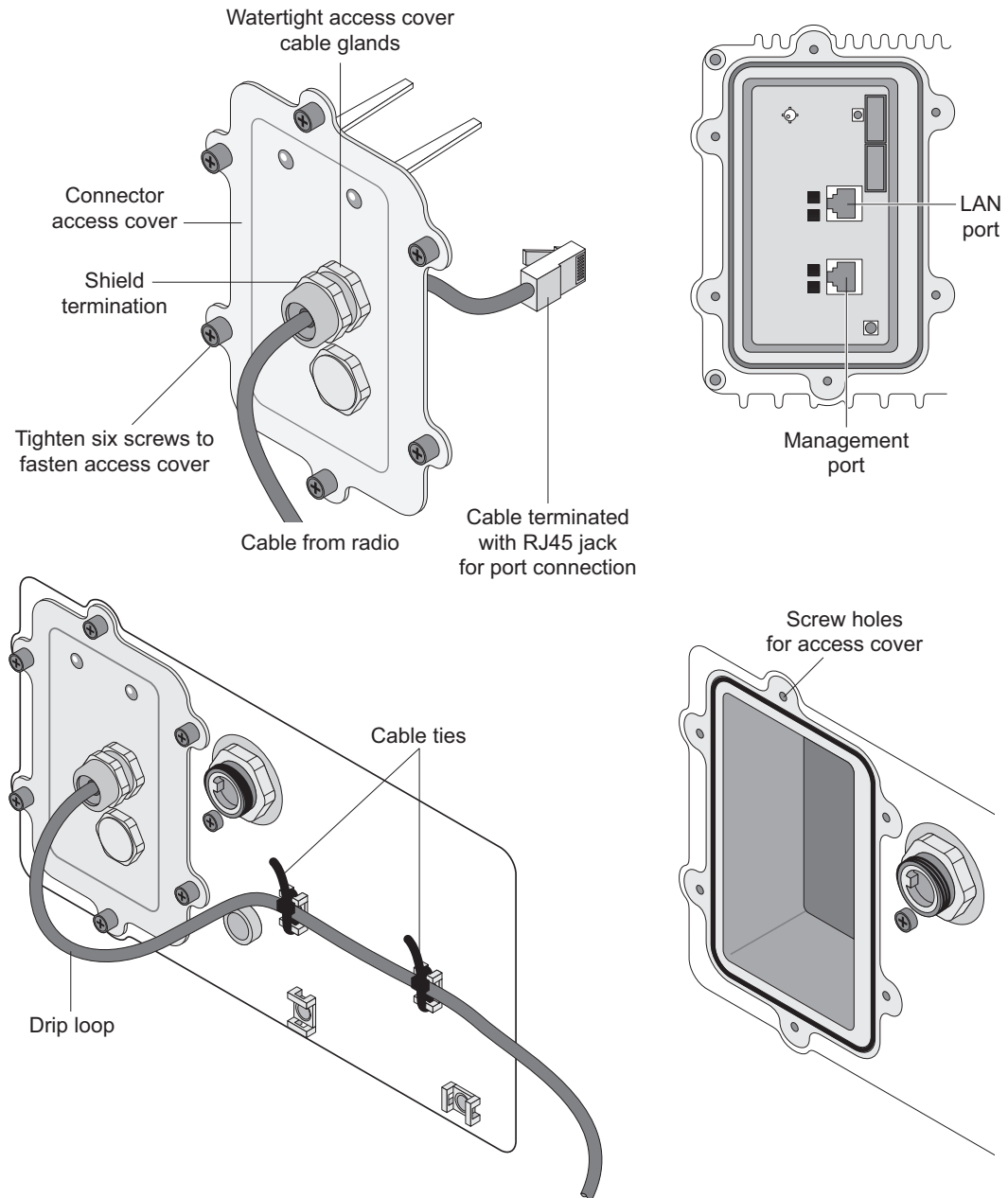
trp_122a

6. Attach the access cover by tightening the 6 screws. Check that the cable gland is securely tightened.

7. Secure the weatherproof cable to the canopy bracket with two cable ties (Figure 34). Use two additional cable ties to anchor the cable to the bottom of the 5210 unit (Figure 35). Refer to Table 29 for canopy cable wiring information.

Table 29 Canopy Cable Wiring

Canopy SM (RJ45)	Color	Tropos 5210 MetroMesh Router	Signal
3	Orange	1	TXD+
6	Orange-White	2	TXD-
1	Blue	3	RXD+
7	Green	4	24Vdc+
8	Green-White	5	24Vdc-
2	Blue-White	6	RXD-
4	Brown	7	24Vdc_RTN
5	Brown-White	8	24Vdc_RTN
Shield	Drain wire	Shield	Shield

10 Cable Termination Instructions

Follow these steps to prepare and terminate cables connected to the 5210 unit:

1. Strip off the outer sheath of cable to expose 6 inches of the inner cable or twisted pairs. The shield may be armored, braided or foil type depending upon cable type (see Table 36).

2. For armored or braided cable, remove all but 1/2 inch of the armor or braid.

   - Remove waxy residues on the shields of "flooded" type cables.
   - For foil shielded cable, remove all but 1/2 inch of the foil, and fold the foil part back onto the outer sheath. Most foil shields are conductive on the inner side, as the outer side typically has a plastic coating.
   - The exposed conductive surfaces will ground to the conductive contacts inside the cable gland.

Figure 36 Cable Components
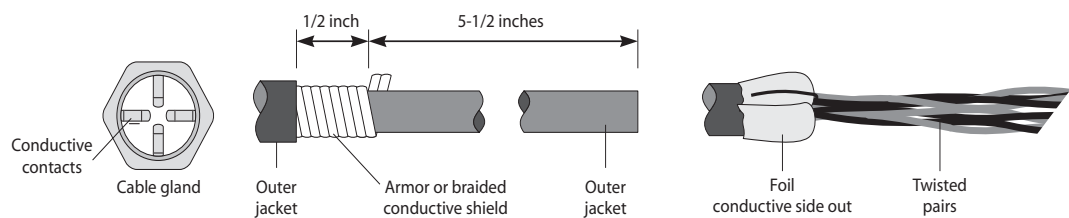
3. Run the stripped part of the cable through the cable gland (Figure 37). Make sure that the braided conductive shield of the cable makes contact with the conductive contacts of the cable gland (Figure 37).

4. Attach the cable gland by first tightening the gland base into the access cover. Then tighten the gland cover to constrict the weather-tight grommet around the outer jacket of the cable, thereby creating a weather-tight fitting.

Figure 37 Cable Gland Assembly
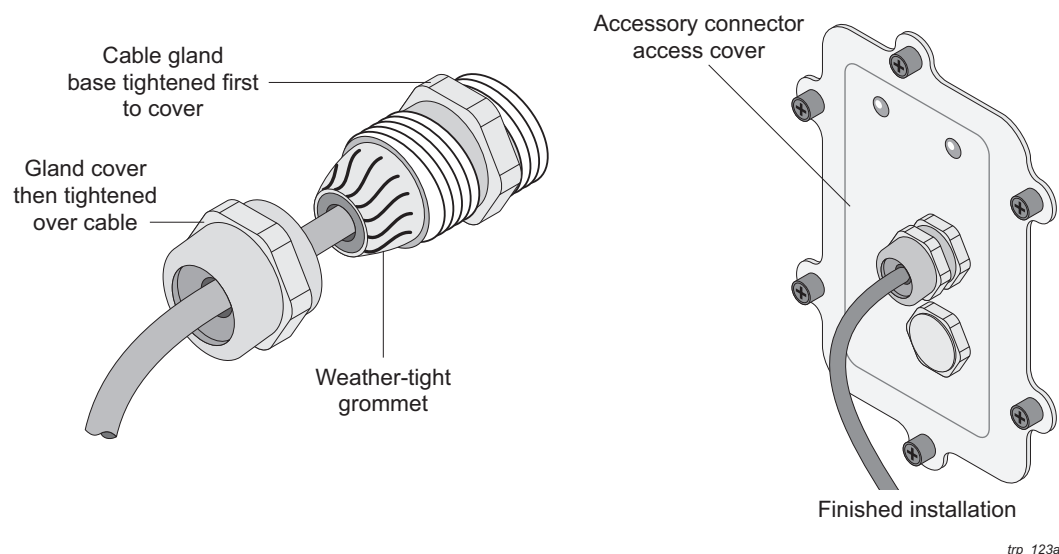
5. Apply a RJ45 modular jack and connect to the LAN or Management port. Figure 37 shows the termination options, and Table 30 provides pin descriptions.

Figure 38 Cable Preparation and Termination
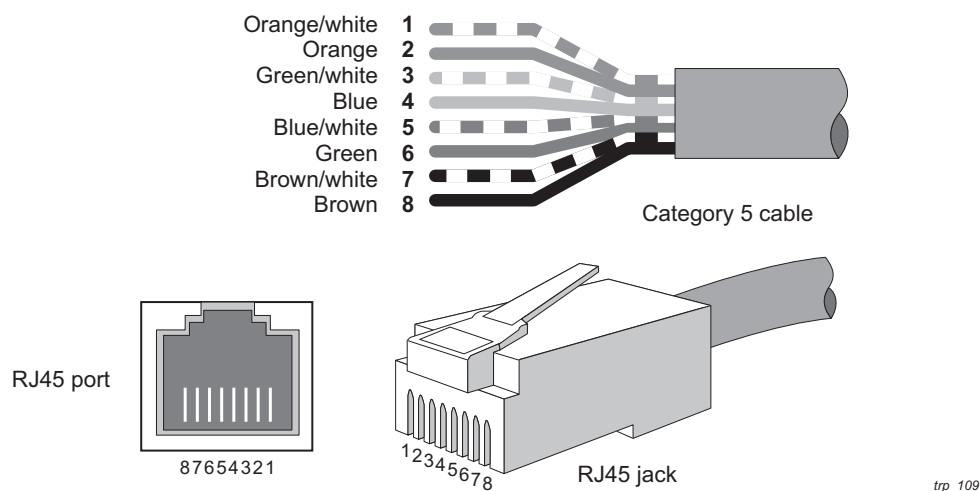
Table 30 TIA/EIA 5688 Wiring - RJ-45 Pin Descriptions for Data Connection

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, 0, 12, 24, 48 Vdc (+)
5	T	PoE+	Blue-White	Power output, 0, 12, 24, 48 Vdc (+)
6	R	RXD-	Green	RX Data 10/100BaseT
7	T	PoE-	Brown-White	Power output, 0, 12, 24, 48 Vdc (-)
8	R	PoE-	Brown	Power output, 0, 12, 24, 48 Vdc (-)

Acronyms

The following acronyms are used in this document.

Table 31 Acronyms

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
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
DC	Direct Current

Table 31 Acronyms (*continued*)

DGT	Directorate General of Telecommunications (Taiwan)
DQPSK	Differential-Quadrature Phase-Shift Keying
DSSS	Direct-Sequence Spread Spectrum
EFT	Electrically Fast Transients
EMC	Electromagnetic Compatibility
EN	IEC standard
ESD	Electrostatic Discharge
ETSI	European Telecommunications Standards Institute
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
N	Neutral
NEC	National Electrical Codes
NEMA	National Electrical Manufacturers Association

Table 31 Acronyms (*continued*)

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

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