

Encrypting downlink broadcasts

An AP can be enabled to encrypt downlink broadcast packets such as the following:

- ARP
- NetBIOS
- broadcast packets containing video data on UDP.

The encryption used is DES for a DES-configured module and AES for an AES-configured module. Before the Encrypt Downlink Broadcast feature is enabled on the AP, air link security must be enabled on the AP.

Isolating SMs in PMP

In an AP, SMs in the sector can be prevented from directly communicating with each other. In CMM4, the connected APs can be prevented from directly communicating with each other, which prevents SMs that are in different sectors of a cluster from communicating with each other.

In the AP, the **SM Isolation** parameter is available in the General tab of the Configuration web page. Configure the SM Isolation feature by any of the following selections from drop-down menu:

- **Disable SM Isolation** (the default selection). This allows full communication between SMs.
- **Enable Option 1 - Block SM destined packets from being forwarded**. This prevents both multicast/broadcast and unicast SM-to-SM communication.
- **Enable Option 2 - Forward SM destined packets upstream**. This not only prevents multicast/broadcast and unicast SM-to-SM communication but also sends the packets, which otherwise may have been handled SM to SM, through the Ethernet port of the AP.

In the CMM and the CMM4, SM isolation treatment is the result of how to manage the port-based VLAN feature of the embedded switch, where all traffic can be switched from any AP to a specified uplink port. However, this is not packet level switching. It is not based on VLAN IDs.

Filtering management through Ethernet

Configure the SM to disallow any device that is connected to its Ethernet port from accessing the IP address of the SM. If the **Ethernet Access Control** parameter is set to **Enabled**, then:

- No attempt to access the SM management interface (by http, SNMP, ftp, or tftp) through Ethernet is granted.
- Any attempt to access the SM management interface over the air (by IP address, presuming that **LAN1 Network Interface Configuration, Network Accessibility** is set to **Public**, or by link from the Session Status or Remote Subscribers tab in the AP) is unaffected.

Allowing management from only specified IP addresses

The Security sub-menu of the Configuration web page in the AP/BHM and SM/BHS includes the **IP Access Control** parameter. Specify one, two, or three IP addresses that must be allowed to access the management interface (by HTTP, SNMP, FTP or TFTP).

If the selection is:

- **IP Access Filtering Disabled**, then management access is allowed from any IP address, even if the Allowed Source IP 1 to 3 parameters are populated.
- **IP Access Filtering Enabled**, and specify at least one address in the Allowed Source IP 1 to 3 parameter, then management access is limited to the specified address(es).

Configuring management IP by DHCP

The **Configuration > IP** web page of every radio contains a **LAN1 Network Interface** Configuration, DHCP State parameter that, if enabled, causes the IP configuration (IP address, subnet mask, and gateway IP address) to be obtained through DHCP instead of the values of those individual parameters. The setting of this DHCP state parameter is also viewable, but is not settable, in the Network Interface tab of the Home page.

In the SM/BHS, this parameter is settable

- in the **NAT** tab of the Configuration web page, but only if NAT is enabled.
- in the **IP** tab of the Configuration web page, but only if the Network Accessibility parameter in the IP tab is set to Public.

Controlling PPPoE PADI Downlink Forwarding

The AP supports the control of forwarding of PPPoE PADI (PPPoE Active Discovery Initiation) packets. This forwarding is configured on the AP GUI **Configuration > Radio** page by parameter **PPPoE PADI Downlink Forwarding**. When set to "Enabled", the AP allows downstream and upstream transmission of PPPoE PADI packets. When set to "Disabled", the AP does NOT allow PPPoE PADI packets to be sent out of the AP RF interface (downstream) but will allow PPPoE PADI packets to enter the RF interface (upstream) and exit the Ethernet interface.

Chapter 4: Legal and regulatory information

This chapter provides end user license agreements and regulatory notifications.



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Glenn Randers-Pehrson

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February 14, 2009

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USB library functions

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D3 JS library

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Compliance with safety standards

This section lists the safety specifications against which the PMP/PTP 450 platform has been tested and certified. It also describes how to keep RF exposure within safe limits.

Electrical safety compliance

The PMP/PTP 450 platform hardware has been tested for compliance to the electrical safety specifications listed in Table 58.

Table 58 PMP 450 platform safety compliance specifications

Region	Specification
USA	UL 60950
Canada	CSA C22.2 No.60950
International	CB certified & certificate to IEC 60950

Electromagnetic compatibility (EMC) compliance

The EMC specification type approvals that have been granted for PMP/PTP 450 platform are listed under Table 59.

Table 59 EMC emissions compliance

Region	Specification
USA	FCC Part 15 Class B
Canada	RSS Gen and RSS 210
International	EN 301 489-1 V1.9.2 EN 301 489-17 V2.1.1

Human exposure to radio frequency energy

Relevant standards (USA and EC) applicable when working with RF equipment are:

- ANSI IEEE C95.1-1991, IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.
- Council recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) (1999/519/EC) and respective national regulations.

- *Directive 2004/40/EC of the European Parliament and of the Council of 29 April 2004* on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields) (18th individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC).
- US FCC limits for the general population. See the FCC web site at <http://www.fcc.gov>, and the policies, guidelines, and requirements in Part 1 of Title 47 of the Code of Federal Regulations, as well as the guidelines and suggestions for evaluating compliance in FCC OET Bulletin 65.
- Health Canada limits for the general population. See the Health Canada web site at http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/99ehd-dhm237/limits-limités_e.html and Safety Code 6.
- EN 50383:2002 to 2010 Basic standard for the calculation and measurement of electromagnetic field strength and SAR related to human exposure from radio base stations and fixed terminal stations for wireless telecommunication systems (110 MHz - 40 GHz).
- BS EN 50385:2002 Product standard to demonstrate the compliances of radio base stations and fixed terminal stations for wireless telecommunication systems with the basic restrictions or the reference levels related to human exposure to radio frequency electromagnetic fields (110 MHz – 40 GHz) – general public.
- ICNIRP (International Commission on Non-Ionizing Radiation Protection) guidelines for the general public. See the ICNIRP web site at <http://www.icnirp.de/> and Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields.

Power density exposure limit

Install the radios for the PMP/PTP 450 platform family of wireless solutions so as to provide and maintain the minimum separation distances from all persons.

The applicable power density exposure limit for RF energy in the 4.9, 5.4 and 5.8 GHz frequency bands is **10 W/m²** and in 900 MHz frequency band is **6 W/m²**. For more information, see [Human exposure to radio frequency energy](#) on page 4-22.

Calculation of power density

The following calculation is based on the ANSI IEEE C95.1-1991 method, as that provides a worst case analysis. Details of the assessment to EN50383:2002 can be provided, if required.

Peak power density in the far field of a radio frequency point source is calculated as follows:

$$S = \frac{P \cdot G}{4\pi d^2}$$

Where:

Is:

S	power density in W/m ²
P	maximum average transmit power capability of the radio, in W
G	total Tx gain as a factor, converted from dB
d	distance from point source, in m

Rearranging terms to solve for distance yields:

$$d = \sqrt{\frac{P \cdot G}{4\pi \cdot S}}$$

Calculated distances and power compliance margins

[Table 60](#) and [Table 61](#) shows calculated minimum separation distances, recommended distances and resulting margins for each frequency band and antenna combination for the USA and Canada. These are conservative distances that include compliance margins. At these and greater separation distances, the power density from the RF field is below generally accepted limits for the general population.

PMP 450 platform equipment adheres to all applicable EIRP limits for transmit power when operating in MIMO mode. Separation distances and compliance margins include compensation for both transmitters.

Explanation of terms used in [Table 60](#) and [Table 61](#):

- P burst – maximum average transmit power during transmit burst (Watt)
- P – maximum average transmit power of the radio (Watt)
- G – total transmit gain as a factor, converted from dB
- S – power density (Watt/m²)
- d – minimum safe separation distance from point source (meters)

Table 60 FCC minimum safe distances – PMP/PTP 450i 900 MHz, 4.9 GHz and 5.8 GHz

Band	Antenna	P burst (W)	P (W)	G (dBi)	S (W/ m ²)	d (m)
900 MHz	Sector antenna		0.19	22.75 (13 dBi)	6.0	0.27
	Yagi antenna (AP)		0.24	23.82 (12 dBi)	6.0	0.28
	Yagi antenna (SM)		0.24	23.89 (12 dBi)	6.0	0.28
4.9 GHz	Omni-directional	0.2138	0.2512	20.0 (13 dBi)	10.0	0.17
	90° sector antenna	0.2138	0.2512	50.0 (17 dBi)	10.0	0.26
	2ft directional flat plate	0.2138	0.2512	631.0 (28 dBi)	10.0	0.93
	4ft directional parabolic	0.851	0.1000	2344.0 (34.9 dBi)	10.0	1.14
	6ft directional parabolic	0.1413	0.1659	5248.0 (37.2 dBi)	10.0	2.19
5.1 GHz	Omni-directional	0.1622	0.1995	20.0 (10 dBi)	10.0	0.15
	90° sector	0.0324	0.0398	50.0 (17 dBi)	10.0	0.10
	2ft directional flat plate	0.0016	0.0020	708.0 (28.5 dBi)	10.0	0.09
	4ft directional parabolic	0.0102	0.0129	2818.0 (34.5 dBi)	10.0	0.44
5.2 GHz	Omni-directional	0.0343	0.0422	20.0 (10 dBi)	10.0	0.07
	90° sector	0.0137	0.0168	50.0 (17 dBi)	10.0	0.07
	2ft directional flat plate	0.0011	0.0013	708.0 (28.5 dBi)	10.0	0.07
	4ft directional parabolic	0.0002	0.0002	2818.0 (34.5 dBi)	10.0	0.06
5.4 GHz	Omni-directional	0.0343	0.0422	20.0 (10 dBi)	10.0	0.07
	90° sector	0.0137	0.0168	50.0 (17 dBi)	10.0	0.07
	2ft directional flat plate	0.0011	0.0013	708.0 (28.5 dBi)	10.0	0.07
	4ft directional parabolic	0.0011	0.0013	708.0 (28.5 dBi)	10.0	0.08
5.8 GHz	Omni-directional	0.24	0.28	20.0 (13 dBi)	10.0	0.18
	90° sector	0.10	0.12	50.0 (17 dBi)	10.0	0.18
	2ft directional flat plate	0.54	0.63	708.0 (28.5 dBi)	10.0	1.57
	4ft directional parabolic	0.54	0.63	3388.0 (35.3 dBi)	10.0	3.43
	6ft directional parabolic	0.54	0.63	6457.0 (38.1 dBi)	10.0	4.74

Table 61 IC minimum safe distances – PMP/PTP 450i 4.9 GHz and 5.8 GHz

Band	Antenna	P burst (W)	P (W)	G (dBi)	S (W/ m ²)	d (m)
4.9 GHz	Omni-directional	0.214	0.251	20.0 (13 dBi)	10.0	0.17
	90° sector	0.214	0.251	50.1 (17 dBi)	10.0	0.26
	2ft directional flat plate	0.214	0.251	631.0 (28 dBi)	10.0	0.93
	6ft directional parabolic	0.141	0.166	5248.0 (37.2 dBi)	10.0	2.19
5.8 GHz	Omni-directional	0.24	0.28	20.0 (13 dBi)	10.0	0.18
	90° sector	0.10	0.12	50.1 (17 dBi)	10.0	0.18
	2ft directional flat plate	0.54	0.63	707.9 (28.5 dBi)	10.0	1.57
	4ft directional parabolic	0.54	0.63	3388.4 (35.3 dBi)	10.0	3.43

Table 62 IC minimum safe distances – PMP/PTP 450 900 MHz, 2.4 GHz, 3.5/3.65 GHz and 5 GHz

Band	Antenna	P burst (W)	G (dBi)	S (W/ m ²)	d (m)
2.4 GHz	Integrated SM (9 dBi)	0.158	6.3 (8 dB)	10.0	0.09
	Integrated SM 12 dBi Reflector Dish	0.158	100 (20 dB)	10.0	0.35
2.4, 5 GHz	Connectorized AP, with 17 dBi Sector	0.158	50 (17 dB)	10.0	0.25
	Integrated SM (8 dBi)	0.316	6.3 (8 dB)	10.0	0.12
3.5, 3.6 GHz	Integrated SM with 11 dBi Reflector Dish	0.316	79.4 (19 dB)	10.0	0.45
	Connectorized AP, with 17 dBi Sector	0.316	50 (17 dB)	10.0	0.35
5 GHz	Integrated SM (9 dBi)	0.158	7.9 (9 dB)	10.0	0.20
	Integrated SM with 8 dBi CLIP	0.158	50 (17 dB)	10.0	0.25
	Integrated SM with 5.5 dBi LENS	0.158	28 (14.5 dB)	10.0	0.19
	Integrated SM 14 dBi Reflector Dish	0.158	199 (23 dB)	10.0	0.50

(*1) P: maximum average transmit power capability of the radio including cable loss (Watt)

Capacité de puissance d'émission moyenne maximale de la radio comprenant la perte dans les câble de connexion (W)

(*2) G: total transmit gain as a factor, converted from dB

Gain total d'émission, converti à partir de la valeur en dB

(*3) S: power density (W/m²)

Densité de puissance (W/m²)

(*4) d: minimum distance from point source (meters)

Distance minimale de source ponctuelle (en mètres)



Note

Gain of antenna in dBi = $10 * \log(G)$.

The regulations require that the power used for the calculations is the maximum power in the transmit burst subject to allowance for source-based time-averaging.

At 5.4 GHz and EU 5.8 GHz, the products are generally limited to a fixed EIRP which can be achieved with the Integrated Antenna. The calculations above assume that the maximum EIRP allowed by the regulations is being transmitted.



Remarque

Gain de l'antenne en dBi = $10 * \log(G)$.

Les règlements exigent que la puissance utilisée pour les calculs soit la puissance maximale de la rafale de transmission soumis à une réduction pour prendre en compte le rapport cyclique pour les signaux modulés dans le temps.

Pour une opération dans la CEE dans les bandes 5,4 GHz et 5,8 GHz, les produits sont généralement limités à une PIRE qui peut être atteinte avec l'antenne intégrée. Les calculs ci-dessus supposent que la PIRE maximale autorisée par la réglementation est atteinte.



Note

If there are no EIRP limits in the country of deployment, use the distance calculations for FCC 5.8 GHz for all frequency bands.

At FCC 5.8 GHz, for antennas between 0.6m (2ft) and 1.8m (6ft), alter the distance proportionally to the antenna gain.



Remarque

Si aucune limite de PIRE existe pour le pays de déploiement, utilisez les calculs de distance pour FCC 5,8 GHz pour toutes les bandes de fréquence.

Pour la band FCC 5,8 GHz et les antennes entre 0,6 m (2 pieds) et 1,8 m (6 pieds), modifier la distance proportionnellement au gain de l'antenne.

Compliance with radio regulations

This section describes how the PMP/PTP 450 platform complies with the radio regulations that are in force in various countries.

**Caution**

Where necessary, the end user is responsible for obtaining any National licenses required to operate this product and these must be obtained before using the product in any particular country. Contact the appropriate national administrations for details of the conditions of use for the bands in question and any exceptions that might apply.

**Caution**

Changes or modifications not expressly approved by Cambium Networks could void the user's authority to operate the system.

**Caution**

For the connectorized version of the product and in order to reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the Effective Isotropically Radiated Power (EIRP) is not more than that permitted for successful communication.

**Attention**

Le cas échéant, l'utilisateur final est responsable de l'obtention des licences nationales nécessaires pour faire fonctionner ce produit. Celles-ci doivent être obtenus avant d'utiliser le produit dans un pays particulier. Contactez les administrations nationales concernées pour les détails des conditions d'utilisation des bandes en question, et toutes les exceptions qui pourraient s'appliquer

**Attention**

Les changements ou modifications non expressément approuvés par les réseaux de Cambium pourraient annuler l'autorité de l'utilisateur à faire fonctionner le système.

**Attention**

Pour la version du produit avec une antenne externe, et afin de réduire le risque d'interférence avec d'autres utilisateurs, le type d'antenne et son gain doivent être choisis afin que la puissance isotrope rayonnée équivalente (PIRE) ne soit pas supérieure au minimum nécessaire pour établir une liaison de la qualité requise.

Type approvals

This system has achieved Type Approval in various countries around the world. This means that the system has been tested against various local technical regulations and found to comply. The frequency bands in which the system operates may be 'unlicensed' and, in these bands, the system can be used provided it does not cause interference. The system is not guaranteed protection against interference from other products and installations.

The radio specification type approvals that have been granted for PMP 450i frequency variants are listed under [Table 63](#).

Table 63 Radio certifications

Region/Country	Band	Specification
Brazil	4.9 GHz	ANATEL, RESOLUÇÃO N° 633, DE 14 DE MARÇO DE 2014
	5.4 GHz	ANATEL, RESOLUTION No. 506, FROM JULY 1, 2008
	5.8 GHz	ANATEL, RESOLUTION No. 506, FROM JULY 1, 2008
Mexico	4.9 GHz	Protocol Between the UNITED STATES OF AMERICA and MEXICO – Use of 4940 to 4990 MHz band.
	5.4 GHz	Acuerdo del 27 de noviembre de 2012
	5.8 GHz	NOM-121-SCT1-2009
USA	4.9 GHz	FCC 47 CFR Part 90
	5.1 GHz	FCC 47 CFR Part 15 E
	5.2 GHz	FCC 47 CFR Part 15 E
	5.4 GHz	FCC 47 CFR Part 15 E
	5.8 GHz	FCC 47 CFR Part 15 C
Canada	4.9 GHz	IC RSS-247, Issue 1
	5.8 GHz	IC RSS-111, Issue 5
Europe	4.9 GHz	ETSI EN302 625; V1.1.1 Broadband Disaster Relief
	5.4 GHz	ETSI EN 301 893 V1.7.1
	5.8 GHz	ETSI EN 302 502 V1.2.1

Brazil specific information

Brazil notification

For compliant operation in the 5.4 GHz band, the Equivalent Isotropic Radiated Power from the integrated antenna or connectorized antenna shall not exceed 30 dBm (0.5 W).

The operator is responsible for enabling the DFS feature on any Canopy 5.4 GHz radio by setting the Country Code to “Brazil”, including after the module is reset to factory defaults.

Important Note: This equipment operates as a secondary application, so it has no rights against harmful interference, even if generated by similar equipment, and cannot cause harmful interference on systems operating as primary applications.

Brazil certification numbers

The Anatel certification number for Brazil for the PMP/PTP 450i is 2426-15-7745.

Australia Notification

900 MHz modules must be set to transmit and receive only on center channels of 920, 922, or 923 MHz so as to stay within the ACMA approved band of 915 MHz to 928 MHz for the class license and not interfere with other approved users.

After taking into account antenna gain (in dBi), 900 MHz modules' transmitter output power (in dBm) must be set to stay within the legal regulatory limit of 30 dBm (1 W) EIRP for this 900 MHz frequency band.

Regulatory Requirements for CEPT Member States (www.cept.org)

When operated in accordance with the instructions for use, Cambium Wireless equipment operating in the 5.1 GHz and 5.4 GHz bands is compliant with CEPT Resolution 229 (REV. WRC-12).


Operating the PMP/PTP 450 platform in the bands 5150 to 5350 MHz and 5470 to 5725 MHz is granted providing it is not causing interference to the existing primary services allocated to those bands.


For compliant operation in the 5250 to 5350 MHz band, the transmit power from the integrated antenna or a connectorized antenna shall be limited to a maximum mean EIRP of 200 mW and a maximum mean EIRP density of 10 mW/MHz in any 1 MHz band.

For compliant operation in the 5470 to 5725 MHz band, the transmit power shall be restricted to a maximum of 250 mW with a maximum mean EIRP of 1 W and a maximum mean EIRP density of 50 mW/MHz in any 1 MHz band.

For compliant operation in the bands 5 250-5 350 MHz and 5 470-5 725 MHz, the PMP/PTP 450 platform employs transmitter power control.

For EU member states, RLAN equipment in the 5.4GHz bands is exempt from individual licensing under Commission Recommendation 2003/203/EC. Contact the appropriate national administrations for details on the conditions of use for the bands in question and any exceptions that might apply. Also see www.ero.dk for further information.

Cambium Radio equipment operating in the 5470 to 5725 MHz band are categorized as “Class 1” devices within the EU in accordance with ECC DEC(04)08 and are “CE” marked **CE 0977**  to show compliance with the European Radio & Telecommunications Terminal Equipment (R&TTE) directive 1999/5/EC. The relevant Declaration of Conformity can be found at http://www.cambiumnetworks.com/support/ec_doc/.

A European Commission decision, implemented by Member States on 31 October 2005, makes the frequency band 5470-5725 MHz available in all EU Member States for wireless access systems. Under this decision, the designation of Canopy 5.4GHz products become “Class 1 devices” and these do not require notification under article 6, section 4 of the R&TTE Directive. Consequently, these 5.4GHz products are only marked with the **CE 0977**  symbol and may be used in any member state.

Chapter 5: Preparing for installation

This chapter describes how to stage and test the hardware for a PMP 450 platform network. This chapter is arranged as follows:

- [Safety](#) on page 5-2: Describes the precautions to be observed and checks to be performed before proceeding with the installation
- [Preparing for installation](#) on page 5-5: Describes the pre-configuration procedure before proceed with installation.
- [Testing system components](#) on page 5-7: Describes the procedures for unpacking and performing and initial staging of the PMP/PTP 450 platform equipment
- [Configuring Link for Test](#) on page 5-15: Describes the procedures for testing the equipment's radio links.

Safety



Warning

To prevent loss of life or physical injury, observe the following safety guidelines. In no event shall Cambium Networks be liable for any injury or damage caused during the installation of the Cambium PMP/PTP 450 platform. Ensure that only qualified personnel install a PMP/PTP 450 platform link.

Power lines

Exercise extreme care when working near power lines.

Working at heights

Exercise extreme care when working at heights.

Power supply

Always use one of the Cambium PMP/PTP 450 platform Series power supply units (PSU) to power the ODU. Failure to use a Cambium supplied PoE could result in equipment damage and will invalidate the safety certification and may cause a safety hazard.

Grounding and protective earth

The Outdoor Unit (ODU) must be properly grounded to protect against lightning. It is the user's responsibility to install the equipment in accordance with national regulations. In the USA follow the requirements of the National Electrical code NFPA 70-2005 and 780-2004 *Installation of Lightning Protection Systems*. In Canada, follow Section 54 of the *Canadian Electrical Code*. These codes describe correct installation procedures for grounding the outdoor unit, mast, lead-in wire and discharge unit, size of grounding conductors and connection requirements for grounding electrodes. Other regulations may apply in different countries and therefore it is recommended that installation of the outdoor unit be contracted to a professional installer.

Powering down before servicing

Always power down and unplug the equipment before servicing.

Primary disconnect device

The ODU power supply is the primary disconnect device.

External cables

Safety may be compromised if outdoor rated cables are not used for connections that will be exposed to the outdoor environment. For outdoor copper Cat5e Ethernet interfaces, always use Cat5e cable that is gel-filled and shielded with copper-plated steel.

RF exposure near the antenna

Strong radio frequency (RF) fields will be present close to the antenna when the transmitter is on. Always turn off the power to the ODU before undertaking maintenance activities in front of the antenna.

Minimum separation distances

Ensure that personnel are not exposed to unsafe levels of RF energy. The units start to radiate RF energy as soon as they are powered up. Never work in front of the antenna when the ODU is powered. Install the ODUs so as to provide and maintain the minimum separation distances from all persons. For minimum separation distances, see [Calculated distances and power compliance margins](#) on page 4-24.

Grounding and lightning protection requirements

Ensure that the installation meets the requirements defined in [Grounding and lightning protection](#) on page 3-8.

Grounding cable installation methods

To provide effective protection against lightning induced surges, observe these requirements:

- Grounding conductor runs are as short, straight and smooth as possible, with bends and curves kept to a minimum.
- Grounding cables must not be installed with drip loops.
- All bends must have a minimum radius of 200 mm (8 in) and a minimum angle of 90°. A diagonal run is preferable to a bend, even though it does not follow the contour or run parallel to the supporting structure.
- All bends, curves and connections must be routed towards the grounding electrode system, ground rod, or ground bar.

- Grounding conductors must be securely fastened.
- Braided grounding conductors must not be used.
- Approved bonding techniques must be used for the connection of dissimilar metals.

Siting ODU and antennas

ODUs, external antennas and GPS receivers are not designed to survive direct lightning strikes. For this reason they must be installed in Zone B as defined in [Lightning protection zones](#) on page 3-9. Mounting in Zone A may put equipment, structures and life at risk.

Thermal Safety

The ODU enclosure may be hot to the touch when in operation. The ODU must not be operated in ambient temperatures exceeding 40°C unless mounted in a Restricted Access Location. For more information, see [ODU ambient temperature limits](#) on page 3-10.



Warning

Do not install the ODU in a location where the ambient temperature could exceed 40°C unless this is a Restricted Access Location as defined by EN 60950-1.



Alerte

L'unité externe ne doit pas être installée dans un endroit où la température ambiante est supérieure à 40C à moins que l'accès soit limité au personnel autorisé.

Preparing for installation

ODU pre-configuration

It is common practice to pre-configure the units during staging before site installation by performing the following tasks:

- [Connecting to the unit](#)
- [Configuring IP and Ethernet interfaces](#)
- [Upgrading the software version and using CNUT](#)
- General configuration
- [Configuring security](#)
- [Configuring radio parameters](#)
- [Setting up SNMP agent](#)
- [Configuring syslog](#)
- [Configuring remote access](#)
- [Monitoring the Link](#)
- [Configuring quality of service](#)
- [Zero Touch Configuration Using DHCP Option 66](#)
- [Configuring Radio via config file](#)
- [Configuring a RADIUS server](#)

If the units are to be pre-configured during staging, the safety precautions below **MUST** be observed.

Preparing personnel

In no event shall Cambium Networks be liable for any injury or damage caused during the installation of the Cambium PMP/PTP 450 platform equipment.

Ensure that only qualified personnel undertake the installation of a PMP/PTP 450 platform system.

Ensure that all safety precautions are observed.

Preparing inventory

Perform the following inventory checks:

- Check that the correct components are available, as described in [Ordering the components](#) on page 2-46.
- Check the contents of all packages against their packing lists.

Preparing tools

Check that following specific tools are available, in addition to general tools:

- RJ45 crimp tool (it must be the correct tool for the type of RJ45 being used).
- Personal Computer (PC) with 10 or 100 or 1000 BaseT Ethernet port
- Internet Explorer or Firefox
- Ethernet patch cables

Testing system components

The best practice is to connect all components—AP/BHM, SMs/BHS, GPS antenna (if applicable) and CMM (if applicable)—in a test setting and initially configure and verify them before deploying them to an installation. In this way, any configuration issues are worked out before going on-site, on a tower, in the weather, where the discovery of configuration issues or marginal hardware is more problematic and work-flow affecting.

Unpacking Components

When a delivery arrives, inspect all packages immediately for damages.

Carefully unpack the equipment, verify that all the components have arrived as per order and are in good condition. Save all packaging materials for equipment transportation to the installation site.

Preparing the ODU

After the equipment is unpacked, the units may be configured for staging tests.

Use either of two methods to configure an AP/BHM:

- Use the Quick Start feature of the product (via GUI menu **Quick Start**)
- Manually set each parameter

After changing configuration parameters on a GUI web page:

- Before you leave a web page, click the **Save** button to save the change(s)
- After making change(s) on multiple web pages, click the **Reboot** button to reboot the module and implement the change(s)

Configuring the Computing Device for Test

If the computer is configured for Dynamic Host Configuration Protocol (DHCP), disconnect the computer from the network. If the computer is instead configured for static IP addressing

- Set the static address in the 169.254 network
- Set the subnet mask to 255.255.0.0.

For detailed instructions, see section [Configuring the management PC](#) on page 5-15.

Factory default Configuration

From the factory, the APs/BHMs and SMs/BHSs are all configured to *not transmit* on any frequency. This configuration ensures that equipment operators do not accidentally turn on an unsynchronized module. Site synchronization of modules is required because

- modules:
 - cannot transmit and receive signals at the same time.
 - use TDD (Time Division Duplexing) to distribute signal access of the downlink and uplink frames.
- when one module transmits while an unintended module nearby receives signal, the transmitting module may interfere with or desense the receiving module. In this context, interference is self-interference (within the same network).

ODU interfaces

See section [PMP/PTP 450 platform interfaces](#) on page 2-7

ODU diagnostic LEDs

See section [AP/BHM LEDs](#) on page 2-11.

See section [SM/BHS LEDs](#) on page 2-12.

Recommended Tools for Installation

The following tools may be needed for installation:

Table 64 Tools for PMP and PTP 450 platform equipment installation

Equipment to Be Installed	Tools Required
AP or BHM	<ul style="list-style-type: none"> • 3 mm Allen Wrench Used for connecting the antenna mating bracket to the rear of the AP housing • Crescent Wrench Pair Used for tightening cable glands • Self-amalgamating and PVC Tape Used for weatherproofing N-type connections

Equipment to Be Installed	Tools Required
AP or BHM or BHS Antenna	<ul style="list-style-type: none"> • 13 mm Spanner Wrench (or Ratchet Spanner Wrench) Pair Used for connecting the antenna (sector or omni for AP, or directional for BH)base to the pole/mast mounting bracket • Self-amalgamating and PVC Tape Used for weatherproofing N-type connections • N-type Torque Wrench (not required but recommended) Used for assuring proper tightening of N-type connectors terminating the RF cables
SM	<ul style="list-style-type: none"> • Wrench/driver (depending on operator’s choice of clamps) Used for tightening clamps to the pole • Alignment tone adapter / headset Used for aligning the SM to the AP
Universal Global Positioning System	<ul style="list-style-type: none"> • Philips Screwdriver Used for attaching the UGPS unit to the pole/mast mounting bracket • 13mm Spanner Wrench (or Ratchet Spanner Wrench) Used for connecting the mounting bracket’s U-bolt to the antenna or mast
Cabling	<ul style="list-style-type: none"> • Electrician’s Scissors or Wire Cutters Used for cutting wire to length • RJ-11/RJ-45 Crimping Tool Used for stripping RJ-11/RJ-45 cables and for terminating cable ends • Cable Testing Device Used to ensure that cables are properly constructed

Standards for Wiring

Modules automatically sense whether the Ethernet cable in a connection is wired as straight-through or crossover. Operators may use either straight-through or crossover cable to connect a network interface card (NIC), hub, router, or switch to these modules. For a straight-through cable, use the EIA/TIA-568B wire color-code standard on both ends. For a crossover cable, use the EIA/TIA-568B wire color-code standard on one end, and the EIA/TIA-568A wire color-code standard on the other end.

Best Practices for Cabling

The following practices are essential to the reliability and longevity of cabled connections:

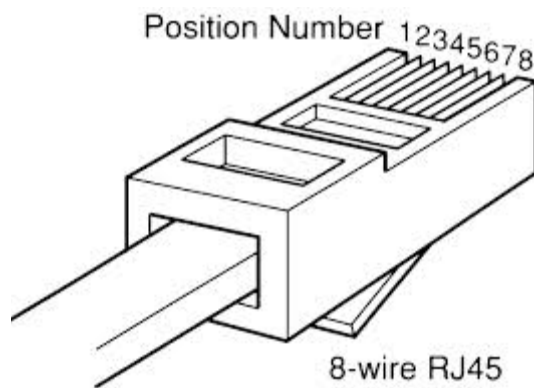
- Use only shielded cables to resist interference.
- For vertical runs, provide cable support and strain relief.
- Include a 2-ft (0.6-m) service loop on each end of the cable to allow for thermal expansion and contraction and to facilitate terminating the cable again when needed.
- Include a drip loop to shed water so that most of the water does not reach the connector at the device.
- Properly crimp all connectors.
- Use dielectric grease on all connectors to resist corrosion.
- Use only shielded connectors to resist interference and corrosion.

Wiring Connectors

The following diagrams correlate pins to wire colors and illustrate crossovers where applicable.

Pin 1, relative to the lock tab on the connector of a straight-through cable is located as shown below.

Figure 39 Pin 1 location



Main port pinout

Table 65 Main port pinout

RJ45 pin	Description
1	+TxRx0
2	-TxRx0
3	+TxRx1
4	+TxRx2
5	-TxRx2
6	-TxRx1
7	+TxRx3
8	-TxRx3

Aux port pinout

Table 66 Aux port pinout

RJ45 pin	Description
1	+TxRx0
2	-TxRx0
3	+TxRx1
4	GPS power out, Alignment tone out, GPS data out
5	GPS data in
6	-TxRx1
7	GPS 0v
8	GPS Sync in

RJ-45 Pinout for Straight-through Ethernet Cable

Figure 40 Straight-through Ethernet Cable

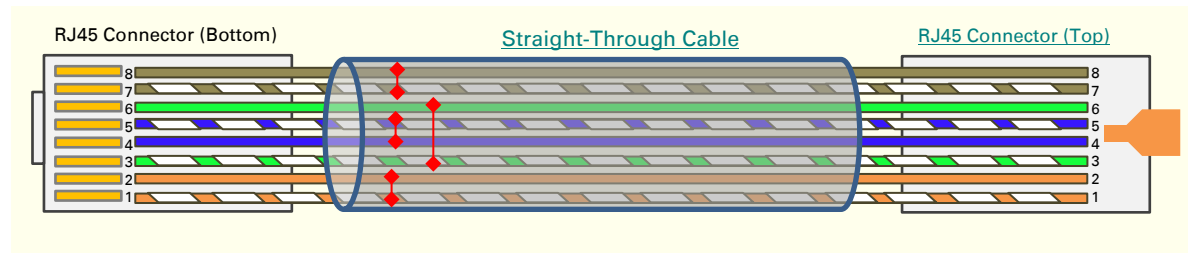


Table 67 RJ-45 pinout for straight-through Ethernet cable

Pin	Signal	Pair	Color
1	TP1+	2	White/orange stripe
2	TP1-	2	Orange solid
3	TP2+	3	White/green stripe
4	TP3-	1	Blue solid
5	TP3+	1	White/blue stripe
6	TP2-	3	Green solid
7	TP4+	4	White/brown stripe
8	TP4-	4	Brown solid

RJ-45 Pinout for Crossover Ethernet Cable

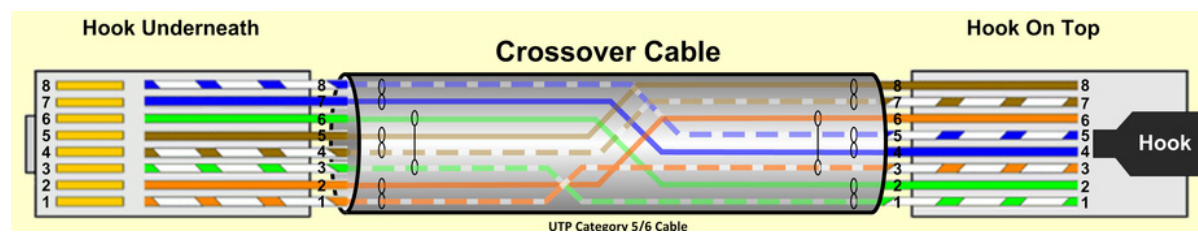


Table 68 RJ-45 pinout for crossover Ethernet cable

Pin	Connection 1			Connection 2		
	Signal	Pair	Color	Signal	Pair	Color
1	TP2+	3	White/green stripe	TP1+	2	White/orange stripe
2	TP2-	3	Green solid	TP1-	2	Orange solid
3	TP1+	2	White/orange stripe	TP2+	3	White/green stripe
4	TP3-	1	Blue solid	TP3-	1	Blue solid
5	TP3+	1	White/blue stripe	TP3+	1	White/blue stripe
6	TP1-	2	Orange solid	TP2-	3	Green solid
7	TP4+	4	White/brown stripe	TP4+	4	White/brown stripe
8	TP4-	4	Brown solid	TP4-	4	Brown solid

AP/BHM to UGPS cable

The AP/BHM to UGPS cable can be constructed from RJ12 to RJ 45 cable using the ping configuration described in [Table 69](#).

Figure 41 AP/BHM to UGPS cable

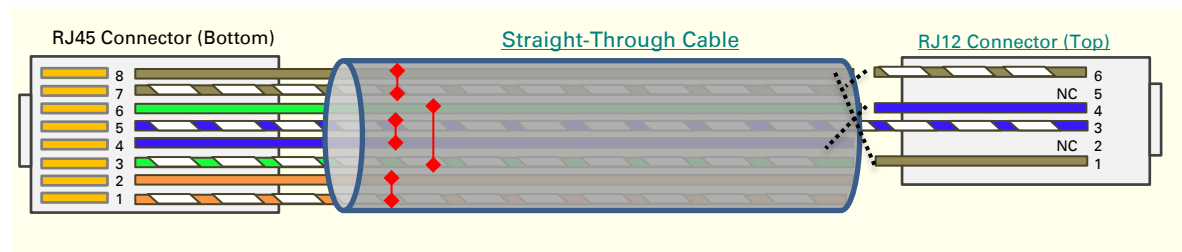


Table 69 AP/BHM to UGPS cable pinout

Pin	450i AP RJ 45 Connector	Pin	UGPS RJ 12 Connector	Connector
1	NC	1	8 on RJ 45	
2	NC	2	NC	
3	NC	3	5 on RJ 45	
4	4 on RJ 12	4	4 on RJ 45	
5	3 on RJ 12	5	NC	

6	NC	6	7 on RJ 45
7	6 on RJ 12		
8	1 on RJ 12		



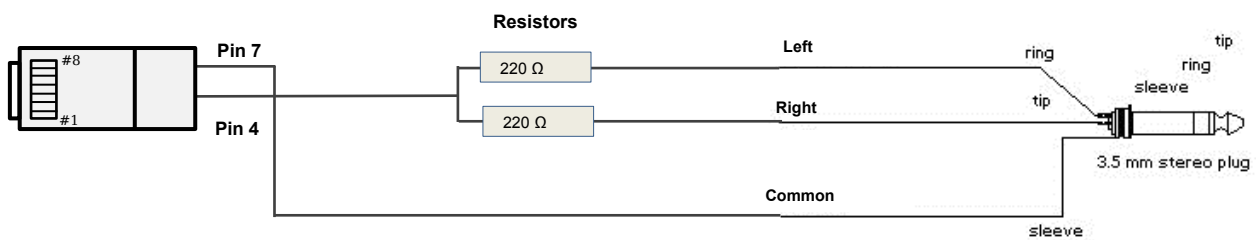
Note

The AP/BHM will only power up the UGPS if it configured to do so.

Alignment tone cable

The alignment tone cable is constructed using RJ45 plug and Stereo plug. The pin configuration is shown in Figure 42

Figure 42 Alignment tone cable pin configuration

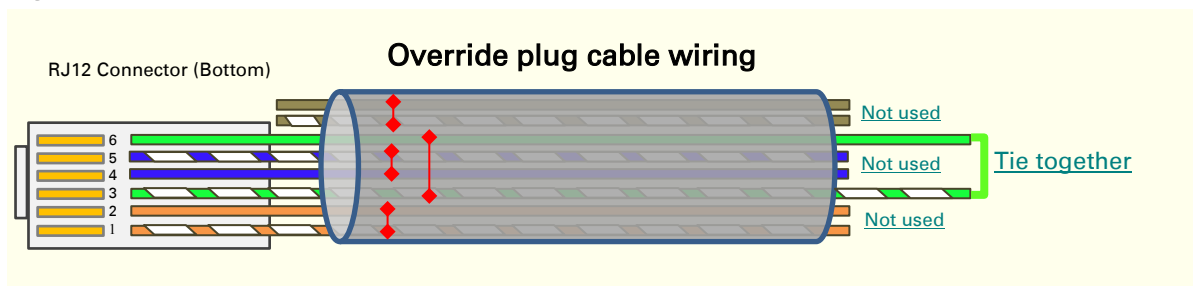


Override plug cable

To construct an override plug, perform the following steps:

- Crimp a RJ-11 6 pin connector onto a 6 inch length of CAT 5 cable
- Pin out all 6 pins
- Short (solder together) pins 4 and 6 on the other end. Do not connect any other wires to anything.

Figure 43 RJ-11 pinout for the default plug



Configuring Link for Test

It is important to stage the AP/BHM and SM/BHS units first to verify proper registration before deploying the modules to the site. To begin configuring the modules for test, see the sections below:

Configuring the management PC

To configure the local management PC to communicate with the AP, SM, BHM or BHS, proceed as follows:

Powering the AP/SM/BH for test configuration

Perform the following steps to power on the ODU.

Procedure 2 Powering the ODU

- 1 Plug one end of a CAT 5 Ethernet cable into the ODU.
- 2 Plug the Ethernet cable connector labeled To Radio into the jack in the pig tail that hangs from the power supply.
- 3 Plug the other connector of the pig tail (this connector labeled To Computer) into the Ethernet jack of the computing device.
- 4 Plug the power supply into an electrical outlet.



Warning

From this point until you remove power from the ODU, stay at least as far from the AP as the minimum separation distance specified in [Minimum separation distances](#) on page 5-3.

- 5 Power up the computing device
- 6 Start the browser in the computing device

The AP/BHM interface provides a series of web pages to configure and monitor the unit. Access web-based interface through a computing device that is either directly connected or connected through a network to the AP/BHM. If the computing device is not connected to a network when it is being configured for test environment, and if the computer has used a proxy server address and port to configure a module, then the operator may need to first disable the proxy setting in the computer.

Perform the following procedure to toggle the computer to *not* use the proxy setting.

Procedure 3 Bypassing browser proxy settings to access module web pages

- 1 Launch Microsoft Internet Explorer
- 2 Select **Tools, Internet Options, Connections, LAN Settings**. Alternate web browser menu selections may differ.
- 3 Uncheck the **Use a proxy server** box.

In the address bar of your browser, enter the IP address of the AP/BHM. (For example, enter `http://169.254.1.1` to access the AP/BHM through its default IP address). The AP/BHM responds by opening the General Status tab of its Home page.

Logging into the web interface – AP/SM/BH

Procedure 4 Logging into the web interface

- 1 Plug one end of a CAT 5 Ethernet cable into the AP/BHM
- 2 Plug the Ethernet cable connector labeled To Radio into the jack in the pig tail that hangs from the power supply.
- 3 Plug the other connector of the pig tail (this connector labeled To Computer) into the Ethernet jack of the computing device.
- 4 Plug the power supply into an electrical outlet.



Warning

From this point until you remove power from the ODU, stay at least as far from the ODU as the minimum separation distance specified in [Minimum separation distances](#) on page 5-3.

Using the Quick Start Configuration Wizard of the AP/BHM

See section [Quick link setup](#) on page 7-12.

Chapter 6: Installation

This chapter describes how to install and test the hardware for a PMP/PTP 450 platform link. It contains the following topics:

- [ODU variants and mounting bracket options](#) on page 6-2 provides details of six different bracket options, including the type of ODU and range of pole diameters supported by each option.
- [Mount the ODU, LPU and surge suppressor](#) on page 6-3 describes how to mount and ground an integrated or connectorized ODU, how to mount and ground the top LPU.
- [Installing the copper Cat5e Ethernet interface](#) on page 6-17 describes how to install the copper Cat5e power over Ethernet interface from the ODU to the PSU.
- [Installing external antennas to a connectorized ODU](#) on page 6-21 describes how to install external antennas for a connectorized ODU.
- [Installing ODU](#) on page 6-54 describes how to install PTP and PMP ODU radios.
- [Installing the AC Power Injector](#) on page 6-59 describes how to install a power supply unit for the PMP/PTP 450 platform, either the AC Power Injector.
- [Supplemental installation information](#) on page 6-62 contains detailed installation procedures that are not included in the above topics, such as how to strip cables, create grounding points and weatherproof connectors.



Note

These instructions assume that LPUs are being installed from the PMP/PTP 450 platform LPU and grounding kit (Cambium part number C000065L007). If the installation does not require LPUs, adapt these instructions as appropriate.

If LPUs are being installed, only use the five black-capped EMC cable glands supplied in the LPU and grounding kit. The silver-capped cable glands supplied in the ODU kits must only be used in PMP/PTP 450 platform installations which do not require LPUs.

ODU variants and mounting bracket options

Mounting bracket– PMP/PTP 450i

The PMP/PTP 450i series supports below mentioned mounting bracket option:

Table 70 PMP/PTP 450i ODU mounting bracket part numbers

Cambium description	Cambium part number
Mounting bracket – low profile adjustable	N000045L002A

The low profile bracket provides elevation adjustment with the PMP/PTP 450i Integrated ODUs of +10° to –5° or +5° to –10°. A larger adjustment range is available using the standard integrated mounting bracket. The connectorized mounting bracket does not provide elevation adjustment.



Note

The connectorized mounting bracket is included with the PMP/PTP 450i Connectorized ODU. Order a bracket separately for PMP/PTP 450i Integrated ODUs.

Mounting bracket– PMP 450 900 MHz SM

The PMP 450i 900 MHz SM has special mounting bracket option. The PMP 450i 900 MHz AP mounting procedure is the same as the other 450i radios. The 900 450 SM has a different mounting bracket which is supplied along with yagi antenna.

Mount the ODU, LPU and surge suppressor

To install the ODU and top LPU, use the following procedures:

- [Attach ground cables to the ODU](#) on page 6-3
- [Mount the ODU on the mast](#) on page 6-5
- [Mount the top LPU](#) on page 6-8
- [Mount the Surge Suppressor](#) on page 6-9

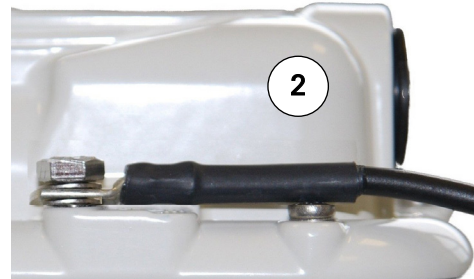
Attach ground cables to the ODU

PMP/PTP 450i Series – AP/SM/BH

- 1 Fasten an AWG 10 (or 6mm²) copper ground cable to each ODU grounding point using the M6 (small) lugs



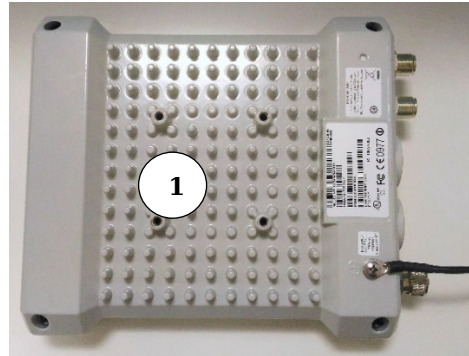
- 2 Tighten the Ground post locking nut in the copper wire



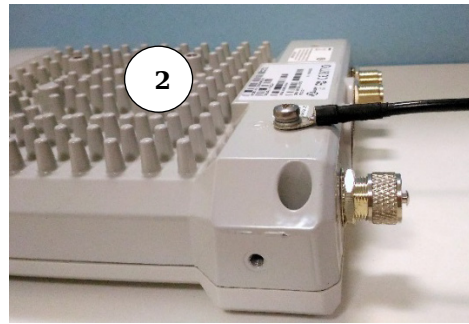
- 3 Securely connect the copper wire to the grounding system (Protective Earth) according to applicable regulations.

PMP 450 AP

- 1 Fasten an AWG 10 (or 6mm²) copper ground cable to each ODU grounding point using the M6 (small) lugs



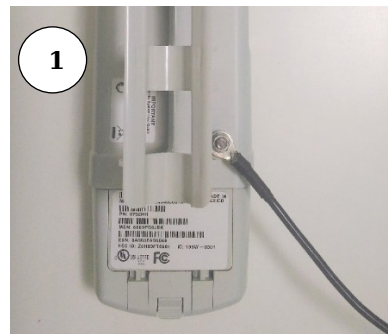
- 2 Tighten the Ground post locking nut in the copper wire



- 3 Securely connect the copper wire to the grounding system (Protective Earth) according to applicable regulations.

PMP 450 SM

- 1 Fasten an AWG 10 (or 6mm²) copper ground cable to each ODU grounding point using the M6 (small) lugs



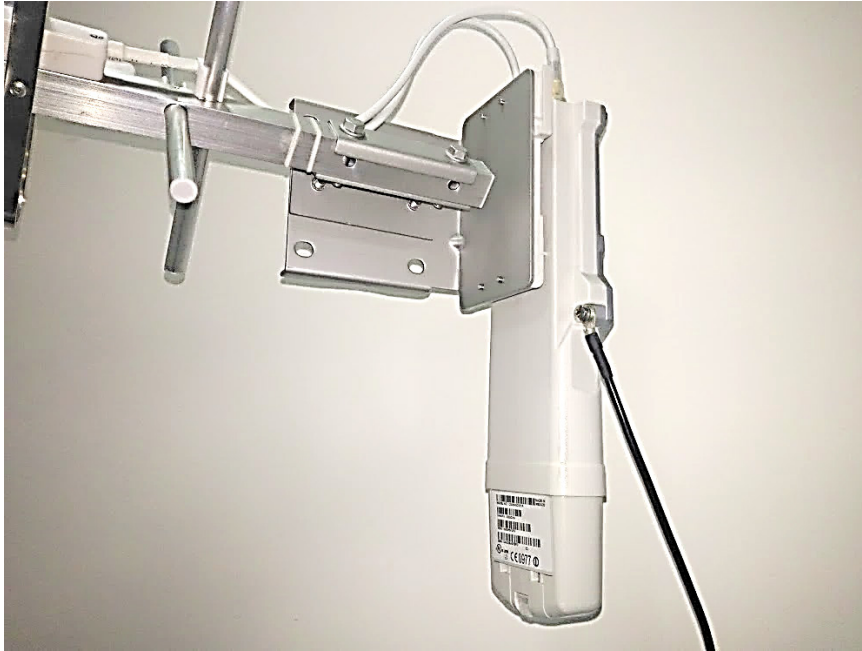
- 2 Tighten the Ground post locking nut in the copper wire



- 3 Securely connect the copper wire to the grounding system (Protective Earth) according to applicable regulations.

The grounding point on PMP 450 900 MHz SM is different from 2.4, 3.5/3.65 and 5 GHz PMP 450 SMs as shown in [Figure 44](#).

Figure 44 PMP 450 900 MHz SM grounding



Mount the ODU on the mast

PMP/PTP 450i Series – AP/SM/BH

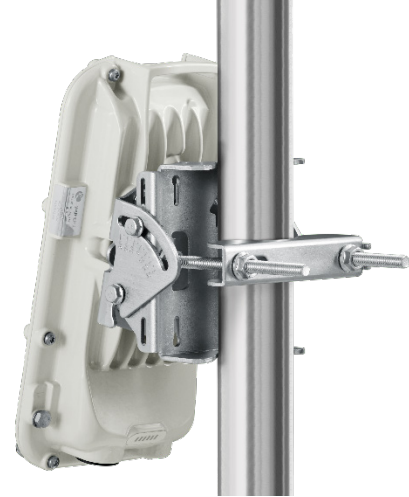


Caution

Do not reverse the bracket clamp, as this arrangement may lead to failure of the assembly. Do not over-tighten the bolts as this may lead to failure of the assembly.

- 1 Use stainless steel hose clamps or equivalent fasteners to lock the ODU into position.
- 2 Remove the base cover of the ODU

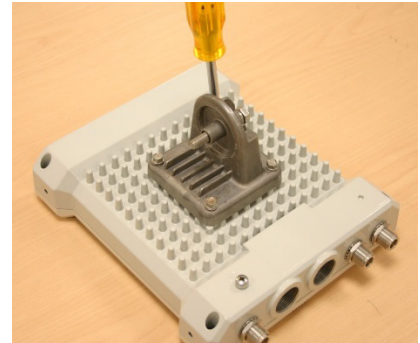
- 3 Terminate the UV outside grade Category 5 Ethernet cable with an RJ-45 connector, and connect the cable to the ODU.



- 4 Wrap a drip loop in the cable.

PMP 450 AP

- 1 Using an 8mm nut driver, attach the pole mount's AP housing bracket to the unit using the 4 M5 x 16mm bolts included with the AP.



- 2 Using the included (depending on pole diameter):
 - M8 x 70mm hex cap bolts (2 quantity)
or
 - M8 x 40mm hex cap bolts (2 quantity)
and
 - M8 flat washers (2 quantity)
 - M8 coil washers (2 quantity)

Attach the mounting bracket to the pole/mast. The mounting bracket is designed to attach to poles with diameters in the range of 2 in. (50mm) to 3in. (75mm).



- 3 Complete the AP mounting assembly by attaching the included:

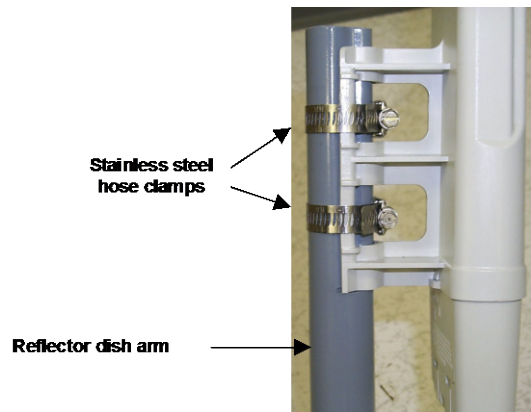
- 8mm hex cap bolt (one quantity)

Through the AP's attached mounting bracket and pole mount. At this time the AP may be adjusted to the desired position and tightened with a 1/2 inch spanner wrench to 11 lb/ft (14Nm).



PMP 450 SM (except PMP 450 SM - 900 MHz)

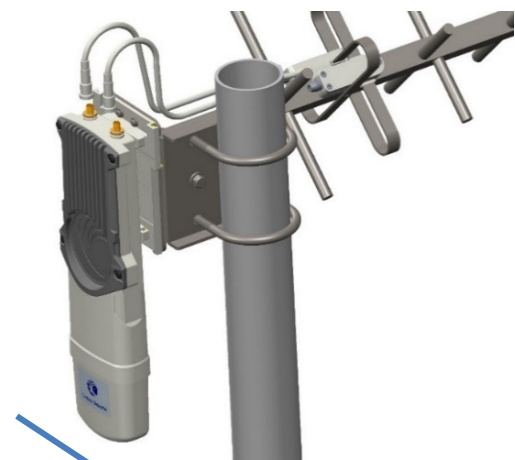
- 1 Use stainless steel hose clamps for the attachment.
- 2 Attach the mounting bracket to the structure. Tighten the locking nut.



PMP 450 900 MHz SM (connectorized)

The PMP 450 900 MHz connectorized SM mounting procedure is different from other radios. It does not get directly mounted on pole.

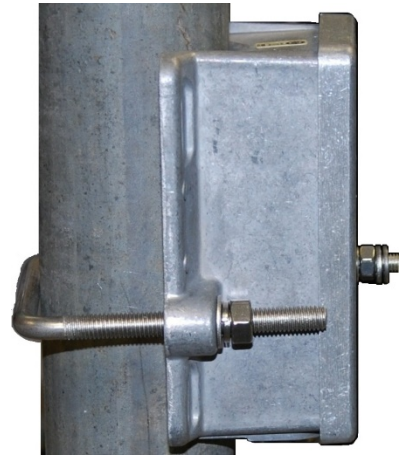
- 1 Align the 900 MHz SM to E bracket of Yagi antenna
- 2 Slide the radio towards right to lock on the antenna



Slide towards right to lock

Mount the top LPU

- 1 For separate LPU mounting, use the U-bolt bracket from the LPU kit to mount the top LPU on the pole below the ODU. Tighten to a torque setting of 7.0 Nm (5.2 lb ft):



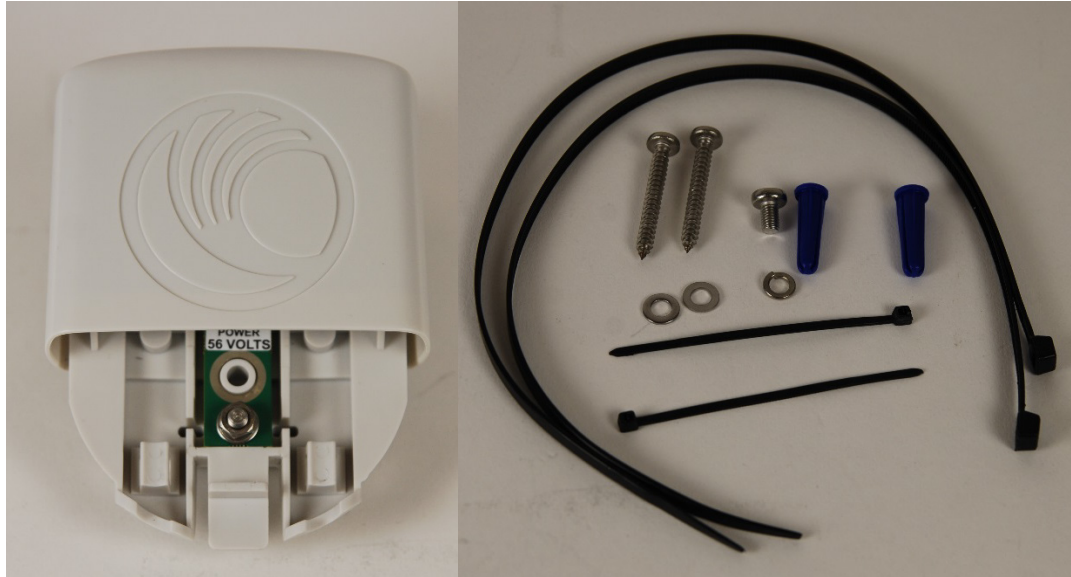
Mount the Surge Suppressor

PMP/PTP 450i Series

The mounting procedure for the Surge Suppressor for PMP/PTP 450i Series is as follows:

- 1 Mount the 1000SSH to the *outside* of the subscriber premises (with the cable openings facing downward), as close to the point where the Ethernet cable penetrates the residence or building as possible, and as close to the grounding system (Protective Earth) as possible.
- 2 Wrap an AWG 10 (or 6mm²) copper wire around the Ground post of the 1000SSH.
- 3 Tighten the Ground post locking nut in the 1000SSH onto the copper wire.
- 4 Securely connect the copper wire to the grounding system (Protective Earth) according to applicable regulations.
- 5 Using diagonal cutters or long nose pliers, remove the knockouts that cover the cable openings to the 1000SSH.
- 6 Pack both of the surge suppressor Ethernet jacks with dielectric grease.
- 7 Wrap an AWG 10 (or 6mm²) copper wire around the Ground post of the 1000SSH.
- 8 Tighten the Ground post locking nut in the 1000SSH onto the copper wire.
- 9 Securely connect the copper wire to the grounding system (Protective Earth) according to applicable regulations.
- 10 Using diagonal cutters or long nose pliers, remove the knockouts that cover the cable openings to the 1000SSH.
- 11 Pack both of the surge suppressor Ethernet jacks with dielectric grease.
- 12 Wrap a splice loop in the loose end of the Ethernet cable from the SM/BHS.
- 13 Connect that cable to one of the Ethernet jacks.
- 14 Connect an Ethernet cable to the other Ethernet jack of the 1000SSH and to the power adapter.
- 15 Replace the cover of the 1000SSH.

Figure 45 100SSH Surge Suppressor



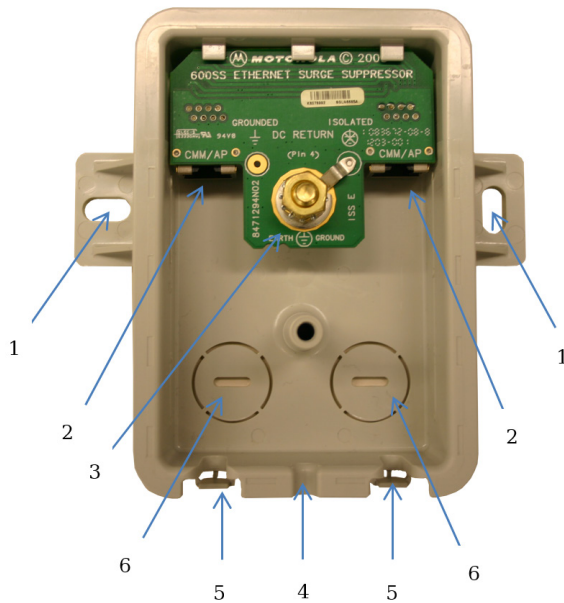
PMP/PTP 450 Series

The PMP/PTP 450 Series uses 600SSH Surge Suppressor. The inside of the surge suppressor is shown in [Figure 46](#).



Caution

The PMP 450 900 MHz SM is based off the 450 platform, be sure to use a 600SS to protect this radio type.

Figure 46 600SSH Surge Suppressor – inside**Key to Callouts 600SSH**

- 1 Holes—for mounting the Surge Suppressor to a flat surface (such as an outside wall). The distance between centers is 4.25 inches (108 mm).
- 2 RJ-45 connectors—One side (neither side is better than the other for this purpose) connects to the product (AP, SM, or cluster management module). The other connects to the AC adaptor’s Ethernet connector.
- 3 Ground post and washer—use heavy gauge (10 AWG or 6 mm²) copper wire for connection. Refer to local electrical codes for exact specifications.
- 4 Ground Cable Opening—route the 10 AWG (6 mm²) ground cable through this opening.
- 5 CAT-5 Cable Knockouts—route the two CAT-5 cables through these openings, or alternatively through the Conduit Knockouts.
- 6 Conduit Knockouts—on the back of the case, near the bottom. Available for installations where cable is routed through building conduit.

**Note**

The 600SSH surge suppressor is shipped in the “isolated” position (pin 4 isolated by 68V from protective earth). If packet error issues occur over the Ethernet link (verify by pinging the device through the 600SSH), configure the 600SSH to “grounded” position (by moving the 600SSH switch from “isolated” to “ground”) to avoid ground loops that may be present in the system.

The mounting procedure for the Surge Suppressor for PMP/PTP 450 Series is as follows:

- 1 Remove the cover of the 600SSH Surge Suppressor.
- 2 With the cable openings facing downward, mount the 600SSH to the *outside* of the subscriber premises, as close to the point where the Ethernet cable penetrates the residence or building as possible, and as close to the grounding system (Protective Earth) as possible.
- 3 Wrap an AWG 10 (or 6mm²) copper wire around the Ground post of the 600SSH.
- 4 Tighten the Ground post locking nut in the 600SSH onto the copper wire.

- 5 Securely connect the copper wire to the grounding system (Protective Earth) according to applicable regulations.
- 6 Using diagonal cutters or long nose pliers, remove the knockouts that cover the cable openings to the 600SSH.
- 7 Pack both of the surge suppressor Ethernet jacks with dielectric grease.
- 8 Wrap an AWG 10 (or 6mm²) copper wire around the Ground post of the 600SSH.
- 9 Tighten the Ground post locking nut in the 600SSH onto the copper wire.
- 10 Securely connect the copper wire to the grounding system (Protective Earth) according to applicable regulations.
- 11 Using diagonal cutters or long nose pliers, remove the knockouts that cover the cable openings to the 600SSH.
- 12 Pack both of the surge suppressor Ethernet jacks with dielectric grease.
- 13 Wrap a splice loop in the loose end of the Ethernet cable from the SM.
- 14 Connect that cable to one of the Ethernet jacks.
- 15 Connect an Ethernet cable to the other Ethernet jack of the 600SSH and to the power adapter.
- 16 Replace the cover of the 600SSH.

General protection installation

To adequately protect a PMP 450i installation, both ground bonding and transient voltage surge suppression are required.

Basic requirements

The following basic protection requirements must be implemented:

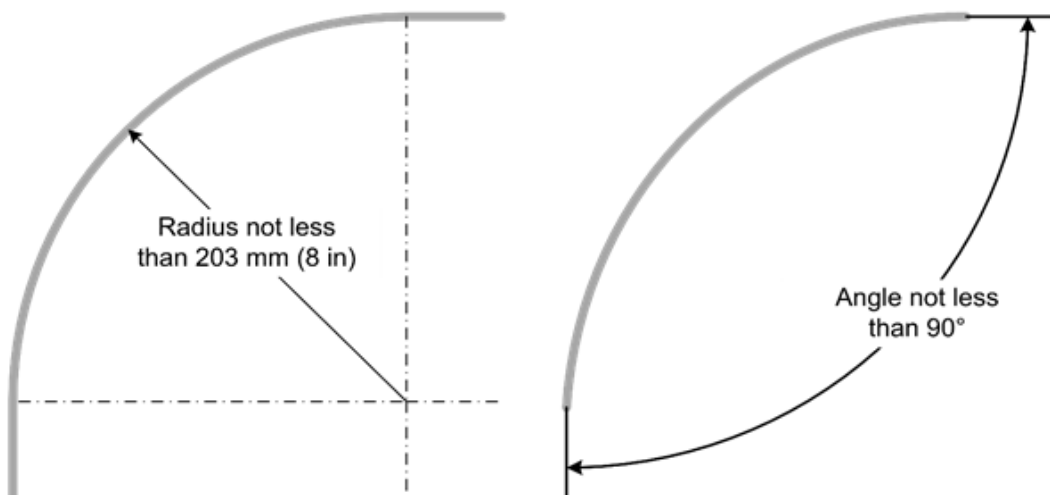
- ODU must be in 'Zone B' (see [Lightning protection zones](#) on page 3-9).
- ODU must be grounded to the supporting structure.
- A surge suppression unit (1000SSH or 600SSH) must be installed on the outside of the building.
- The distance between the ODU and 1000SSH/600SSH should be kept to a minimum.
- The drop cable must not be laid alongside a lightning air terminal.
- All grounding cables must be a minimum size of 10 mm² csa (8AWG), preferably 16 mm² csa (6AWG), or 25 mm² csa (4AWG).

Grounding cable requirements

When routing, fastening and connecting grounding cables, the following requirements must be implemented:

- Grounding conductors must be run as short, straight, and smoothly as possible, with the fewest possible number of bends and curves.
- Grounding cables must not be installed with drip loops.
- All bends must have a minimum radius of 203 mm (8 in) and a minimum angle of 90° (Figure 47). A diagonal run is preferable to a bend, even though it does not follow the contour or run parallel to the supporting structure.
- All bends, curves and connections must be routed towards the grounding electrode system, ground rod, or ground bar.
- Grounding conductors must be securely fastened.
- Braided grounding conductors must not be used.
- Approved bonding techniques must be used for the connection of dissimilar metals.

Figure 47 Grounding cable minimum bend radius and angle



Caution

Do not attach grounding cables to the ODU mounting bracket bolts, as this arrangement will not provide full protection.

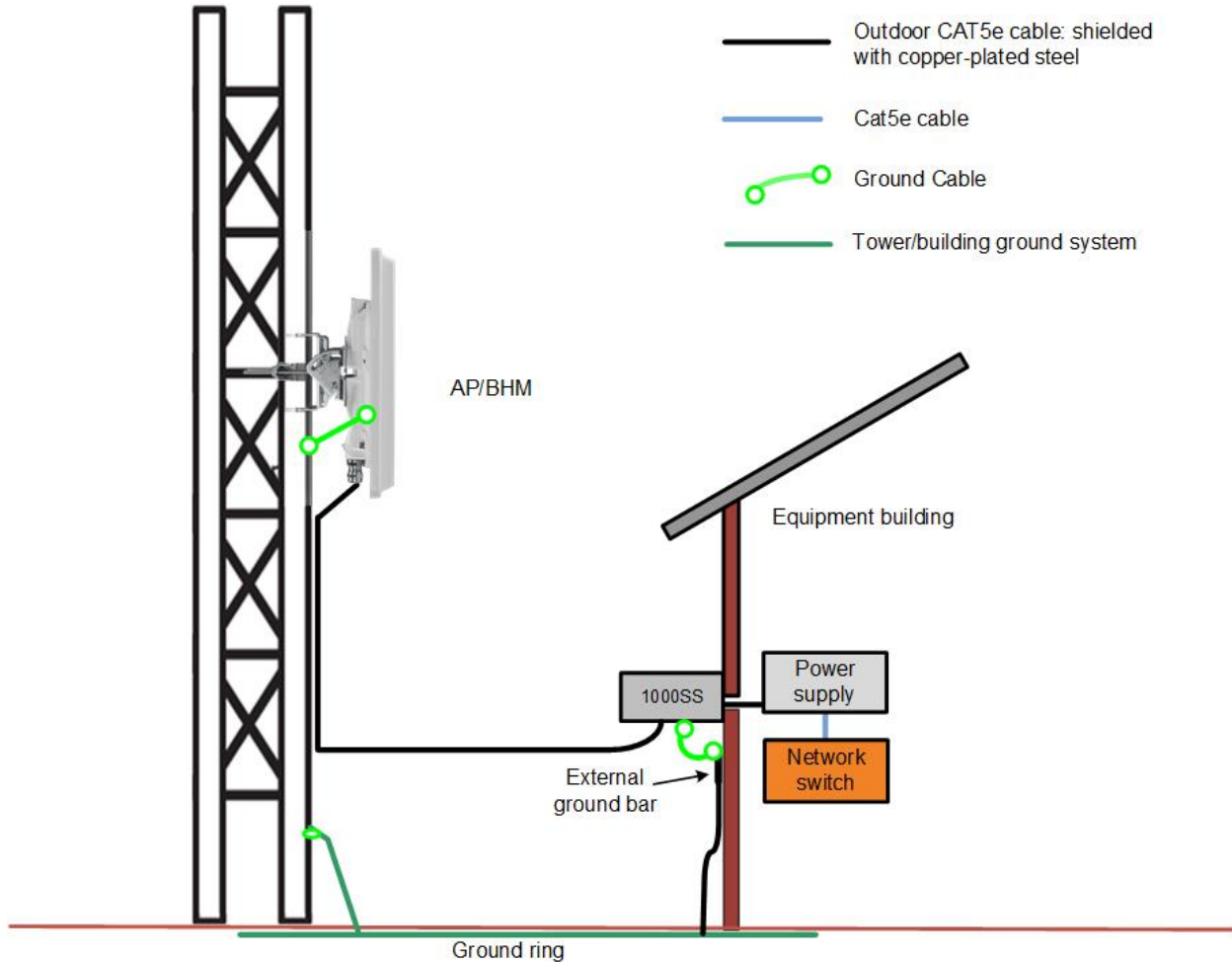
Protection requirements for a mast or tower installation

If the ODU is to be mounted on a metal tower or mast, then in addition to the general protection requirements (above), the following requirements must be observed:

- The equipment must be lower than the top of the tower or its lightning air terminal.
- The metal tower or mast must be correctly grounded.

Schematic examples of mast or tower installations are shown in [Figure 48](#).

Figure 48 Grounding and lightning protection on mast or tower



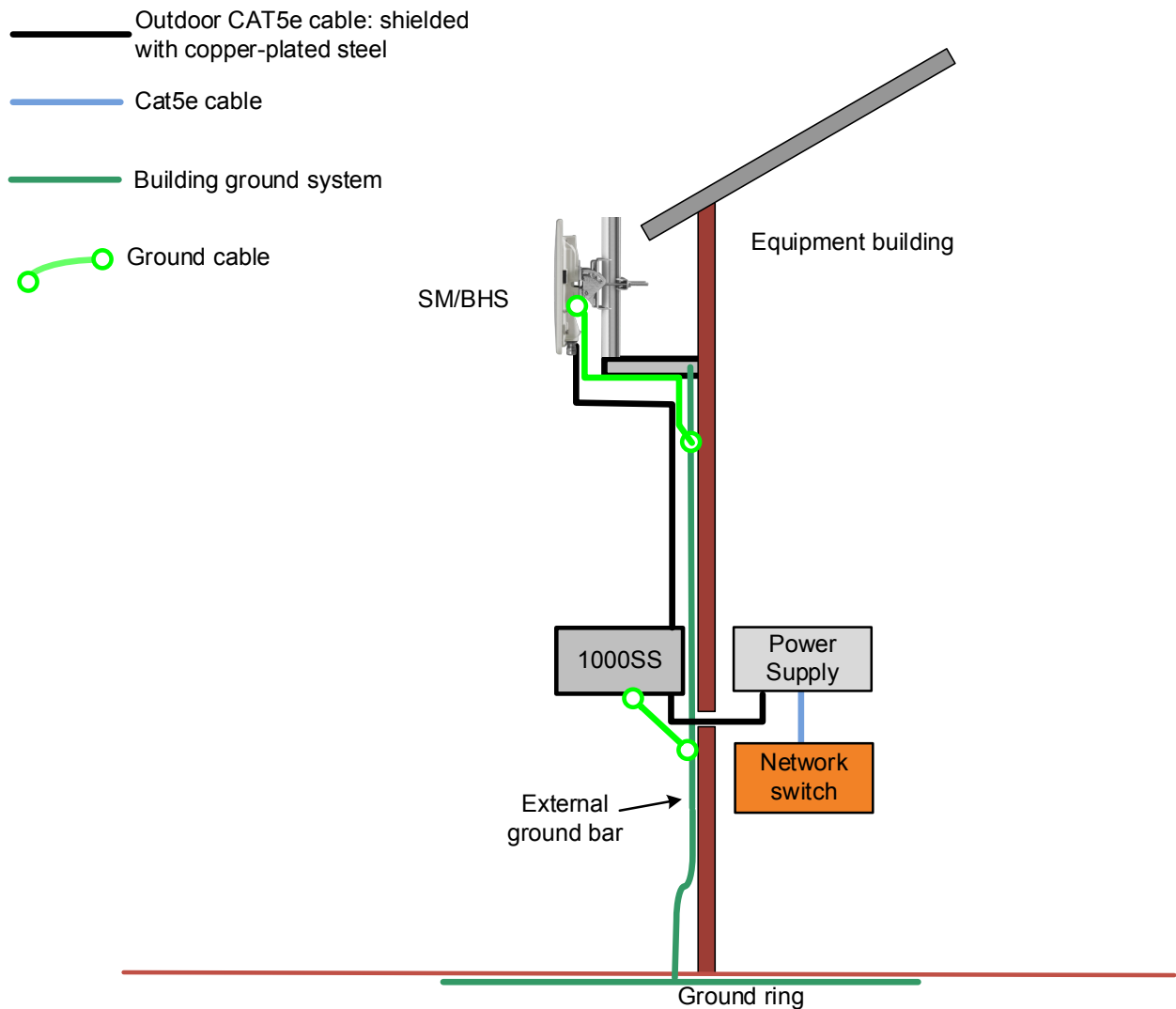
Protection requirements for a wall installation

If the ODU is to be mounted on the wall of a building, then in addition to the general protection requirements (above), the following requirements must be observed:

- The equipment must be lower than the top of the building or its lightning air terminal.
- The building must be correctly grounded.

Schematic examples of wall installations are shown in [Figure 49](#).

Figure 49 Grounding and lightning protection on wall

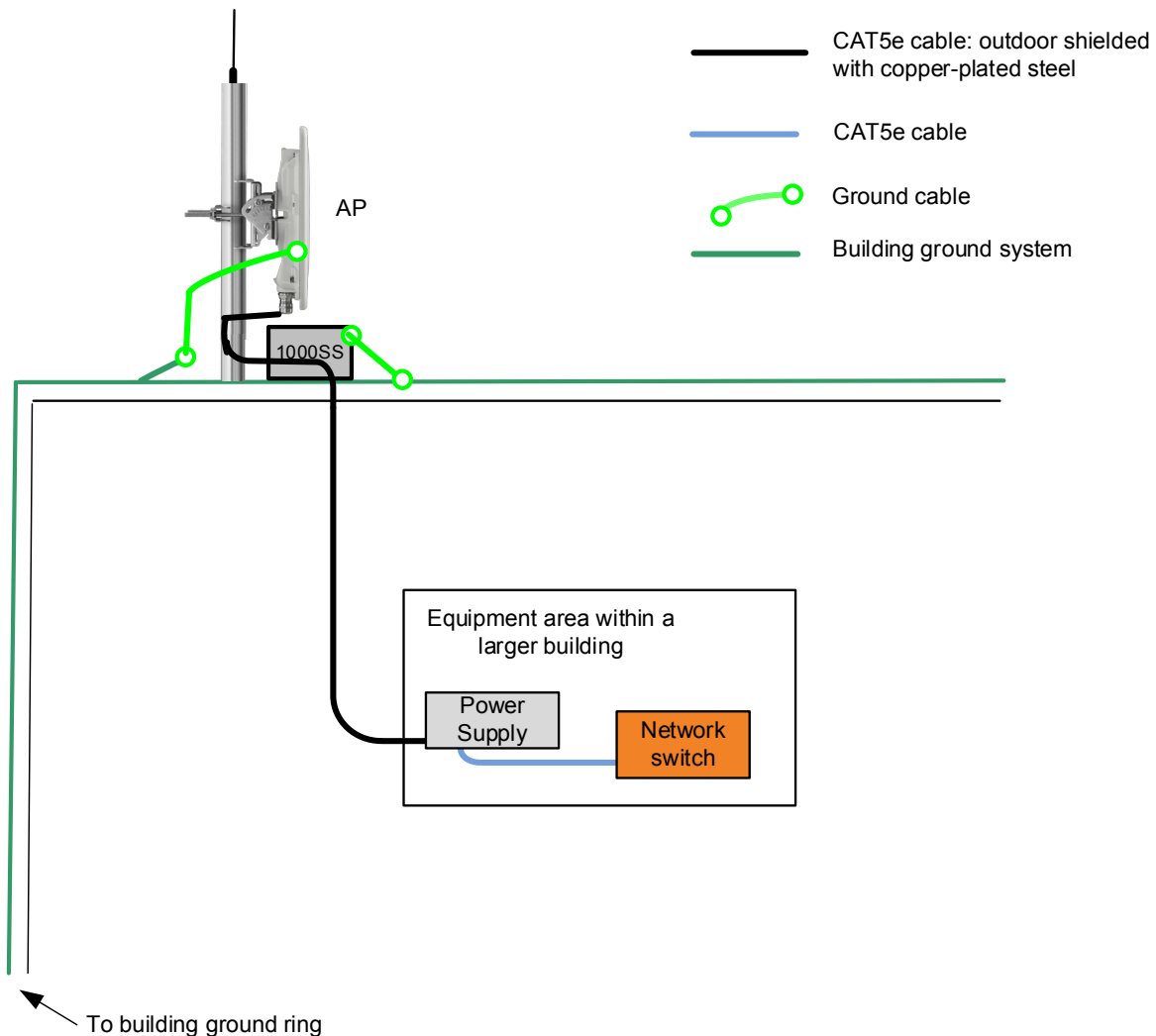


Protection requirements on a multifloor building

If the ODU is to be mounted on a high rise building, it is likely that cable entry is at roof level (Figure 29) and the equipment room is several floors below. The following additional requirements must be observed:

- The ODU must be below the lightning terminals and finials.
- A grounding conductor must be installed around the roof perimeter to form the main roof perimeter lightning protection ring.
- Air terminals are typically installed along the length of the main roof perimeter lightning protection ring typically every 6.1m (20ft).
- The main roof perimeter lightning protection ring must contain at least two down conductors connected to the grounding electrode system. The down conductors should be physically separated from one another, as far as practical.

Figure 50 Grounding and lightning protection on building



Installing the copper Cat5e Ethernet interface

To install the copper Cat5e Ethernet interface, use the following procedures:

- [Install the main drop cable](#) on page 6-17
 - [Install the bottom LPU to PSU drop cable](#) on page 6-19
 - [Installing external antennas to a connectorized ODU](#) on page 6-21
-

**Caution**

To avoid damage to the installation, do not connect or disconnect the drop cable when power is applied to the PSU or network terminating equipment.

**Caution**

Always use Cat5e cable that is gel-filled and shielded with copper-plated steel. Alternative types of Cat5e cable are not supported by Cambium Networks. Cambium Networks supply this cable (Cambium part numbers WB3175 and WB3176), RJ45 connectors (Cambium part number WB3177) and a crimp tool (Cambium part number WB3211). The LPU and grounding kit contains a 600 mm length of this cable.

Install the main drop cable

**Warning**

The metal screen of the drop cable is very sharp and may cause personal injury.

- ALWAYS wear cut-resistant gloves (check the label to ensure they are cut resistant).
 - ALWAYS wear protective eyewear.
 - ALWAYS use a rotary blade tool to strip the cable (DO NOT use a bladed knife).
-

**Warning**

Failure to obey the following precautions may result in injury or death:

- Use the proper hoisting grip for the cable being installed. If the wrong hoisting grip is used, slippage or insufficient gripping strength will result.
 - Do not reuse hoisting grips. Used grips may have lost elasticity, stretched, or become weakened. Reusing a grip can cause the cable to slip, break, or fall.
 - The minimum requirement is one hoisting grip for each 60 m (200 ft) of cable.
-

Cut to length and fit hoisting grips

- 1 Cut the main drop cable to length from the top LPU to the bottom LPU.
- 2 Slide one or more hoisting grips onto the top end of the drop cable.
- 3 Secure the hoisting grip to the cable using a special tool, as recommended by the manufacturer.

Terminate with RJ45 connectors



Caution

Check that the crimp tool matches the RJ45 connector, otherwise the cable or connector may be damaged.

- 1 Strip the cable outer sheath and fit the RJ45 connector load bar.
- 2 Fit the RJ45 connector housing as shown. To ensure there is effective strain relief, locate the cable inner sheath under the connector housing tang.

Table 71 RJ45 connector and cable color code

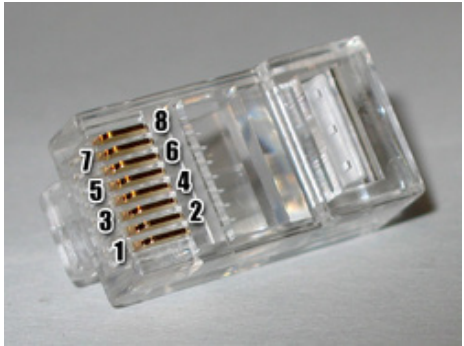
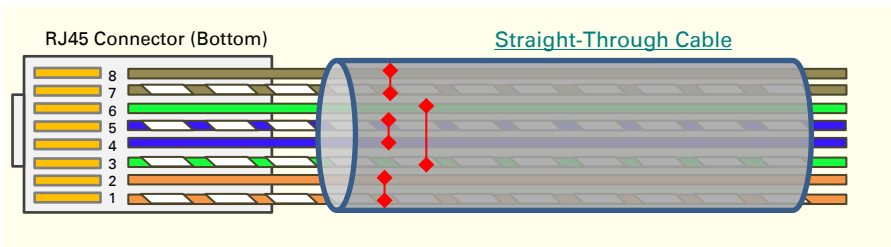
Pin	Color (Supplied cable)	Color (Conventional)	Pins on plug face
1	Light Orange	White/Orange	
2	Orange	Orange	
3	Light Green	White/Green	
4	Blue	Blue	
5	Light Blue	White/Blue	
6	Green	Green	
7	Light Brown	White/Brown	
8	Brown	Brown	

Figure 51 RJ45 cable

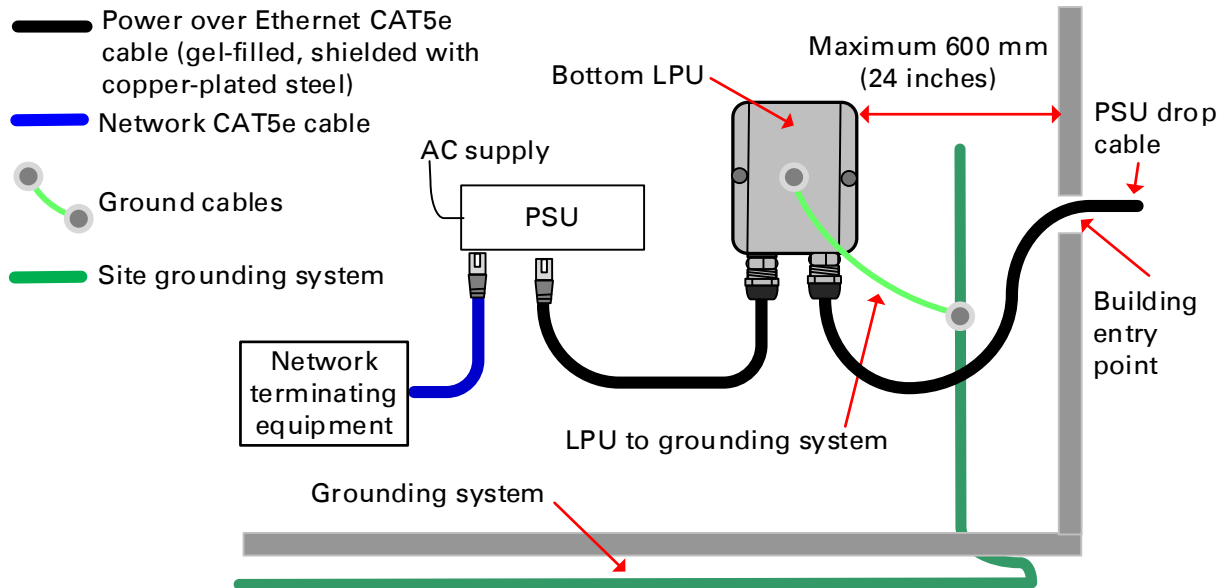


Install the bottom LPU to PSU drop cable

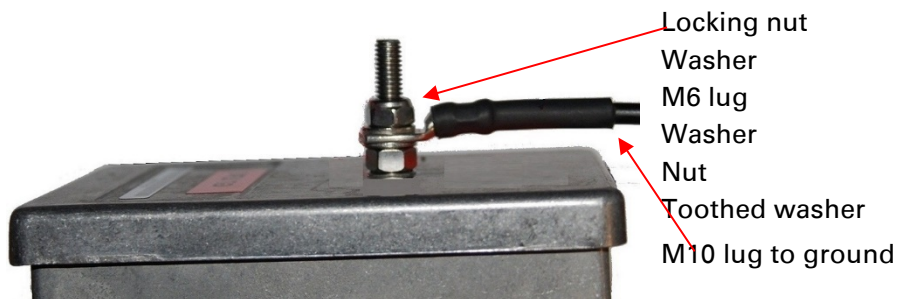
Install the bottom LPU

Install the bottom LPU, ground it, and connect it to the main drop cable.

- 1 Select a mounting point for the bottom LPU within 600 mm (24 in) of the building entry point. Mount the LPU vertically with cable glands facing downwards.



- 2 Connect the main drop cable to the bottom LPU.
- 3 Fasten one ground cable to the bottom LPU using the M6 (small) lug. Tighten both nuts to a torque of 5 Nm (3.9 lb ft):



- 4 Select a building grounding point near the LPU bracket. Remove paint from the surface and apply anti-oxidant compound. Fasten the LPU ground cable using the M10 (large) lug.

Install the LPU to PSU drop cable

Use this procedure to terminate the bottom LPU to PSU drop cable with RJ45 connectors at both ends, and with a cable gland at the LPU end.



Warning

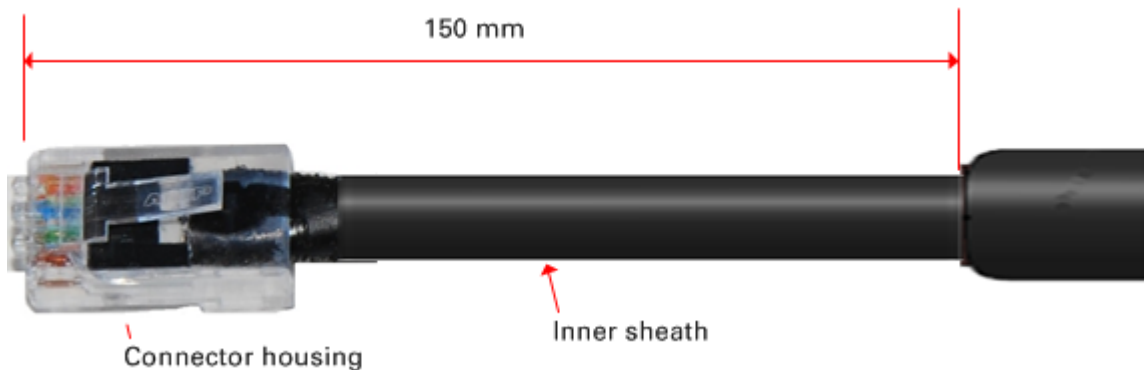
The metal screen of the drop cable is very sharp and may cause personal injury. ALWAYS wear cut-resistant gloves (check the label to ensure they are cut resistant). ALWAYS wear protective eyewear. ALWAYS use a rotary blade tool to strip the cable, not a bladed knife.



Caution

Check that the crimp tool matches the RJ45 connector, otherwise the cable or connector may be damaged.

- 1 Cut the drop cable to the length required from bottom LPU to PSU.
- 2 **At the LPU end only:**
 - Fit one cable gland and one RJ45 connector by following the procedure [Terminate with RJ45 connectors](#) on page 6-18.
 - Connect this cable and gland to the bottom LPU.
- 3 **At the PSU end only:** Do not fit a cable gland. Strip the cable outer sheath and fit the RJ45 connector load bar. Fit the RJ45 connector housing. To ensure there is effective strain relief, locate the cable inner sheath under the connector housing tang:

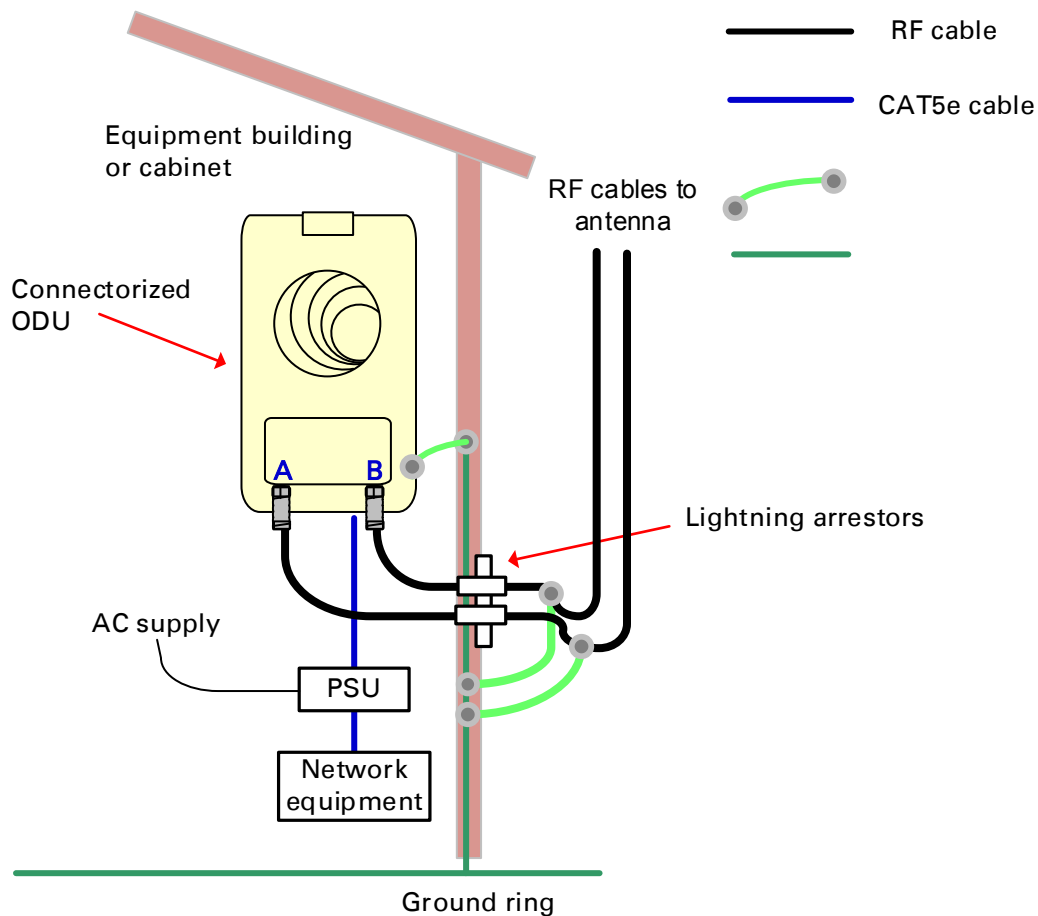


Installing external antennas to a connectorized ODU

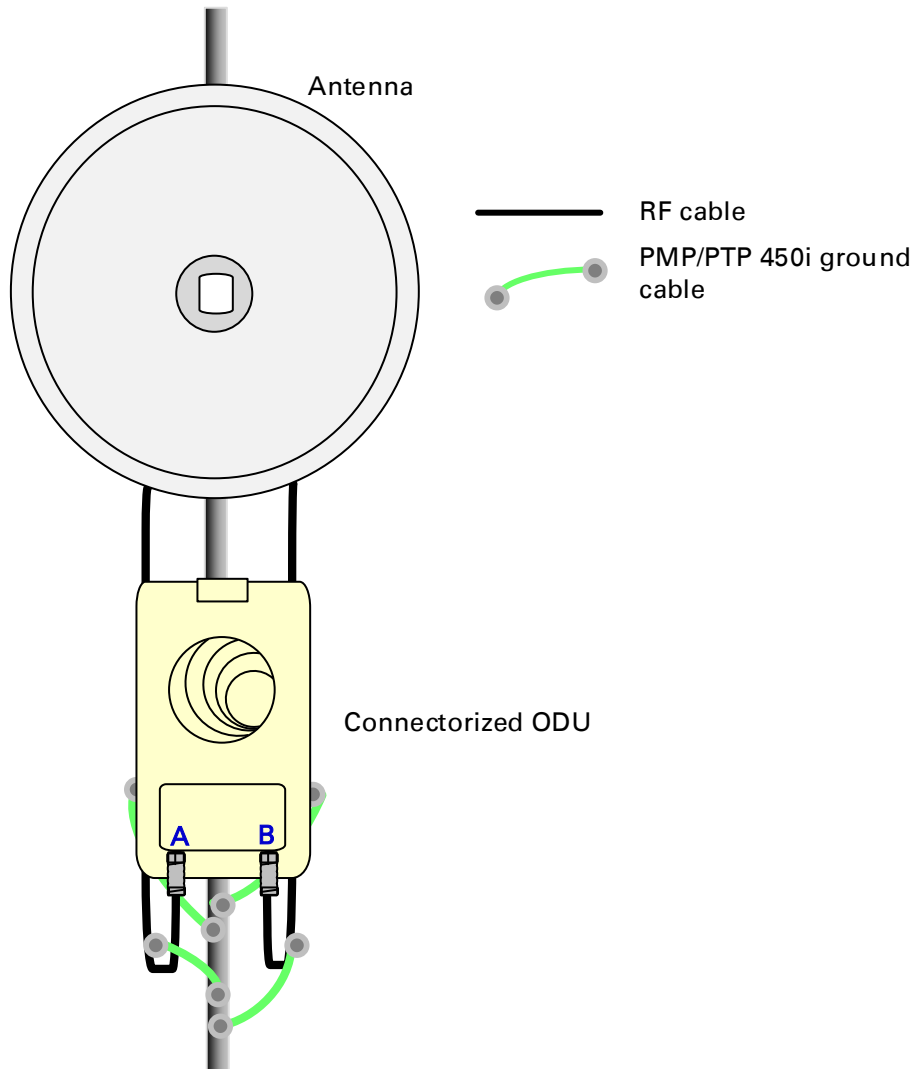
PMP 450i Series

To mount and connect an external antenna to the connectorized ODU, proceed as follows:

- 1 Mount the antenna(s) according to manufacturer's instructions.
- 2 Connect the ODU A and B interfaces to the antenna(s) with RF cable of type LMR-400 (Cambium part numbers 30010194001 and 30010195001) and N type connectors (Cambium part number 09010091001). Tighten the N type connectors to a torque setting of 1.7 Nm (1.3 lb ft).
- 3 If the ODU is mounted indoors, install lightning arrestors at the building entry point:
- 4 Form drip loops near the lower ends of the antenna cables. These ensure that water is not channeled towards the connectors.
- 5 If the ODU is mounted outdoors, weatherproof the N type connectors (when antenna alignment is complete) using PVC tape and self-amalgamating rubber tape.
- 6 Weatherproof the antenna connectors in the same way (unless the antenna manufacturer specifies a different method).



- 7 Ground the antenna cables to the supporting structure within 0.3 meters (1 foot) of the ODU and antennas using the Cambium grounding kit (part number 01010419001):



- 8 Fix the antenna cables to the supporting structure using site approved methods. Ensure that no undue strain is placed on the ODU or antenna connectors. Ensure that the cables do not flap in the wind, as flapping cables are prone to damage and induce unwanted vibrations in the supporting structure.



Note

A video on weatherproofing procedure can be found at:

<https://www.youtube.com/watch?v=a-twPfcVq4A>

Assembling the PMP 450i 5.x GHz AP sector antenna and attaching to the radio

To assemble a PMP 450i Series AP antenna, perform the following steps.



Note

Cambium recommends to assemble the antenna, attach the AP and cabling, and to seal the RF connections before installing the unit at the deployment site.

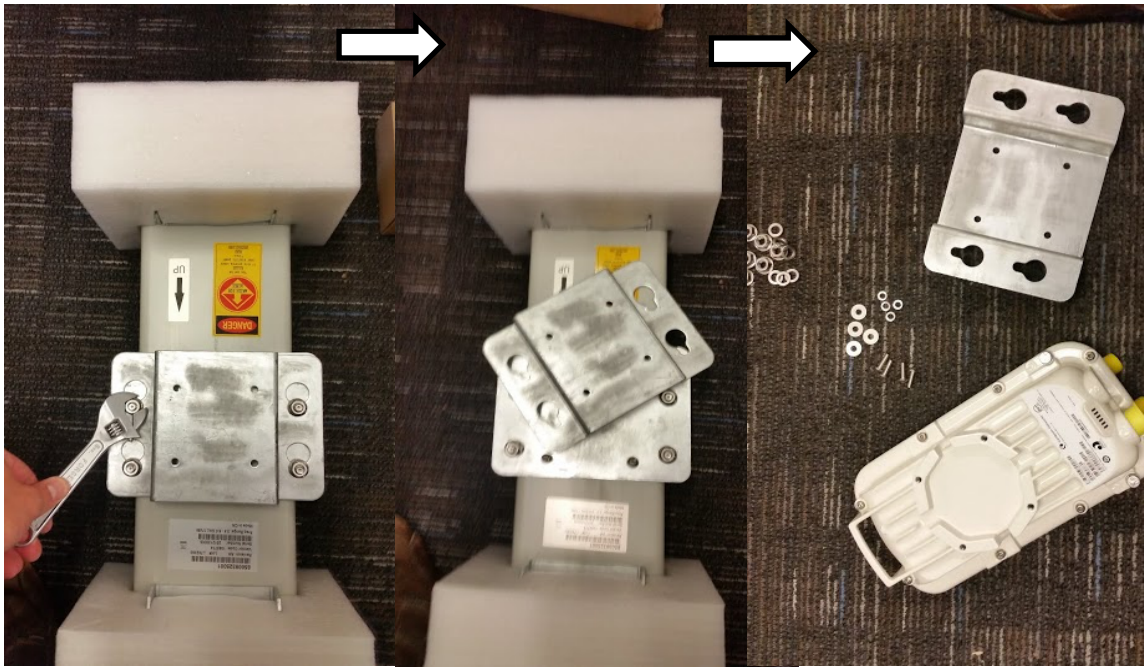
- 1 Inventory the parts to ensure that you have them all before you begin. The full set of parts is shown below.

Figure 52 AP antenna parts



- 2 Remove top plate from the antenna as shown in [Figure 53](#).

Figure 53 Antenna top plate



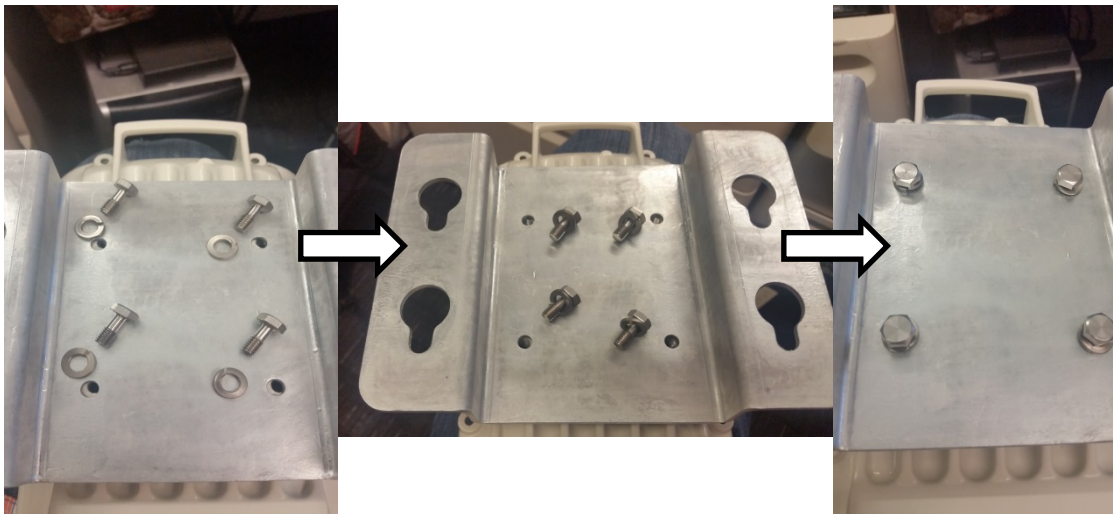
- 3 Attach the antenna plate to the AP as shown in [Figure 54](#).



Note

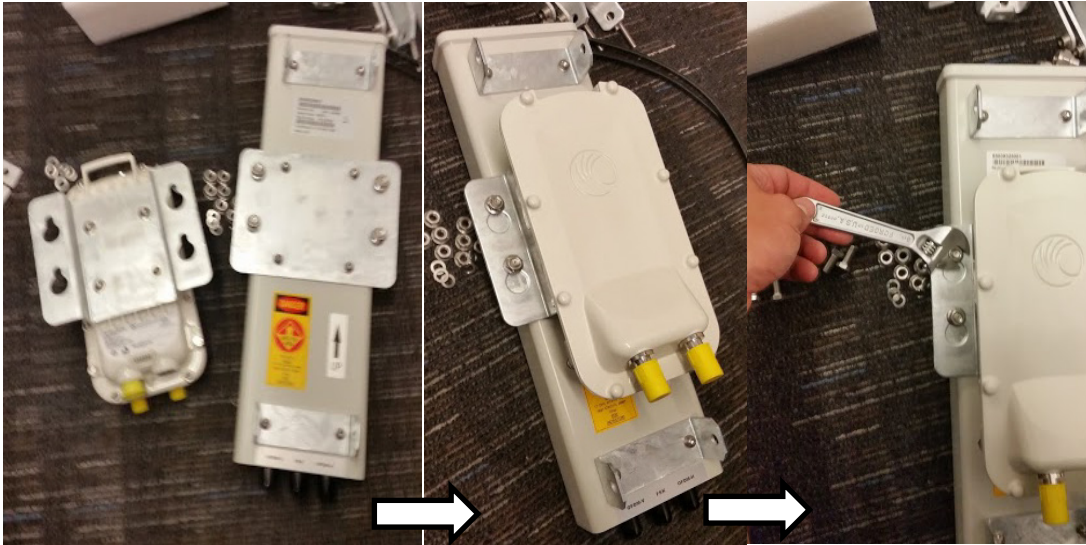
Please use the four “thin neck” M6 bolts and split washers provided with the connectorized units rather than the ones provided in the antenna kit.

Figure 54 Attaching antenna plate to the AP



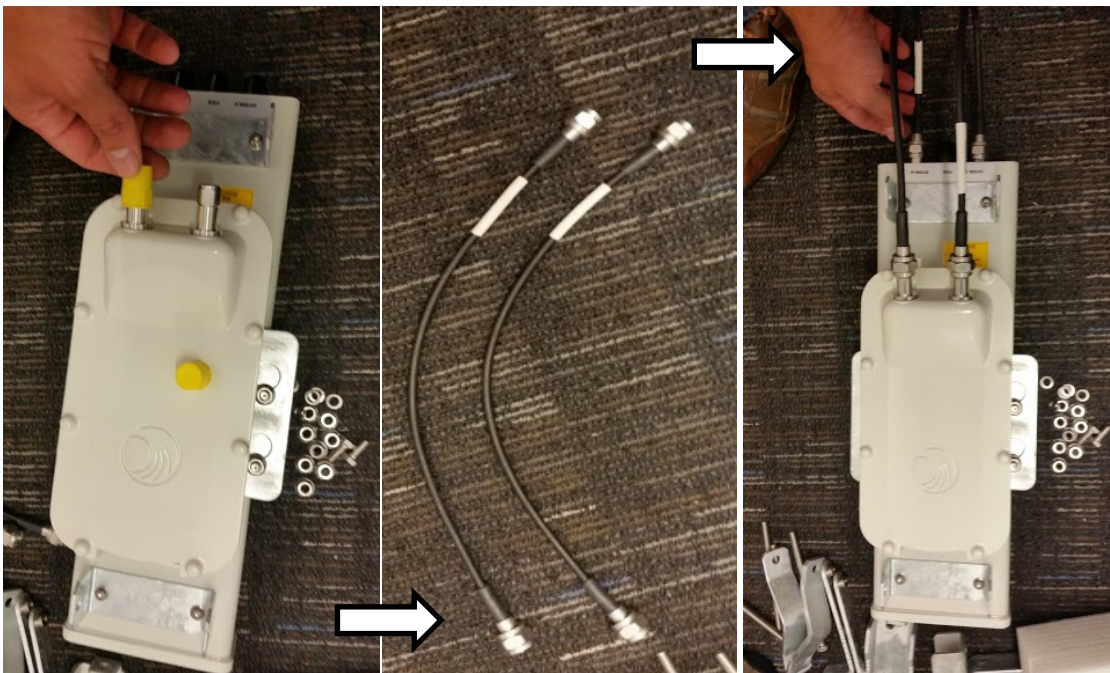
- 4 Attach the plate mounted AP to the antenna and tighten the (4) serrated flange nuts using a spanner wrench

Figure 55 Attaching the plate



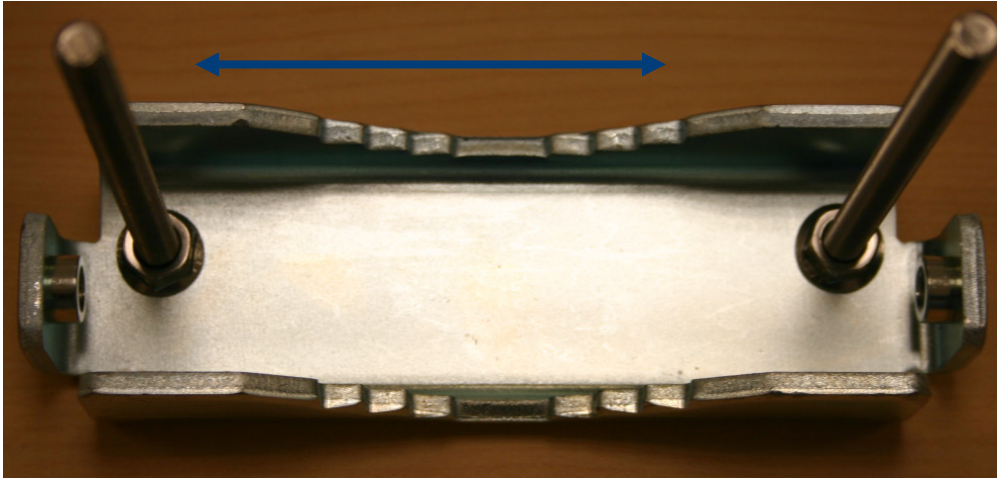
- 5 Connect the port A of AP to vertical and port B of AP to horizontal polarization interfaces of the antenna with RF cable. Tighten the N type connectors to a torque setting of 1.7 Nm (1.3 lb ft).

Figure 56 Connect the port A and B to the PMP 450i AP



- 6 Assembling the upper bracket by attaching the (2) 7" hex bolts to the bracket using (2) serrated flange nuts

Figure 57 AP antenna upper bracket assembly



- 7 Attach the upper bracket to the adjustment arms using (2) hex bolts, (2) flat washers and (2) lock washers. Feed the bolt through the lock washer then flat washer, then thread the bolt into the upper bracket's threaded receptacle.

Figure 58 AP antenna upper bracket attached to upper adjustment arms

