Aerohive Deployment Guide

For HiveAP and HiveManager Devices

Aerohive Technical Publications

Copyright Notice

HiveAP Compliance Information

Federal Communication Commission Interference Statement

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 in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna

- Increase the separation between the equipment and receiver

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected

- Consult the dealer or an experienced radio/TV technician for help

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Important: FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 centimeters (8 inches) between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Wireless 5 GHz Band Statements

High power radars are allocated as primary users (meaning they have priority) of the 5250-5350 MHz and 5650-5850 MHz bands. These radars could cause interference and/or damage to the HiveAP when used in Canada.

The term "IC" before the radio certification number only signifies that Industry Canada technical specifications were met.

Industry Canada - Class B

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus as set out in the interference-causing equipment standard entitled "Digital Apparatus," ICES-003 of Industry Canada.

Cet appareil numérique respecte les limites de bruits radioélectriques applicables aux appareils numériques de Classe B prescrites dans la norme sur le matériel brouilleur: "Appareils Numériques," NMB-003 édictée par l'Industrie.

Wi-Fi Certification

The Wi-Fi CERTIFIED™ Logo is a certification mark of the Wi-Fi Alliance®. The Aerohive HiveAP 20 ag has been certified for WPA™, WPA2™, WMM® (Wi-Fi Multimedia™), WMM Power Save, and the following types of EAP (Extensible Authentication Protocol):

- EAP-TLS

- EAP-TTLS/MSCHAPv2

- PEAPv0/EAP-MSCHAPv2

- PEAPv1/EAP-GTC

- EAP-SIM

EC Conformance Declaration

Marking by the above symbol indicates compliance with the Essential Requirements of the R&TTE Directive of the European Union (1999/5/EC). This equipment meets the following conformance standards:

- EN 60950-1 (IEC 60950-1) - Product Safety

- EN 301 893 - Technical requirements for 5 GHz radio equipment

- EN 300 328 - Technical requirements for 2.4 GHz radio equipment

- EN 301 489-1 / EN 301 489-17 - EMC requirements for radio equipment

Countries of Operation and Conditions of Use in the European Community

HiveAPs are intended to be operated in all countries of the European Community. Requirements for indoor vs. outdoor operation, license requirements and allowed channels of operation apply in some countries as described below.

- Before operating a HiveAP, the admin or installer must properly enter the current country of operation in the command line interface as described in .
- HiveAPs automatically limit the allowable channels determined by the current country of operation. Incorrectly entering the country of operation might result in illegal operation and cause harmful interference to other systems. The admin is obligated to ensure HiveAPs are operating according to the channel limitations, indoor/outdoor restrictions and license requirements for each European Community country as described in this section.
- HiveAPs can be operated indoors or outdoors in all countries of the European Community using the 2.4 GHz band: Channels 1 - 13, except where noted below.
  - In Italy, you must apply for a license from the national spectrum authority to operate a HiveAP outdoors.
  - In Belgium outdoor operation is only permitted using the 2.46 - 2.4835 GHz band: Channel 13.
  - In France outdoor operation is only permitted using the 2.4 - 2.454 GHz band: Channels 1 - 7.
- HiveAPs are restricted to indoor use when operated in the European Community using the 5.15 - 5.25 GHz band: Channels 36, 40, 44, 48. Because the frequency ranges 5.25 – 5.35 and 5.47 – 5.725 are affected by DFS (Dynamic Frequency Selection), HiveAPs block channels 52, 56, 60, 64, and 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140.
- The 5 GHz Turbo Mode feature is not allowed for operation in any European Community country. You can find the current setting for this feature in two places. In the HiveManager GUI, click **Configuration** > **Network Objects**> **Radio Profiles** > *profile* > **Advanced**. In the HiveAP CLI, enter this command: **show radio profile** *profile*. By default, Turbo Mode is disabled.

Declaration of Conformity in Languages of the European Community

English	Hereby, Edgecore, declares that this Radio LAN device is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.
Finnish	Valmistaja Edgecore vakuuttaa täten että Radio LAN device tyyppinen laite on direktiivin 1999/5/EY oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen.
Dutch	Hierbij verklaart Edgecore dat het toestel Radio LAN device in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 1999/5/EG. Bij deze Edgecore dat deze Radio LAN device voldoet aan de essentiële eisen en aan de overige relevante bepalingen van Richtlijn 1999/5/EC.
French	Par la présente Edgecore déclare que cet appareil Radio LAN est conforme aux exigences essentielles et aux autres dispositions relatives à la directive 1999/5/CE.
Swedish	Härmed intygar Edgecore att denna Radio LAN device står I överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 1999/5/EG.
Danish	Undertegnede Edgecore erklærer herved, at følgende udstyr Radio LAN device overholder de væsentlige krav og øvrige relevante krav i direktiv 1999/5/EF.
German	Hiermit erklärt Edgecore, dass sich dieser/diese/dieses Radio LAN device in Übereinstimmung mit den grundlegenden Anforderungen und den anderen relevanten Vorschriften der Richtlinie 1999/5/EG befindet". (BMWi) Hiermit erklärt Edgecore die Übereinstimmung des Gerätes Radio LAN device mit den grundlegenden Anforderungen und den anderen relevanten Festlegungen der Richtlinie 1999/5/EG. (Wien)
Greek	με την παρουσα Edgecore δηλωνει οτι radio LAN device συμμορφωνεται προς τισ ουσιωδεισ απαιτησεισ και τισ λοιπεσ σΧετικεσ διαταξεισ τησ οδηγιασ 1999/5/εκ
Italian	Con la presente Edgecore dichiara che questo Radio LAN device è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 1999/5/CE.
Spanish	Por medio de la presente Manufacturer declara que el Radio LAN device cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 1999/5/CE.
Portuguese	Manufacturer declara que este Radio LAN device está conforme com os requisitos essenciais e outras disposições da Directiva 1999/5/CE.

HiveAP 20 ag Safety Compliance

Power Cord Safety

Please read the following safety information carefully before installing a HiveAP.

Warning: Installation and removal of HiveAPs must be carried out by qualified personnel only.

- HiveAPs must be connected to an earthed (grounded) outlet to comply with international safety standards.
- Do not connect HiveAPs to an A.C. outlet (power supply) without an earth (ground) connection.

- The appliance coupler (the connector to the unit and not the wall plug) must have a configuration for mating with an EN 60320/IEC 320 appliance inlet.
- The socket outlet must be near the HiveAP and easily accessible. You can only remove power from a HiveAP by disconnecting the power cord from the outlet.
- HiveAPs operate under SELV (Safety Extra Low Voltage) conditions according to IEC 60950. The conditions are only maintained if the equipment to which they are connected also operates under SELV conditions.
- A HiveAP receiving power through its PoE (Power over Ethernet) interface must be in the same building as the equipment from which it receives power.

France and Peru only:

HiveAPs cannot be powered from IT* supplies. If your supplies are of IT type, then a HiveAP must be powered by 230 V (2P+T) via an isolation transformer ratio 1:1, with the secondary connection point labelled Neutral, connected directly to earth (ground).

* Impédance à la terre

Important! Before making connections, make sure you have the correct cord set. Check it (read the label on the cable) against the description on the following page.

Power Cord Set	
U.S.A. and Canada	The cord set must be UL-approved and CSA certified.
	Minimum specifications for the flexible cord: - No. 18 AWG not longer than 2 meters, or 16 AWG - Type SV or SJ - 3-conductor
	The cord set must have a rated current capacity of at least 10 A.
	The attachment plug must be an earth-grounding type with NEMA 5-15P (15 A, 125 V) or NEMA 6-15 (15 A, 250 V) configuration.
Denmark	The supply plug must comply with Section 107-2-D1, Standard DK2-1a or DK2-5a.
Switzerland	The supply plug must comply with SEV/ASE 1011.
U.K.	The supply plug must comply with BS1363 (3-pin 13 A) and be fitted with a 5 A fuse that complies with BS1362.
	The mains cord must be <HAR> or <BASEC> marked and be of type HO3VVF3GO.75 (minimum).
Europe	The supply plug must comply with CEE7/7 ("SCHUKO").
	The mains cord must be <HAR> or <BASEC> marked and be of type HO3VVF3GO.75 (minimum).
	IEC-320 receptacle.

Veuillez lire attentivement les informations de sécurité relatives à l'installation d'un point d'accès HiveAP.

Avertissement: L'installation et la dépose de points d'accès HiveAP doivent être effectuées uniquement par un personnel qualifié.

- Les points d'accès HiveAP doivent être connectés sur le secteur par une prise électrique munie de terre (masse) afin de respecter les standards internationaux de sécurité.
- Ne jamais connecter des points d'accès HiveAP à une alimentation électrique non-pourvue de terre (masse).
- Le boitier d'alimentation (connecté directement au point d'accès) doit être compatible avec une entrée électrique de type EN 60320/IEC 320.
- La prise secteur doit se trouver à proximité du point d'accès HiveAP et facilement accessible. Vous ne pouvez mettre hors tension un point d'accès HiveAP qu'en débranchant son alimentation électrique au niveau de cette prise.

- Pour des raisons de sécurité, le point d'accès HiveAP fonctionne à une tension extrêmement basse, conformément à la norme IEC 60950. Les conditions de sécurité sont valables uniquement si l'équipement auquel le point d'accès HiveAP est raccordé fonctionne également selon cette norme.
- Un point d'accès HiveAP alimenté par son interface réseau Ethernet en mode POE (Power over Ethernet) doit être physiquement dans le même bâtiment que l'équipement réseau qui lui fournit l'électricité.

France et Pérou uniquement:

Un point d'accès HiveAP ne peut pas être alimenté par un dispositif à impédance à la terre. Si vos alimentations sont du type impédance à la terre, alors le point d'accès HiveAP doit être alimenté par une tension de 230 V (2P+T) via un transformateur d'isolement à rapport 1:1, avec le neutre connecté directement à la terre (masse).

Cordon électrique - Il doit être agréé dans le pays d'utilisation	
Etats-Unis et Canada	Le cordon doit avoir reçu l'homologation des UL et un certificat de la CSA.
	Les spécifications minimales pour un cable flexible - AWG No. 18, ou AWG No. 16 pour un cable de longueur inférieure à 2 mètres. - Type SV ou SJ - 3 conducteurs
	Le cordon doit être en mesure d'acheminer un courant nominal d'au moins 10 A.
	La prise femelle de branchement doit être du type à mise à la terre (mise à la masse) et respecter la configuration NEMA 5-15P (15 A, 125 V) ou NEMA 6-15P (15 A, 250 V).
Danemark	La prise mâle d'alimentation doit respecter la section 107-2 D1 de la norme DK2 1a ou DK2 5a.
Suisse	La prise mâle d'alimentation doit respecter la norme SEV/ASE 1011.
Europe	La prise secteur doit être conforme aux normes CEE 7/7 ("SCHUKO"). LE cordon secteur doit porter la mention <HAR> ou <BASEC> et doit être de type HO3VVF3GO.75 (minimum).

Bitte unbedingt vor dem Einbauen des HiveAP die folgenden Sicherheitsanweisungen durchlesen.

Warnung: Die Installation und der Ausbau des Geräts darf nur durch Fachpersonal erfolgen.

- Das Gerät sollte nicht an eine ungeerdete Wechselstromsteckdose angeschlossen werden.
- Das Gerät muß an eine geerdete Steckdose angeschlossen werden, welche die internationalen Sicherheitsnormen erfüllt.
- Der Gerätestecker (der Anschluß an das Gerät, nicht der Wandsteckdosenstecker) muß einen gemäß EN 60320/IEC 320 konfigurierten Geräteeingang haben.
- Die Netzsteckdose muß in der Nähe des Geräts und leicht zugänglich sein. Die Stromversorgung des Geräts kann nur durch Herausziehen des Gerätenetzkabels aus der Netzsteckdose unterbrochen werden.
- Der Betrieb dieses Geräts erfolgt unter den SELV-Bedingungen (Sicherheitskleinstspannung) gemäß IEC 60950. Diese Bedingungen sind nur gegeben, wenn auch die an das Gerät angeschlossenen Geräte unter SELV-Bedingungen betrieben werden.

Stromkabel. Dies muss von dem Land, in dem es benutzt wird geprüft werden:	
U.S.A. und Kanada	Der Cord muß das UL gepruft und war das CSA beglaubigt.
	Das Minimum spezifikation fur der Cord sind: - Nu. 18 AWG - nicht mehr als 2 meter, oder 16 AWG. - Der typ SV oder SJ - 3-Leiter
	Der Cord muß haben eine strombelastbarkeit aus wenigstens 10 A.
	Dieser Stromstecker muß hat einer erdschluss mit der typ NEMA 5-15P (15A, 125V) oder NEMA 6-15P (15A, 250V) konfiguration.
Danemark	Dieser Stromstecker muß die ebene 107-2-D1, der standard DK2-1a oder DK2-5a Bestimmungen einhalten.
Schweiz	Dieser Stromstecker muß die SEV/ASE 1011Bestimmungen einhalten.
Europe	Europe Das Netzkabel muß vom Typ HO3VVF3GO.75 (Mindestanforderung) sein und die Aufschrift <HAR> oder <BASEC> tragen. Der Netzstecker muß die Norm CEE 7/7 erfüllen ("SCHUKO").

Liability Disclaimer

Installation of Aerohive equipment must comply with local and national electrical codes and with other regulations governing this type of installation. Aerohive Networks, its channel partners, resellers, and distributors assume no liability for personal injury, property damage, or violation of government regulations that may arise from failing to comply with the instructions in this guide and appropriate electrical codes.

Chapter 3   The HiveAP 28 Outdoor Platform

The Aerohive HiveAP 28 is a new generation wireless access point that is customized for outdoor use. It is mountable in any direction and on any hard surface, post, or wire strand. It can receive power either through an Ethernet cable or power cord.

Note: Do not open the HiveAP 28 chassis. There are no serviceable parts inside.

This guide combines product information, installation instructions, and configuration examples for both the HiveAP and HiveManager platforms. This chapter covers the following topics relating to the HiveAP 28:

HiveAP Product Overview

The HiveAP 28 is a multi-channel wireless AP (access point) for outdoor use. It is compatible with IEEE 802.11b/g (2.4 GHz) and IEEE 802.11a (5 GHz) standards and supports a variety of Wi-Fi (wireless fidelity) security protocols, including WPA (Wi-Fi Protected Access) and WPA2.

You can see the hardware components on the HiveAP 28 in Figure 1. Each component is described in Table 1.
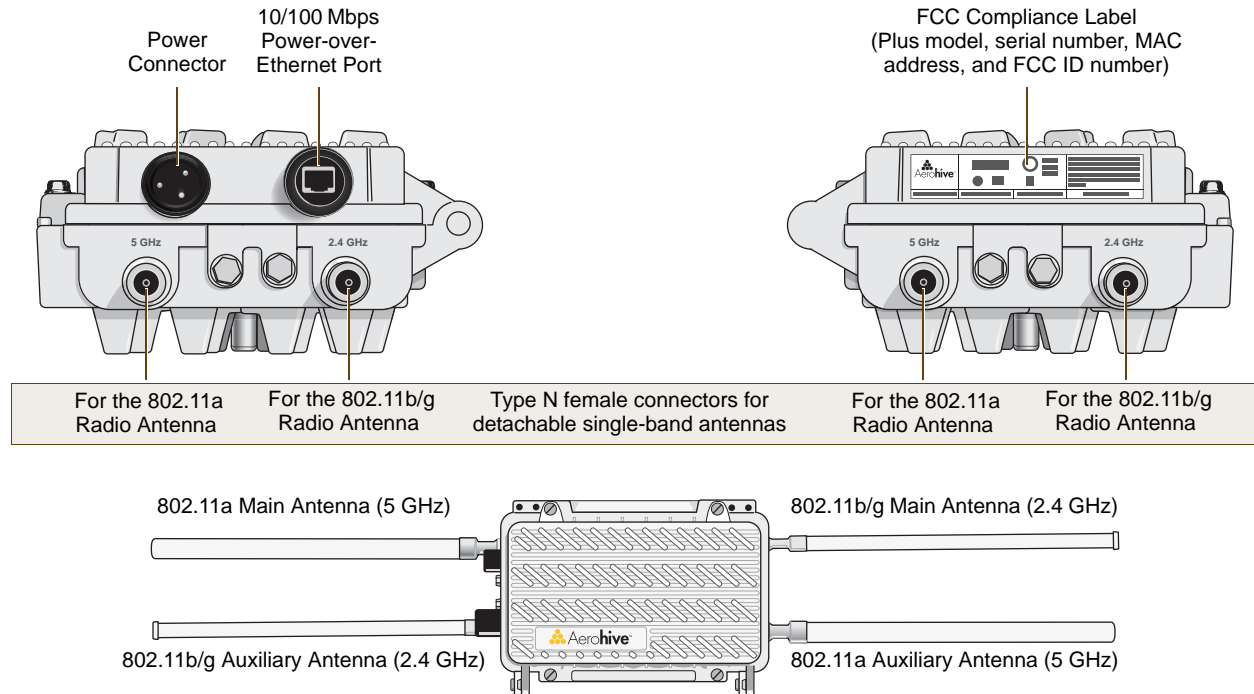
Figure 1   *HiveAP 28 Hardware Components*

Power Connector

10/100 Mbps Power-over-Ethernet Port

FCC Compliance Label
(Plus model, serial number, MAC address, and FCC ID number)

5 GHz   2.4 GHz   5 GHz   2.4 GHz

| For the 802.11a Radio Antenna | For the 802.11b/g Radio Antenna | Type N female connectors for detachable single-band antennas | For the 802.11a Radio Antenna | For the 802.11b/g Radio Antenna |

802.11a Main Antenna (5 GHz)   802.11b/g Main Antenna (2.4 GHz)

802.11b/g Auxiliary Antenna (2.4 GHz)   802.11a Auxiliary Antenna (5 GHz)

Table 1   *HiveAP 28 Component Descriptions*

| Component	Description
Detachable Single-Band Antennas	The two pairs of detachable omnidirectional dipole antennas operate at two radio frequencies: one pair at 2.4 GHz (for IEEE 802.11b/g) and the other at 5 GHz (for IEEE 802.11a). For details, see "Antennas" on page 37.
Type N Connectors (Female)	Attach antennas to the HiveAP 28 through these connectors. For details, see "Attaching Antennas" on page 42.
Waterproof Power Connector	Using the power connector is one of two methods through which you can power the HiveAP 28. To connect it to a 100 – 240-volt AC power source, use the power cable that ships with the product as an extra option. Because the HiveAP does not have an on/off switch, connecting it to a power source automatically powers on the device. The power source must have a readily accessible service disconnect switch incorporated into the fixed wiring installation so that you have the ability to turn the power on and off. (The other method that the HiveAP can obtain power is through its PoE port.)

Component	Description
10/100 Mbps PoE Port	The 10/100-Mbps Ethernet port supports IEEE 802.3af PoE (Power over Ethernet) and receives RJ-45 connectors. The HiveAP can receive its power through an Ethernet connection to PSE (power sourcing equipment) that is 802.3af-compatible. (If you connect the HiveAP to a power source through the power connector and PoE port simultaneously, the device draws power through the power connector and automatically disables PoE.)
	The HiveAP 28 can also connect to the wired network or to a wired device (such as a security camera) through this port. It is compatible with 10/100Base-T/TX and automatically negotiates half- and full-duplex connections with the connecting device. It is autosensing and adjusts to straight-through and cross-over Ethernet cables automatically (MDI/MDI-X). It also automatically adjusts for 802.3af Alternative A and B methods of PoE. For details, see "Ethernet Port".

Ethernet Port

The HiveAP 28 has a 10/100Base-T/TX PoE (Power over Ethernet) port. Its pin assignments follow the TIA/EIA-568-B standard (see Figure 2 on page 26). The PoE port accepts standard types of Ethernet cable—cat3, cat5, cat5e, or cat6—and can receive power over this cable from power sourcing equipment (PSE) that is 802.3af-compatible. Such equipment can be embedded in a switch or router, or it can come from purpose-built devices that inject power into the Ethernet line en route to the HiveAP. Because the PoE port has autosensing capabilities, the wiring termination in the Ethernet cable can be either straight-through or cross-over (MDI/MDI-X). For outdoor deployments use weatherproofed shielded twisted pair (STP) Ethernet cables.

To ensure a waterproof seal for the Ethernet connection, use the RJ-45 connector assembly, which comes in three parts: a compression nut, end cap, and gasket.

Figure 2   Connecting the Ethernet Cable
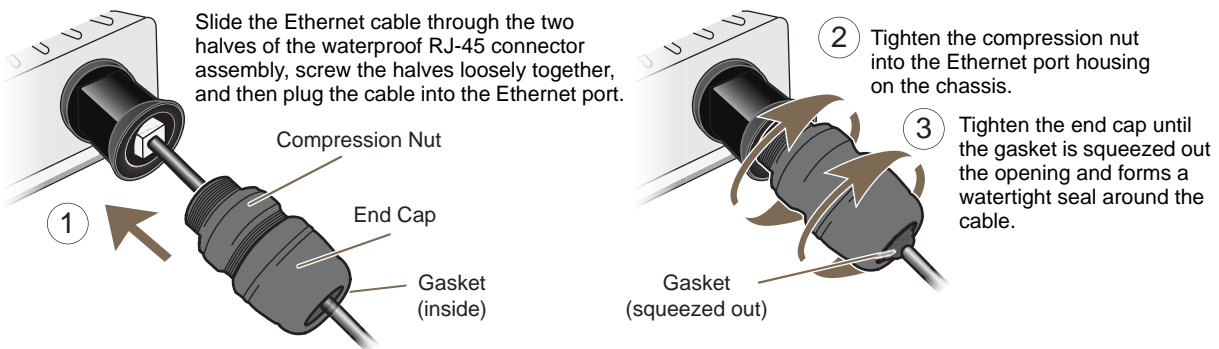
1. Insert one end of the Ethernet cable through the waterproof RJ-45 connector assembly and plug the cable into the Ethernet port.
2. Tighten the compression nut by twisting it clockwise into the Ethernet port housing on the chassis.
3. Tighten the end cap by twisting it clockwise onto the compression nut and tighten until the rubber gasket emerges and wrap itself around the Ethernet cable.

   The Ethernet connection is now sealed and waterproof.

4. Connect the other end of the Ethernet cable to PSE (power sourcing equipment), such as a power injector, if the HiveAP 28 receives power through PoE, or directly to a network device, such as a switch, if it receives power through a power cord.

> *Note: To prevent damage to the HiveAP 28 or power injector when using PoE to provide power, connect the Ethernet cable from the power injector to the HiveAP 28, and connect the injector to a power jack before applying power.*

If the Ethernet cable connects the HiveAP to another device that is indoors, you must install appropriate lightning protection at the point before it enters the building. Failing to do so might cause damage to the equipment as well as serious injury or death.

> *Note: When the HiveAP acts as a mesh point and does not use the Ethernet port, cover the Ethernet port with a connector cap to prevent water intrusion and possible safety hazards.*

Power Connector

The HiveAP 28 can receive power through an Ethernet cable using PoE or through a power cord. Aerohive recommends using either PoE or wiring the power cord directly to a 100 – 240-volt AC power source. Only plug the power cord into an electric outlet when configuring the device before deployment or when testing it in the lab.

> *Note: When the HiveAP receives power through PoE, cover the power connector with a connector cap to prevent water intrusion and possible safety hazards.*

To connect the power cord to the HiveAP 28:

1. Align the slot in the power cord plug with the small tab at the top of the three-pin power connector, and slide the plug firmly over the pins until it is fully seated in the power connector.
2. Slide the cover over the connector and tighten it by turning the cover clockwise.
3. Install a lightning protector between the HiveAP 28 and its power source.
4. When possible, run the cord through a conduit to protect it from the elements. Where the cord is exposed, allow enough slack in it to create a drip loop. Leaving some slack in the cord lets water run away from the connections at each end. Use only a weatherproof power cord, such as the cord that ships with the HiveAP 28.
5. Strip the other end of the power cord and wire it directly to a power source, such as a junction box that has a service disconnect switch that you can use to turn the power on and off. Also, because the HiveAP 28 does not have short-circuit (over current) protection built into it, it relies on the protection provided by the power source to which you connect it. Ensure that the protective device, such as a circuit breaker, is not rated greater than 15A. Furthermore, if you need to install the HiveAP 28 in a wet or damp location, the AC branch circuit that is powering it must be provided with ground fault protection (GFCI), as required by Article 210 of the National Electrical Code (NEC).

> *Note: The HiveAP 28 must be grounded. Do not operate it unless there is a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available.*
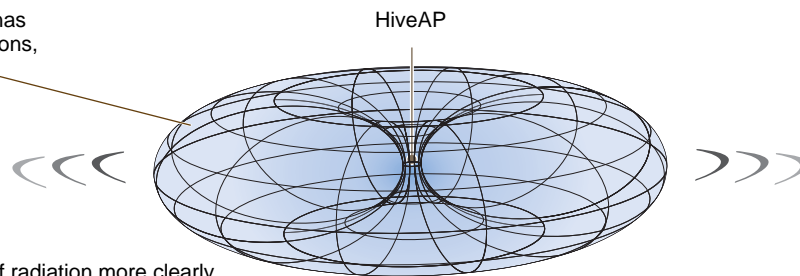
Antennas

The HiveAP 28 includes two detachable single-band antennas with 8dBi gains (802.11b/g) and two detachable single-band antennas with 10dBi gains (802.11a). These antennas are omnidirectional, providing fairly equal coverage in all directions in a toroidal (donut-shaped) pattern around each antenna. When the antennas are vertically positioned, coverage expands primarily on the horizontal plane, extending horizontally much more than vertically. See Figure 3, which shows the toroidal pattern emanating from a single vertically positioned antenna. Note that when high gain antennas are added, the torus shape becomes somewhat elongated or compressed. If the HiveAP 28 is mounted higher than 20 feet the center of the torus curves inward so that the connection quality, directly underneath the center of the HiveAP 28, becomes compromised.

To change coverage to be more vertical than horizontal, position the HiveAP so that the antennas are on a horizontal plane. You can also resize the area of coverage by increasing or decreasing the signal strength.

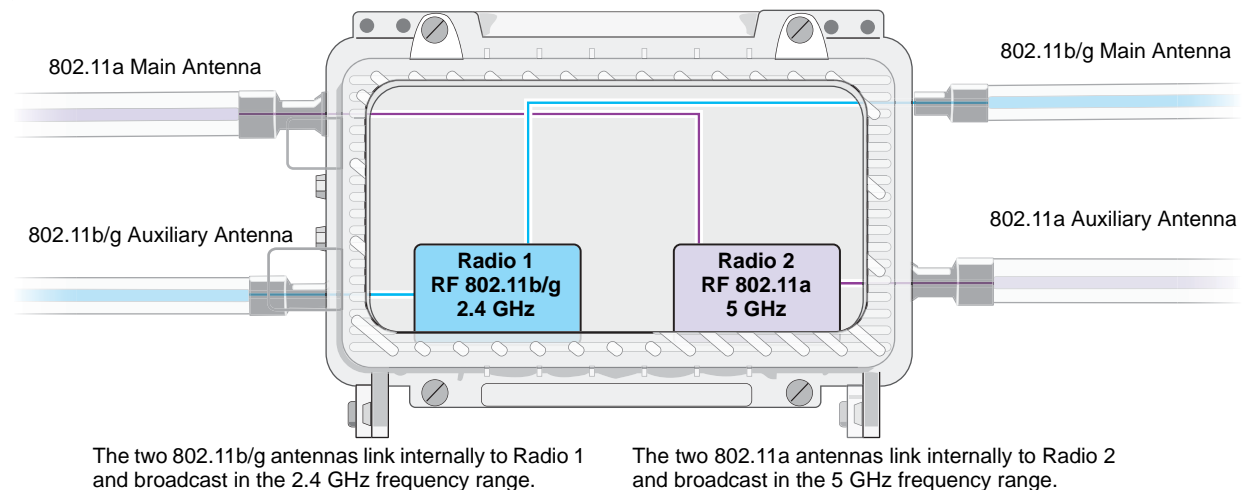*Figure 3   Omnidirectional Radiation Pattern*

The omnidirectional antennas radiate equally in all directions, forming a toroidal pattern.

HiveAP

Note: To show the shape of radiation more clearly, this illustration depicts the coverage provided by only one active antenna and is not drawn to scale.

The pairs of antennas operate concurrently in two different frequency ranges: 2.4 GHz (IEEE 802.11b/g) and 5 GHz (IEEE 802.11a). Using two different frequency ranges reduces the probability of interference that can occur when numerous channels operate within the same range. Conceptually, the relationship of antennas and radios is shown in Figure 4. (For information about attaching the antennas to the HiveAP 28, see "Attaching Antennas" on page 42.)

Figure 4   Antennas and Radios

802.11a Main Antenna

802.11b/g Main Antenna

802.11b/g Auxiliary Antenna

802.11a Auxiliary Antenna

**Radio 1
RF 802.11b/g
2.4 GHz**

**Radio 2
RF 802.11a
5 GHz**

The two 802.11b/g antennas link internally to Radio 1 and broadcast in the 2.4 GHz frequency range.

The two 802.11a antennas link internally to Radio 2 and broadcast in the 5 GHz frequency range.

Note: *The HiveAP 20 uses* `interface` *interface* `radio antenna external` *command to enable an external antenna attached to it. Entering this command on the HiveAP 28 disables the antenna on the opposite side of the device from the radio to which the interface is linked and results in a loss of diversity.*

MOUNTING THE HIVEAP 28 AND ATTACHING ANTENNAS

Using the mounting accessories (available separately) you can mount the HiveAP in various locations:

- "Pole Mount" on page 39 – Mount the HiveAP 28 on a pole such as the arm of a street light.
- "Strand Mount" on page 40 – Suspend the HiveAP 28 from a cable or phone line.
- "Surface Mount" on page 41 – Mount the HiveAP 28 on a flat surface such as a wall or beam.

You can mount the HiveAP 28 in any of these locations as long as the object to which you mount it and the attaching screws can support its weight (9 lbs., 4.08 kg).

After mounting the HiveAP 28, attach the antennas as explained in "Attaching Antennas" on page 42.
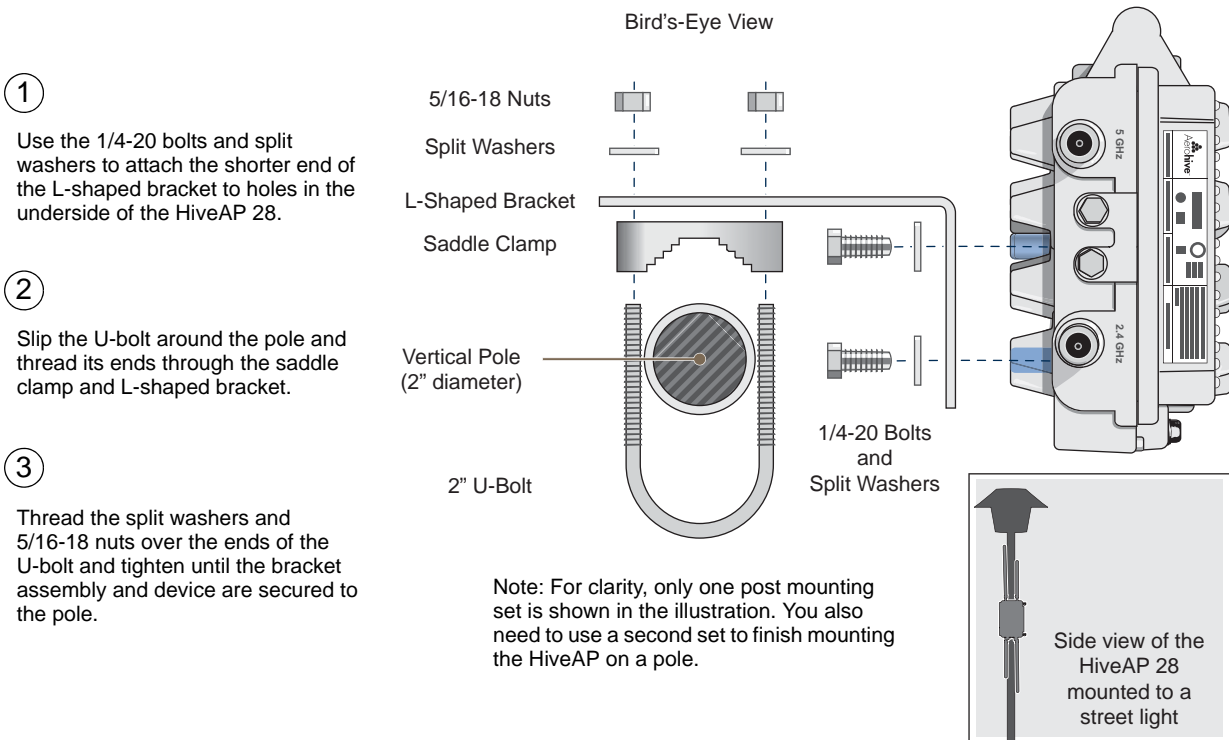
Before you mount the HiveAP 28 and attach antennas, read the following warnings and cautions:

- To install the HiveAP 28, you must be a qualified installation professional, licensed or certified in accordance with local regulations.
- Use lightning arrestors and ground both the HiveAP 28 and any separately mounted antennas.
- Do not connect or disconnect antennas or cables from the HiveAP 28 during periods of lightning activity.
- If you need to place the HiveAP 28 in an explosive environment, such as in an oil refinery, mine, or any place where there is flammable gas, it must first be encased in an ATEX enclosure.
- To comply with RF (radio frequency) exposure limits, do not place antennas within 6.56 feet (2 meters) of people.
- Do not locate antennas near overhead power lines or other electric light or power circuits, or where they can come into contact with such circuits. When installing antennas, take extreme care not to come into contact with such circuits, which might cause serious injury or death. For proper installation and grounding of the antenna, refer to national and local electrical codes: NFPA (National Fire Protection Association) 70, National Electrical Code Article 810 (U.S.); Canadian Electrical Code, Part I, CSA 22.1 and Section 54 (Canada); and if local or national electrical codes are not available, refer to IEC (International Electrotechnical Commission) 364, Part 1 through 7 (other countries).
- To prevent damage, avoid over-tightening the connectors, nuts, and screws used to mount the antenna and the antenna itself.

Pole Mount

To mount the HiveAP 28 to a pole with a 2-inch diameter, you need two sets of the L-shaped brackets, two 2" U-bolts, saddle clamps, and the nuts, bolts, and washers shown in Figure 5. You also need a wrench to tighten the nuts and bolts securely.

Figure 5   Attaching the HiveAP 28 to a Pole

Bird's-Eye View

①

Use the 1/4-20 bolts and split washers to attach the shorter end of the L-shaped bracket to holes in the underside of the HiveAP 28.

②

Slip the U-bolt around the pole and thread its ends through the saddle clamp and L-shaped bracket.

③

Thread the split washers and 5/16-18 nuts over the ends of the U-bolt and tighten until the bracket assembly and device are secured to the pole.

5/16-18 Nuts

Split Washers

L-Shaped Bracket

Saddle Clamp

Vertical Pole (2" diameter)

2" U-Bolt

1/4-20 Bolts and Split Washers

5 GHz

2.4 GHz

Side view of the HiveAP 28 mounted to a street light

Note: For clarity, only one post mounting set is shown in the illustration. You also need to use a second set to finish mounting the HiveAP on a pole.

1. Align two of the holes in the shorter end of the bracket with two of the holes in the HiveAP, insert the two bolts through the washers and bracket, and screw them into the holes in the HiveAP 28 chassis, using a wrench to tighten the bolts so that the bracket is securely attached.

    Note: Repeat this step to attach the other bracket to the HiveAP. However, this time, place the long end of the bracket in the opposite direction of the first one for better stability. For example, if you attached the first bracket with its long end positioned toward the outside edge of the device, install this second bracket with the long end of the bracket toward the middle.

2. Holding a saddle clamp against the inside of the long end of one of the L-shaped brackets, slip a U-bolt around the pole and thread it through the two holes in the saddle clamp and L-shaped bracket.

    Note: One of the holes in the bracket is arc-shaped so that you can adjust the angle of the mounted device if necessary.
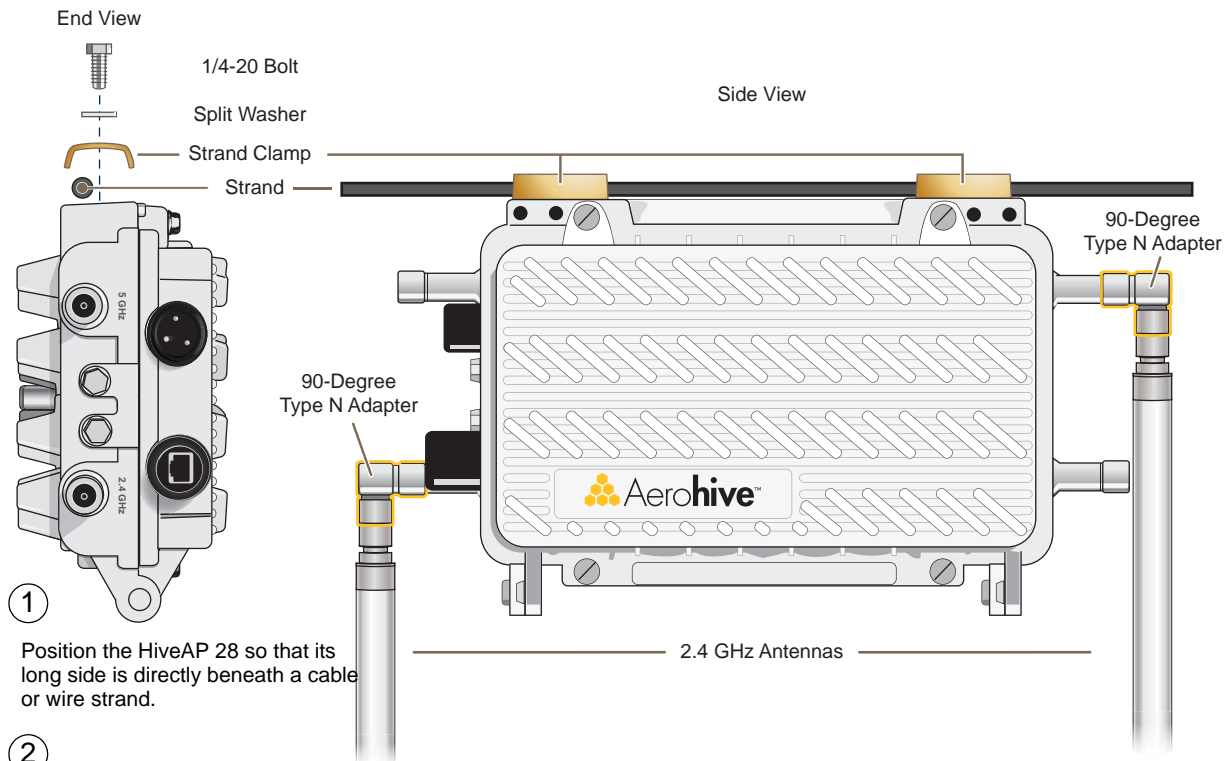
3. Thread a split washer and 5/16-18 nut to each end of the U-bolt, and tighten them with a wrench to secure the U-bolt firmly to the pole.

    Note: Repeat steps 2 and 3 to attach the other U-bolt and saddle clamp to the remaining L-shaped bracket and secure the HiveAP 28 to the pole.

Strand Mount

The HiveAP 28 outdoor platform can also be mounted on a cable or strand of wire as shown in Figure 6. When mounted on a wire strand, use 90-degree N type adapters (not included) to orient the antennas vertically. If you do not use the adapters and orient the antennas horizontally, the area covered will be far less.

Figure 6   Clamping the HiveAP 28 to a Wire Strand

End View

1/4-20 Bolt

Side View

Split Washer

Strand Clamp

Strand

5 GHz

2.4 GHz

90-Degree
Type N Adapter
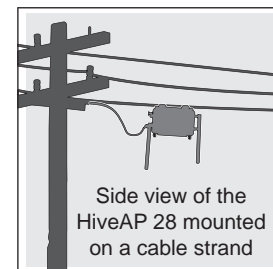
90-Degree
Type N Adapter

2.4 GHz Antennas

① Position the HiveAP 28 so that its long side is directly beneath a cable or wire strand.

② Place the strand clamps over the wire, and bolt the clamps tightly to the chassis around the strand.

③ Attach 90-degree type N adapters to the 2.4 GHz antenna connectors so that the adapters face downward, and then attach the antennas to the adapters

Note: For clarity, only one bolt, washer, and strand clamp are shown in the illustration on the left. You also need to use a second set of these items to finish clamping the HiveAP to a wire strand.

Side view of the HiveAP 28 mounted on a cable strand

To mount the HiveAP 28 on a wire or strand, you need a wrench and two 1/4-20 bolts, split washers, strand clamps, and 90-degree type N adapters. In the following instructions, you use only the 2.4 GHz antennas.

1. Position the HiveAP 28 so that its long side (with three holes at each end) is underneath a cable or wire strand running lengthwise along the upper side of the chassis (for the proper orientation, see the inset in Figure 6).

2. Place the strand clamp over the wire and use the 1/4-20 bolt and split washer to secure the strand between the clamp and chassis.

> *Note: Repeat the preceding steps to fasten the other end of the HiveAP 28 to the cable or wire strand.*

3. Attach the 90-degree type N adapters to the two 2.4 GHz antenna connectors and then attach the antennas to the adapters so that the antennas face downward. For details, see "Attaching Antennas" on page 42.
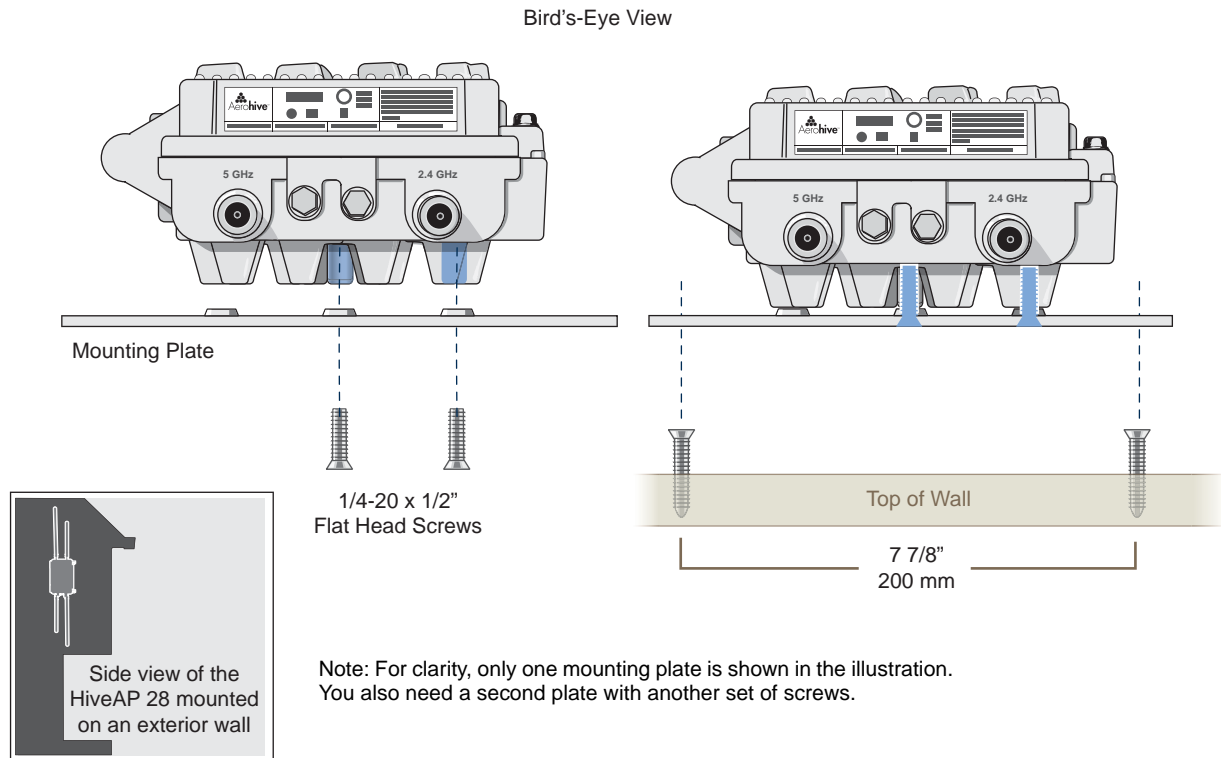
Surface Mount

You can use the mounting plate to attach the HiveAP 28 to any surface that supports its weight (9 lbs., 4.08 kg), and to which you can screw or nail the plate. First, mount the plate to the HiveAP 28, and then attach the plate to the surface, as shown in Figure 7. Note that the screw heads that you attach to the wall or surface must be small enough for the keyholes on the mounting plate to slip over them.

> *Note:* *Because the metal in a wall can degrade the radio signal pattern, Aerohive recommends using sector antennas instead of omnidirectional antennas when mounting the device on a wall.*

Figure 7 *Mounting the HiveAP 28 on a Wall*

① With the ridged edge of the holes on the mounting plates facing the HiveAP 28, use 1/4-20 x 1/2 inch screws to secure the two mounting plates to its underside.

② Attach four screws to a secure object such as a wall or beam. Space them 8 1/8" (206 mm) apart vertically and 7 7/8" (200 mm) apart horizontally.

③ Guide the screws fastened to the wall through the keyholes in the mounting plates.

Bird's-Eye View

Mounting Plate

1/4-20 x 1/2"
Flat Head Screws

Side view of the HiveAP 28 mounted on an exterior wall

5 GHz   2.4 GHz

Top of Wall

7 7/8"
200 mm

Note: For clarity, only one mounting plate is shown in the illustration. You also need a second plate with another set of screws.

To mount the HiveAP 28 to a surface like a wall, you need two mounting plates, four 1/4-20 x 1/2" flat head screws, four screws (no bigger than 5/16"), and a screw driver:

1. Align the ridged edge of one of the mounting plates with two of the holes located on the underside of the HiveAP 28, and use two 1/4-20 x 1/2" flat head screws to secure the plate against the HiveAP 28. Then attach the other mounting plate to the HiveAP 28 in the same way.

2. Attach four 5/16" screws to a wall or beam. They must be 8 1/8" (206 mm) apart vertically and 7 7/8" (200 mm) apart horizontally to accommodate the keyholes on the mounting plates.

3. Guide the keyholes over the screws fastened to the wall and push downward after the screw heads have cleared the keyholes.

Attaching Antennas

You can connect the antennas directly to the HiveAP 28 or mount them separately. Although connecting the antennas directly to the device typically provides better performance, in some cases the location of the HiveAP might not be a good location for the antennas; for example, if the HiveAP 28 is mounted on a reinforced concrete wall that interferes with radio coverage. In such cases, mounting the antennas separately in a more open location can improve coverage; however, bear in mind that cables introduce loss into the overall signal strength and that the longer the cable connecting the antennas to the HiveAP 28, the greater the loss will be.

Note: Cover any unused antenna connectors with a connector cap to prevent water intrusion and possible safety hazards.

Connecting Antennas Directly to the HiveAP 28

The two 2.4 GHz and two 5 GHz antennas that ship with the HiveAP 28 have male Type N connectors that you can connect directly to the female Type N antenna connectors on the HiveAP 28. You can also use self-amalgamating PTFE (polytetrafluoroethylene) tape, which is available separately from Aerohive, to create a waterproof seal at the points of attachment.

To attach the antennas:

1. Remove the antenna connector covers from the HiveAP 28 (you can leave a cover on the connector if you are not planning to use it), and make sure that the surface of the connectors on the HiveAP 28 and the connectors on the antennas are clean.

2. If you are using PTFE tape, wrap the tape around the threads on the HiveAP 28 antenna connectors as follows:

    2.1. Starting at one end of the threads on one of the connectors, stretch the tape and wrap it in half-lap layers until you cover the threads completely.

    2.2. Wrap the tape in the opposite direction to bring it back onto itself for one full wrap.

    2.3. Place one thumb on the tape at the point of termination and stretch the tape until it breaks.

    2.4. Repeat the preceding steps to cover all the connectors to which you will attach antennas.

3. Connect the 2.4 GHz antennas to the 2.4 GHz antenna connectors. (To tighten an antenna, turn the antenna base cap—the textured metal band that encloses the connector—clockwise over the tape-covered threads of the HiveAP antenna connector.)

    Their connections are now sealed and waterproof.

4. Repeat the preceding steps to connect the 5 GHz antennas.
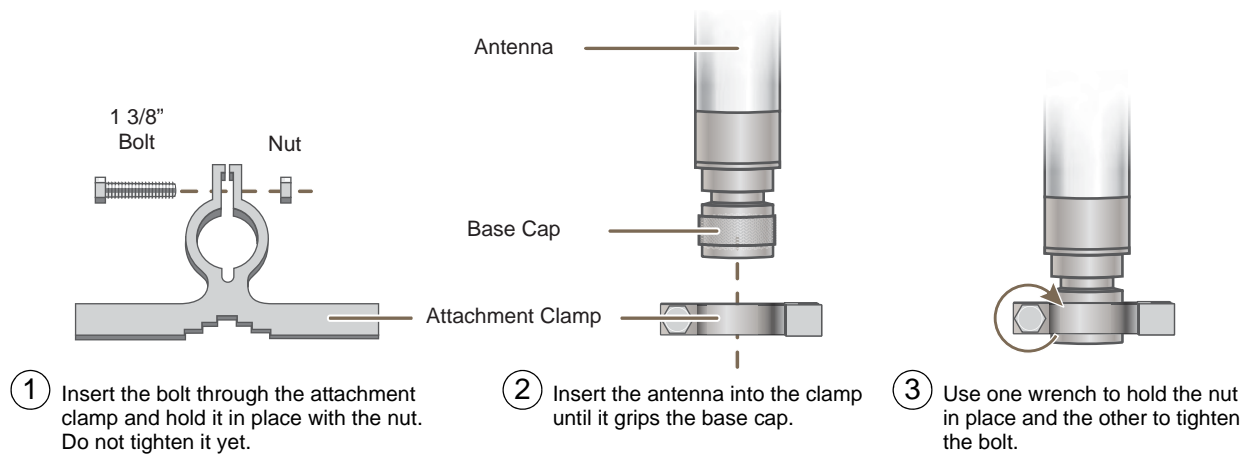
Mounting Antennas Separately

In addition to connecting antennas directly to the HiveAP 28, you can also mount them separately and run a cable between the antennas and the device. Use either male-to-female cables with Type N connectors or use male-to-male or female-to-female cables with cable gender changers. (The antennas have male Type N connectors and the HiveAP 28 has female Type N connectors.)

Note: Using cables to mount antennas separately causes some signal loss and using a cable gender changer can cause even more. The amount of loss varies from product to product, so refer to the documentation accompanying the cables and gender changer you use for information. To minimize loss, Aerohive recommends using LMR400 cables and using the shortest cables possible.

You can mount antennas at the top of a pole as shown in Figure 8 and Figure 9, or to a flat surface. If you must mount the antenna lower on a pole, the pole must be nonmetallic—such as one made from a hard plastic like PVC (polyvinyl chloride)—so that it does not distort the signal. Aerohive recommends that antennas be installed away from power lines and obstructions that can interfere with radio coverage.
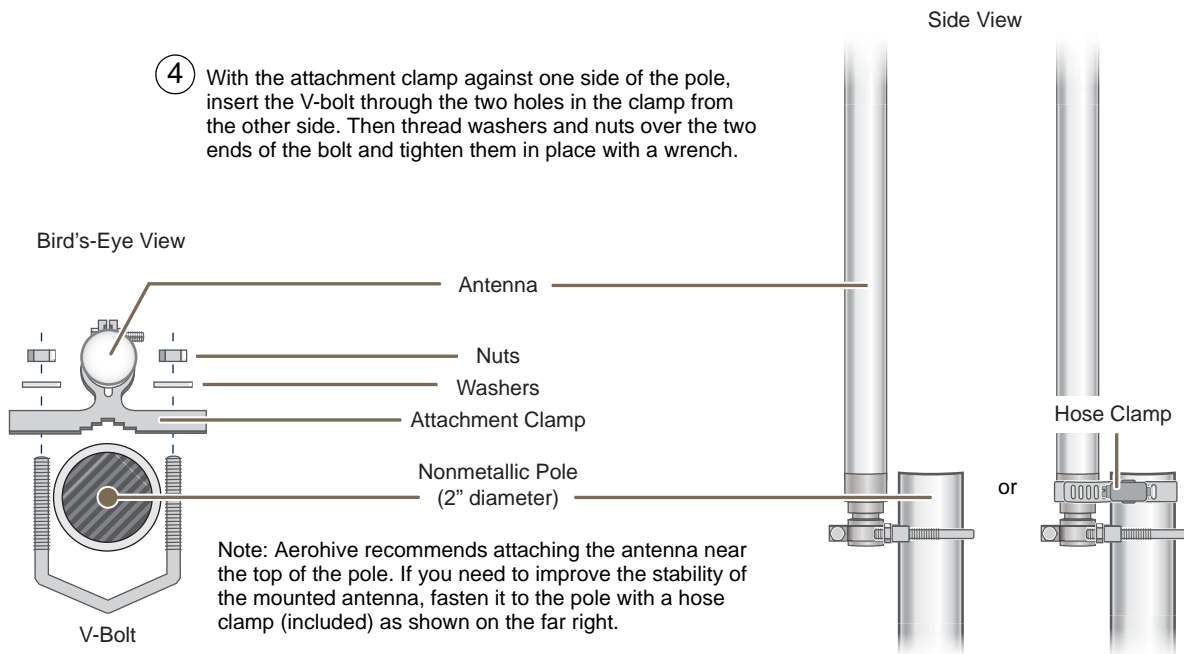
For each antenna that you mount, you need an attachment clamp, a 1 3/8" bolt and nut, a V-bolt, two washers and two nuts, a hose clamp, and two wrenches.

Figure 8   Securing an Antenna to an Attachment Clamp

① Insert the bolt through the attachment clamp and hold it in place with the nut. Do not tighten it yet.

② Insert the antenna into the clamp until it grips the base cap.

③ Use one wrench to hold the nut in place and the other to tighten the bolt.

1. Insert the 1 3/8" bolt through the attachment clamp and screw a nut loosely onto its end.
2. Place the antenna base cap inside the attachment clamp.
3. Using a pair of wrenches, tighten the nut to the bolt until the clamp grips the base cap firmly.

Figure 9   Mounting an Antenna to a Pole

④ With the attachment clamp against one side of the pole, insert the V-bolt through the two holes in the clamp from the other side. Then thread washers and nuts over the two ends of the bolt and tighten them in place with a wrench.

Note: Aerohive recommends attaching the antenna near the top of the pole. If you need to improve the stability of the mounted antenna, fasten it to the pole with a hose clamp (included) as shown on the far right.

4. To mount the antenna on a nonmetallic pole, place the attachment clamp against the pole, thread the V-bolt through the holes on the attachment, the washers, and nuts, and use the wrenches to tighten the nuts to the bolt. (Optional) For added stability, fasten the top of the antenna to the pole with the hose clamp.

To mount the antenna directly to a flat surface, run bolts or screws (not included) through the two holes in the attachment clamp, and fasten them firmly to the surface.

Note: Radio coverage might be limited if the surface acts as an obstruction.

5. Make sure that all the antenna and cable connectors are clean. If you are using PTFE tape, wrap the tape around the threads on the HiveAP 28 antenna connectors as explained in "Connecting Antennas Directly to the HiveAP 28" on page 42.

6. Assuming that you are using male-to-female cables, connect the female Type N connector on the cables to the male connectors on the antennas.

7. Connect the male Type N connectors on the cables to the female antenna connectors on the HiveAP 28.

DEVICE, POWER, AND ENVIRONMENTAL SPECIFICATIONS

Understanding the range of specifications for the HiveAP is necessary for optimal deployment and device operation. The following specifications describe the physical features and hardware components, the power adapter and PoE (Power over Ethernet) electrical requirements, and the temperature and humidity ranges in which the device can operate.

Device Specifications

- Chassis dimensions: 13 13/16" W x 4 3/8" H x 8 3/8" D (35 cm W x 11 cm H x 21 cm D)
- Weight: (9 lbs., 4.08 kg)
- Antennas: Two detachable single-band 8dBi 802.11b/g antennas and two detachable single-band 10dBi 802.11a antennas
- Maximum Transmission Power: 20 dBm
- Ethernet port: autosensing 10/100Base-T/TX Mbps, with IEEE 802.3af-compliant PoE (Power over Ethernet)

Power Specifications

- AC/DC power adapter:
  - Input:100 – 240 VAC
  - Output: 17 watts
- PoE nominal input voltages: 48 V, 0.35A
- RJ-45 power input pins: Wires 4, 5, 7, 8 or 1, 2, 3, 6

Environmental Specifications

- Operating temperature: -40 to 140 degrees F (-40 to 60 degrees C)
- Storage temperature: -40 to 194 degrees F (-40 to 90 degrees C)
- Relative Humidity: Maximum 100%

Table 2 Maximum allowed conducted output power for specified antennas.

802.11b RF (8dBi Omnidirectional, Model : S2406BFNM)		
Frequency	2412MHz	2437MHz	2462MHz
Peak Power Output (dBm)	14.20	14.00	14.20
802.11g (8dBi Omnidirectional, Model : S2406BFNM)		
Frequency	2412MHz	2437MHz	2462MHz
Peak Power Output (dBm)	16.20	16.80	15.00
802.11a (10dBi Omnidirectional, Model : S4908WBF)		
Frequency	5745MHz	5785MHz	5825MHz
Peak Power Output (dBm)	17.80	17.40	17.60