Meru AP300

Installation Guide

June 2012

MERU NETWORKS, INC.
Limited Product Warranty

This Limited Product Warranty applies to the original end-user customer of the Meru product which you purchased for your own use, and not for resale ("Product"), from Meru Networks, Inc. ("Meru") or its authorized reseller ("Reseller").

Limited Warranties

— One-year limited hardware warranty: Meru warrants to you that Meru hardware (other than Third Party Products as described below) will be free from defects in materials and workmanship for a one-year period after the date of delivery of the applicable product to you from Meru or its Reseller (the "Hardware Warranty Period"). If Meru receives written notice from you of such defects during the Hardware Warranty Period, Meru will, at its option, either repair or replace Meru hardware that Meru determines to be defective. Replacement products may be remanufactured units, and will be warranted for the remainder of the original Hardware Warranty Period, or if greater, for thirty days from delivery of such replacement. Should Meru be unable to repair or replace the Meru hardware, Meru (or its Reseller, as applicable) will refund to you the purchase price of the Product.

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Exclusions

The warranty on the Product shall not apply to defects resulting from the following:

— Alteration or modification of the Product in any way, including without limitation configuration with software or components other than those supplied by Meru or integration with parts other than those supplied by Meru.

— Abuse, damage or otherwise being subjected to problems caused by negligence or misapplication (including without limitation improper or inadequate maintenance or calibration), relocation of the products (including without limitation damage caused by use of other than Meru shipping containers), or use of the products other than as specified in the applicable Meru product documentation (including without limitation incompatible operating environments and systems), or improper site preparation or maintenance.

— Damage as a result of accidents, extreme power surge, extreme electromagnetic field, acts of nature or other causes beyond the control of Meru.

— Use of the Product with software, interfacing, parts or supplies not supplied by Meru.

The warranty on the Product does not apply if the Product is sold, or in the case of software, licensed, for free for evaluation or demonstration purposes.

Meru expressly disclaims any warranty or obligation to support the Product for all operating environments – for example, as illustration and not limitation, Meru does not warrant or ensure interoperability of the Product with future telecommunication systems or other future software or hardware.

You understand and acknowledge that the Products may generate, use or radiate radio frequency energy and may interfere with radio communications and/or radio and television receptions if is not used and/or installed in accordance with the documentation for such products. WHILE MERU USES COMMERCIALLY REASONABLE EFFORTS TO ENSURE COMPLIANCE OF THE PRODUCTS WITH APPLICABLE UNITED STATES FEDERAL COMMUNICATIONS COMMISSION AND PROTECT AGAINST HARMFUL INTERFERENCES, YOU ACKNOWLEDGE AND AGREE THAT INTERFERENCES WITH RADIO COMMUNICATIONS AND/OR RADIO AND TELEVISION RECEPTIONS MAY OCCUR AND THAT MERU WILL NOT BE LIABLE FOR ANY DAMAGES OR INCONVENIENCE BASED ON SUCH INTERFERENCES.

Third Party Products - The above Limited Warranties are exclusive of products manufactured by third parties ("Third Party Products"). If such third party manufacturer provides a separate warranty with respect to the Third Party Product, Meru will include such warranty in the packaging of the Meru Product.

Return procedures

To obtain warranty service you must: (a) obtain a return materials authorization number ("RMA#") from Meru by contacting rmaadmin@merunetworks.com, and (b) deliver the Product, in accordance with the instructions provided by Meru, along with proof of purchase in the form of a copy of the bill of sale including the Product's serial number, contact information, RMA# and detailed description of the defect, in either its original package or packaging providing the Product with a

degree of protection equivalent to that of the original packaging, to Meru at the address below. You agree to obtain adequate insurance to cover loss or damage to the Product during shipment.

If you obtain an RMA# and return the defective Product as described above, Meru will pay the cost of returning the Product to Meru. Otherwise, you agree to bear such cost, and prior to receipt by Meru, you assume risk of any loss or damage to the Product. Meru is responsible for the cost of return shipment to you if the Meru Product is defective.

Returned products which are found by Meru to be not defective, returned out-of-warranty or otherwise ineligible for warranty service will be repaired or replaced at Meru's standard charges and shipped back to you at your expense.

At Meru's sole option, Meru may perform repair service on the Product at your facility, and you agree to provide Meru with all reasonable access to such facility and the Product, as required by Meru. On-site repair service may be available and is governed by the specific terms of your purchase.

All replaced parts, whether under warranty or not, are the property of Meru.

Warranty limitations

THE WARRANTIES SET FORTH ABOVE ARE EXCLUSIVE AND NO OTHER WARRANTY, WHETHER WRITTEN OR ORAL, IS EXPRESSED OR IMPLIED BY MERU, TO THE MAXIMUM EXTENT PERMITTED BY LAW. THERE ARE NO OTHER WARRANTIES RESPECTING THE PRODUCT AND DOCUMENTATION AND SERVICES PROVIDED UNDER THIS AGREEMENT, INCLUDING WITHOUT LIMITATION ANY WARRANTY OF DESIGN, MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (EVEN IF MERU HAS BEEN INFORMED OF SUCH PURPOSE), TITLE OR AGAINST INFRINGEMENT OF THIRD PARTY RIGHTS. IF ANY IMPLIED WARRANTY CANNOT BE DISCLAIMED UNDER APPLICABLE LAW, THEN SUCH IMPLIED WARRANTY SHALL BE LIMITED IN DURATION TO THE HARDWARE AND SOFT-WARE WARRANTY PERIODS DESCRIBED ABOVE.

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MERU SPECIFICALLY DOES NOT WARRANT THAT THE MERU SOFTWARE WILL BE ERROR FREE OR OPERATE WITHOUT INTERRUPTION.

THE REMEDIES IN THIS LIMITED PRODUCT WARRANTY ARE YOUR SOLE AND EXCLUSIVE REMEDIES, AND MERU'S SOLE AND EXCLUSIVE LIABILITY, FOR BREACH OF THE HARD-WARE OR SOFTWARE WARRANTY SET FORTH ABOVE.

Limitations of Liability

You acknowledge and agree that the consideration which you paid to Meru does not include any consideration by Meru of the risk of consequential, indirect or inci-dental damages which may arise in connection with your use of, or inability to use, the Product. THUS, MERU AND ITS RESELLER WILL NOT BE LIABLE FOR ANY INDI-RECT, INCIDENTAL, SPECIAL, PUNITIVE OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION LOST PROFITS, LOST BUSINESS, LOST DATA, LOSS OF USE, OR

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THE LIMITATIONS SET FORTH HEREIN ARE INTENDED TO LIMIT THE LIABILITY OF MERU AND ITS RESELLERS AND SHALL APPLY NOTWITHSTANDING ANY FAILURE OF ESSENTIAL PURPOSE OF ANY LIMITED REMEDY.

The jurisdiction applicable to you may not allow the limitations of liability or damages set forth above, in which case such limitation shall only apply to you to the extent permitted in such jurisdiction.

Additional Information

This Limited Product Warranty shall be governed by and construed in accordance with the laws of the State of California, U.S.A., exclusive of its conflict of laws principles. The U.N. Convention on Contracts for the International Sale of Goods shall not apply.

This Limited Product Warranty is the entire and exclusive agreement between you and Meru with respect to its subject matter, and any modification or waiver of any provision of this statement is not effective unless expressly set forth in writing by an authorized representative of Meru.

All inquiries or claims made under this Limited Product Warranty must be sent to Meru at the following address:

Meru Networks Inc.,
894 Ross Drive, CA 94087, USA

Tel: 408-215-5300

Fax: 408-215-5301

Email: support@merunetworks.com

Contents

About This Guide

This guide provides installation instructions for the Meru AP300s, which includes both the AP300 and the AP320i models. The term access point is used interchangeably throughout this document to apply to any model when there are no differences among the models.

Audience

This guide is intended for anyone installing Meru Wireless LAN System Access Points (APs).

Other Sources of Information

Additional information is available in the following Meru publications, Web site, and external references.

Meru Publications

- *Meru System Director Release Notes*
- *Meru System Director Getting Started Guide*
- *Meru Controller Installation Guide*
- *Meru System Director Command Reference*
- *Meru System Director Configuration Guide*

Website Resources

For the first 90 days after you buy a Meru controller, you have access to online support. If you have a support contract, you have access for the length of the contract. See this web site for information such as:

- *Meru System Director Release Notes*
- Knowledge Base (Q&A)

- Downloads
- Open a ticket or check an existing one
- Customer Discussion Forum

The URL is: **http://support.merunetworks.com**

- *Meru System Director Getting Started Guide*
- *Meru Controller Installation Guide*
- *Meru System Director Release Notes*
- *Meru System Director Configuration Guide*
- *Meru System Director Command Reference*

External References

- Stevens, W. R. 1994. *TCP/IP Illustrated, Volume 1, The Protocols.* Addison-Wesley, Reading, Mass.
- Gast, M.S. 2002. *802.11 Wireless Networks, The Definitive Guide.* O'Reilly and Associates, Sebastopol, Calif.

Typographic Conventions

This document uses the following typographic conventions to help you locate and identify information:

Note: Provides extra information, tips, and hints regarding the topic.

Caution! Identifies important information about actions that could result in damage to or loss of data, or could cause the application to behave in unexpected ways.

Warning! Identifies critical information about actions that could result in equipment failure or bodily harm.

Contacting Meru

You can visit Meru Networks, Inc. on the Internet at this URL:

http://www.merunetworks.com

Customer Services and Support

For assistance, contact Meru Customer Services and Support 24 hours a day at +1-888-637-8952 (+1-888-Meru-WLA(N)) or +1-408-215-5305. Email can be sent to support@merunetworks.com.

Meru Networks, Inc. Customer Services and Support provide end users and channel partners with the following:

- Telephone technical support
- Software update support
- Spare parts and repair service

RMA Procedures

Contact Meru Customer Services and Support for a Return Material Authorization (RMA) for any Meru equipment.

Please have the following available when making a call:

- Company and contact information
- Equipment model and serial numbers
- Meru software release and revision numbers (for example, 3.0.0-35)
- A description of the symptoms the problem is manifesting
- Network configuration

Chapter 1
Access Points

Access Points contain radio devices that communicate with the Meru Controller and form the wireless LAN (WLAN). The Meru Controller and Access Points connect to the site's wired LAN through wired switches. Wireless clients associate with the Access Points as they roam throughout the WLAN. As such, they are an extension of the wired LAN, providing the wireless benefits of client mobility, enhanced access, and dynamic network configuration.

Figure 1: Wireless LAN Connected to Network
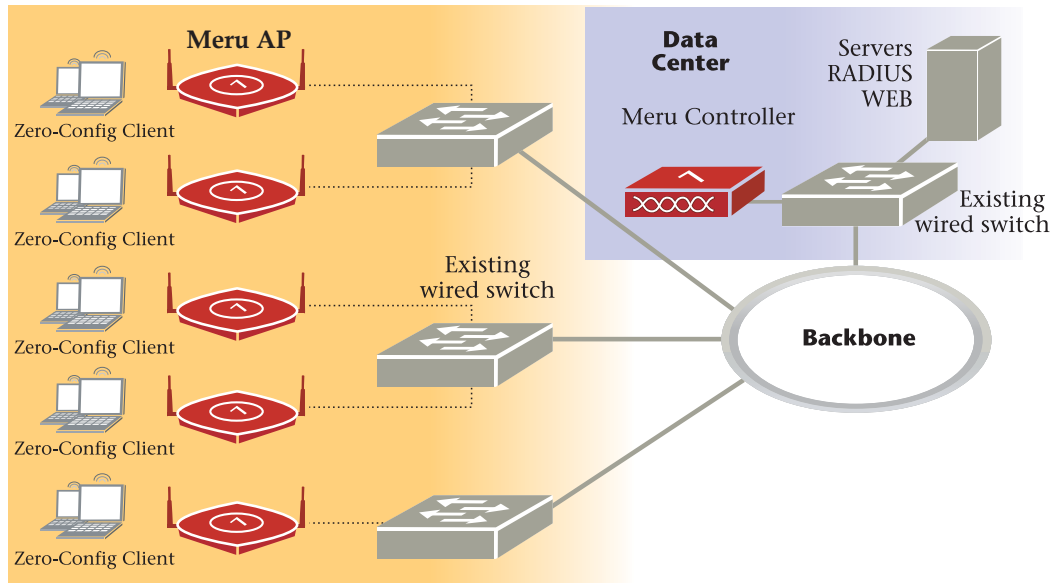
AP300

The AP300 Access Point series delivers high performance, full-speed, Wi-Fi certified 802.11n based on draft 2.0 connectivity while simultaneously supporting legacy 802.11a/b/g devices. AP300 is available in the configurations shown below.

AP300 Configurations

Model	Configuration
AP332i	Two dual-band 802.11n radios with 3x3 MIMO and internal antennas
AP332e	Two dual-band 802.11n radios with 3x3 MIMO and external antennas
AP320i	Two dual-band 802.11n radios with 3x3 MIMO and internal antennas
AP320e	Two dual-band 802.11n radios with 3x3 MIMO and external antennas
AP310	Single dual-band 802.11n radio with 3x3 MIMO and external antennas
AP311	Single dual-band 802.11n radio and single 802.11a/b/g radio (AP320 upgradable) with external antennas
AP302	Two dual-band 802.11a/b/g radios (AP320 upgrade able) with external antennas
AP301	Single dual-band 802.11a/b/g radio (AP310 upgrade able) with external antennas

AP300

Features for the AP300 include:

- 802.11n support with channel bonding in both 2.4GHz and 5GHz frequency bands. Channel bonding combines two 20Mhz channels into a single-wide 40Mhz channel for increased throughput.
- Dual-band external antenna options optimized for MIMO mode
- Plug and Play deployment using centralized controller platforms
- Multi-layered security including standard WPA2, 802.11i security such as automatic traffic inspection
- Each of these Access points may be powered by a standard 802.3af PoE device.

- Air Traffic Control technology for 802.11n devices and legacy a/b/g devices
- 3x3 MIMO with 3 chains and 3 receive chains, delivering two spatial streams
- For AP302 and AP311, the a/b/g radio software upgrades to 802.11n for maximum investment protection.
- Channel span architecture which requires no channel planning or configuration
- Six standard multiband, omni-directional antennas for AP302, AP311, AP320, and AP332 models. Three standard multiband, omni-directional antennas for AP310 and AP301.
- Powered by 5 volt DC input, 802.3af or 802.3at compliant PoE device.

Figure 2: AP320e

AP320i

The AP320i Access Point is an internal-antenna AP with two dual-band 802.11n radios and 3x3 MIMO and internal antennas.

Features for the AP320i include:

- Internal antennas
- 802.11n support with channel bonding in both 2.4GHz and 5GHz frequency bands. Channel bonding combines two 20Mhz channels into a single-wide 40Mhz channel for increased throughput.
- Plug and Play deployment using centralized controller platforms
- Multi-layered security including standard WPA2 features such as automatic traffic inspection
- Standard 802.3af PoE support and support for many 802.3at devices

- Air Traffic Control technology for 802.11n devices and legacy a/b/g devices
- Channel span architecture that requires no channel planning or configuration

Figure 3: AP320i

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AP332e

The AP332e Access Point is an external-antenna AP with two dual-band 802.11n radios and 3x3 MIMO and internal antennas.

Features for the AP332e include:

- External antennas
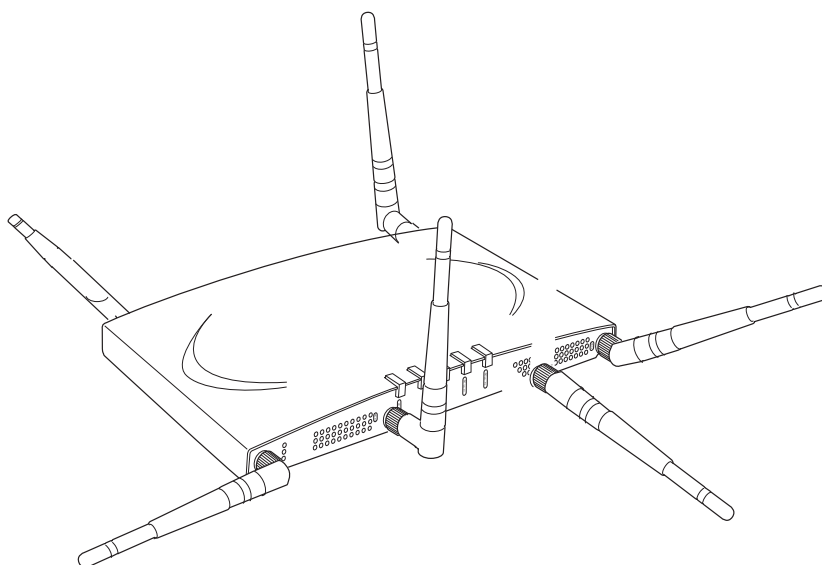- 802.11n support with channel bonding in both 2.4GHz and 5GHz frequency bands. Channel bonding combines two 20Mhz channels into a single-wide 40Mhz channel for increased throughput.
- Plug and Play deployment using centralized controller platforms
- Multi-layered security including standard WPA2 features such as automatic traffic inspection
- Standard 802.3af PoE support and support for many 802.3at devices
- Air Traffic Control technology for 802.11n devices and legacy a/b/g devices
- Channel span architecture that requires no channel planning or configuration
- Up to 128 clients per radio regardless of the encryption in use
- DFS capability (in permitted regions)
- Support for wired stations via the secondary ethernet interface
- Per-packet data rates up to 450Mbps
- Mesh and VPN capability with appropriate controller licenses
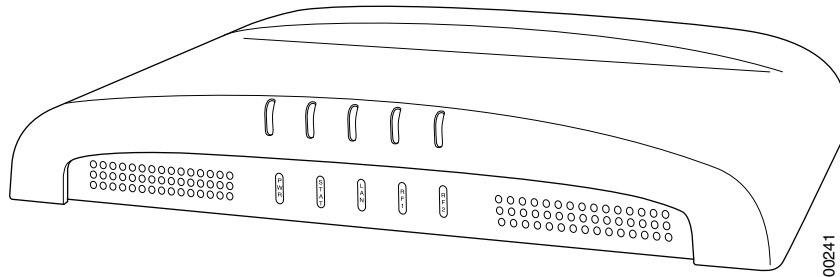
AP332i

The AP332i Access Point is an internal-antenna AP with two dual-band 802.11n radios and 3x3 MIMO and internal antennas.

Features for the AP332i include:

- Internal antennas
- 802.11n support with channel bonding in both 2.4GHz and 5GHz frequency bands. Channel bonding combines two 20Mhz channels into a single-wide 40Mhz channel for increased throughput.
- Plug and Play deployment using centralized controller platforms
- Multi-layered security including standard WPA2 features such as automatic traffic inspection
- Standard 802.3af PoE support and support for many 802.3at devices
- Air Traffic Control technology for 802.11n devices and legacy a/b/g devices
- Channel span architecture that requires no channel planning or configuration
- Up to 128 clients per radio regardless of the encryption in use
- DFS capability (in permitted regions)
- Support for wired stations via the secondary ethernet interface
- Per-packet data rates up to 450Mbps
- Mesh and VPN capability with appropriate controller licenses

Chapter 2
Installing AP300

This chapter describes how to install and configure an AP300. It contains the following sections:

- Safety Precautions
- Unpack the AP300
- Determine Power Requirements
- Installation Requirements
- Install the AP300
- Check AP300 LED Activity
- Where to Go From Here

Safety Precautions

IMPORTANT—Read and follow the regulatory instructions in Appendix B before installing and operating this product.

If an optional power supply is used, it must be one supplied by Meru Networks.

	Warning!	This product is intended to be supplied by a UL Listed power supply marked Class 2 or LPS and rated minimum 5Vdc, 3A.

The AP300 is intended only for installation in Environment A as defined in IEEE 802.3af. All interconnected equipment must be contained within the same building, including the interconnected equipment's associated LAN connection.

Best Practices for an AP300/AP1000 Network

Read this section if you have both AP1000 and AP320i active simultaneously on the same network. The following best practices should be followed to get optimal performance from such a mixed network.

- AP320i and AP300 are interchangeable and fully compatible to share a virtual cell. It's like having two AP300s with different antennas. The only difference is that AP320i is detected as a such in the UI of the controller.
- If possible, do not deploy AP1000 and AP300/AP320i at the same physical location; we recommend that there be no overlapping coverage between AP1000 and AP300.
- If AP1000 and AP300/AP320i do have overlapping coverage, you have two options. Deploy them on seperate channels or make sure the ESS profiles on both AP types are unique. The chart below shows two ESS scenarios, one supported, one not supported.

Supported ESS Scenario	AP1000 Configuration	AP320i Configuration
Two Unique ESS profiles	ESS Profile name in controller is UniqueName1	ESS Profile name in controller is UniqueName2
AP1000 and AP320i SSID string over the air	Meru	Meru

Unsupported ESS Scenario	AP1000 Configuration	AP320i Configuration
Same ESS profiles	ESS Profile name in controller is same name	ESS Profile name in controller is same name
AP1000 and AP320i SSID string over the air	Meru	Meru

Assumptions for the above best practices include:

- AP1000 is using Virtual Port with BSSID Virtual Cell.
- AP320i is using Virtual Port with BSSID Virtual Cell.
- AP1000s and AP300s are on the same channel. (AP1000 and AP320i could also be on different channels.)
- AP1000s and AP320i is are on the same controller. (AP1000 and AP320i could also be on different controllers as long as each controller has a unique controller index.)

Unpack the AP300

The AP300 series has five models as shown below.

Model	Radios
PSM3x	One a/b/g/n, one spectrum
AP320	Two a/b/g/n
AP311	One a/b/g/n, one a/b/g
AP310	One a/b/g/n
AP302	One a/b/g

Confirm that the AP300 shipping package contains these items:

- AP300 with attached mounting bracket
- Six antennas (four for PSM3x)
- Screws for the mounting bracket

Determine Power Requirements

Power requirements vary, depending on which AP300 radios are deployed and what MIMO mode is used. See the chart below for supported power sources for different radio configurations.

Radio 1 MIMO	Radio 2 MIMO	802.3af PoE	802.3at PoE	DC Power
2x2	2x2	●	●	●
2x2	3x3	●	●	●
3x3	2x2	●	●	●
3x3	3x3	Do not recommend	● limitation below	●

802.af PoE Usage

When using System Director 3.6/4.0/4.1 and 802.3af PoE, Meru supports radios set to any MIMO settings except 3x3 on dual radios. This is because two radios set to 3x3 MIMO using an 802.3af switch may not have enough power if the cable is too long. Shorter cables frequently work, however. Meru supports:

- Single 3x3 radio
- Dual 2 x 2 radios
- Dual radio with one set to 2x2 and the other one set to 3x3

When using System Director 4.0 and 802.3af, the AP300 MIMO configuration is limited to the following:

- 3x3 for the 5 GHz radio
- 2x2 for the 2.4 GHz radio

802.3at PoE Usage

When using System Director 3.6/4.0/4.1 and 802.3at, the following radio combinations are recommended:

- Single 3x3 radio
- Dual 2 x 2 radios
- Dual radio with one set to 2x2 and the other one set to 3x3

- Dual 3x3 radios are recommended with a limitation. Use 802.3at power for two 3x3 MIMO radios when the switch has a high enough power output to support all devices on the PoE. Calculate the amount of power needed by each AP300/AP320i in 3x3 mode (13 watts), add that to power required by other PoE devices on the switch and compare that value to the total power output from the switch.

The calculation for 802.3at PoE use looks something like this:

```
(Number of AP300s * 13watts) + (sum of all other PoE devices power requirements) <= switch
   power provided
```

For a list of supported PoEs, see the appendix Supported Power Over Ethernet Devices for Meru APs

Installation Requirements

An array of holes on the mounting bracket allows the AP300 to be mounted on the wall and over junction boxes or molly bolts. There are holes for passing the PoE Ethernet or external power supply cable through the bracket if the bracket is mounted on a junction box.

The AP300 has a security cable slot so you can lock the AP300 with a standard security cable, such as those used to secure laptop computers.

Purchase optional mounting kits to mount the AP300 either from the ceiling or inside an enclosure:

- Suspended Ceiling Rail Mounting Kit: ACC-MNT-SCRMKIT
- Above Suspended Ceiling Mounting Kit (T-Bar Hanger): ACC-MNT-ASCMKIT
- Inside a Hoffman Enclosure using Hoffman compatible mounting bracket: ACC-AP300-BHE (enclosure not provided)
- Above hanging ceiling tiles. Suitable for use in environmental air space in accordance with the Section 300-22(c) of the National Electric Code and Sections 2- 128.12 - 010 (3) and 12 - 100 of the Canadian Electrical Code. Part 1. C22. 1.

To complete AP300 installation, you need the items listed below.

Installation Type	Items Required
Horizontal mounting	None
Vertical mounting over a wall stud	- Two #6 x 2" wood screws for a wood stud; or - Two #6 x 1½" metal screws for a metal stud - Mounting bracket
Vertical mounting on sheetrock	- Two #6 x 1" screws - Two #4-6 x 7/8" ribbed plastic wall anchors - Mounting bracket

Installation Type	Items Required
Horizontal mounting below a hanging ceiling	• Two caddy fasteners • Two plastic spacers • Two keps nuts (with attached lock washer) • Mounting bracket
Using existing third party brackets	• Use included shoulder screws
Mounting above a ceiling tile	• Two T-rail clips • One T-box hanger • One bracket mounting clip • Mounting bracket

Additional Equipment

A power source is needed to power the AP300. See Determine Power Requirements.

Install the AP300

Select a Location
Attach the Provided Antennas
Install the Remote Antenna Mount (optional)
Install External ACC-ANT-MIMO-MNT Antenna with Three Connectors (optional)
Install Remote ACC-ANT-6ABGN-24 Antenna with Six Connectors (optional)
Install Antennas With One Connector (optional)
Install the Access Point

Select a Location

All AP300 interconnected equipment, including the associated LAN connection, must be contained within the same building. In addition, the AP300 location should meet the following conditions:

● Relatively unobstructed access to the stations the AP serves. Select a location with minimal physical obstructions between the AP and the wireless stations. In an office with cubicles, mounting the APs below a hanging ceiling (plenum is supported) or the wall near the ceiling provides the least obstructed communications path. On a wall, orient the AP300 horizontally so that you can read the Meru logo without tilting your head at 90 degrees - this orientation provides optimum MIMO performance.

- Access to wall outlet or a to a Power over Ethernet (PoE) connection to the network switch servicing the controller.

- We recommend planning for about 50 clients per radio (or per interference region) if you plan to use Virtual Port and plan to have phones as clients. For a data-only installation, plan up to 128 clients per radio, meaning 256 for AP320 and 128 for other AP300 models. Refer to the Meru Deployment Guides on the support site for more information.

AP300 is designed to provide 360 degree omni-directional coverage as illustrated below. Plan placement with this pattern in mind.

Figure 4: Coverage Pattern for AP300 When Ceiling Mounted
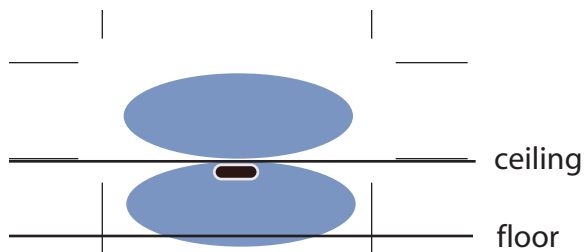
Most installations receive the best coverage using the following guidelines:

- Install APs toward the center of the building.

- Place APs about 80 feet apart.

- Do not install APs near metal objects, such as heating ducts, metal doors, or electric service panels.

- For best coverage, orient antennas as shown in Figure 6.

Attach the Provided Antennas

All AP300s have six external antenna ports, labeled 1 - 6. These units operate with six antennas attached, even though some configurations don't use all six. Instead of attaching an antenna, you can cap unused antenna connectors with 50 ohm Reverse Polarity SMA terminators. (For a list of approved terminators, see http://www.merunetworks.com/merusupport.) Meru supplied antennas are suitable only for indoor use unless they are mounted in an outdoor enclosure (see Mount AP300 in a Hoffman Enclosure). To achieve the best performance from your AP300, position antennas at a 90 degree angle relative to each other as shown in Figure 6. The antennas do not have to be oriented exactly as shown in the figure, but it is important to maintain the relative angles. If for some reason you are unable to maintain those angles, the network still operates, but you may experience up to 20% drop in throughput depending on the antenna orientation.

Figure 6: AP320, AP311 or AP302 Antennas 1-6 in Ceiling and Wall Mount Configuration
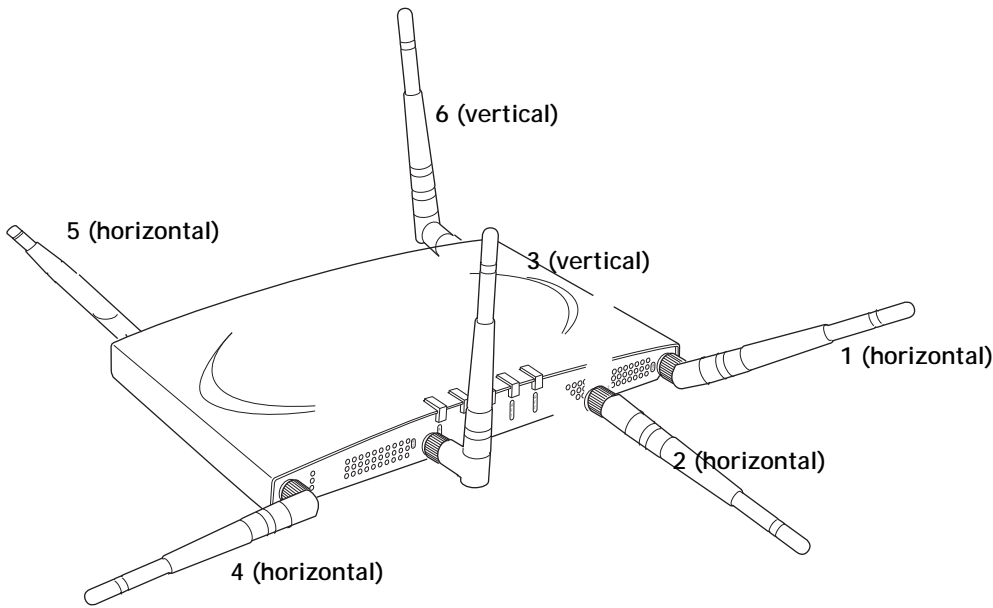
The following antenna connections are used during operation of the AP320, AP311, and AP302. Note that PSM3x APs will only have four antennas, rather than the typical six.

Table 1: AP300 With Two Radios and Corresponding Antennas

Model	Radio 1 (Ant4, Ant5, Ant6)	Radio 2 (Ant1, Ant2, Ant3)
PSM3x	a/b/g/n with 3 dual band omni-directional antennas (only one radio can be N)	Spectrum radio with one omni-directional antenna.
AP320	a/b/g/n with 3 dual band omni-directional antennas	a/b/g/n with 3 dual band omni-directional antennas
AP311	a/b/g/n with 3 dual band omni-directional antennas (only one radio can be N)	a/b/g/n with 3 dual band omni-directional antennas (only one radio can be N)
AP302	a/b/g with 3 dual band omni-directional antennas	a/b/g with 3 dual band omni-directional antennas

Table 2: AP310 With One Radios and Corresponding Antennas

Model	Radio 1 (Ant1, Ant2, Ant3)
AP310	a/b/g/n with 3 dual band omni-directional antennas

The AP310 has six external antenna ports labeled 1 - 6. However, AP310 uses only three of those antennas and the unused antenna connectors are blocked. Figure 7 illustrates the recommended antenna configuration for the AP310.

Figure 7: AP310 Antennas 1-3
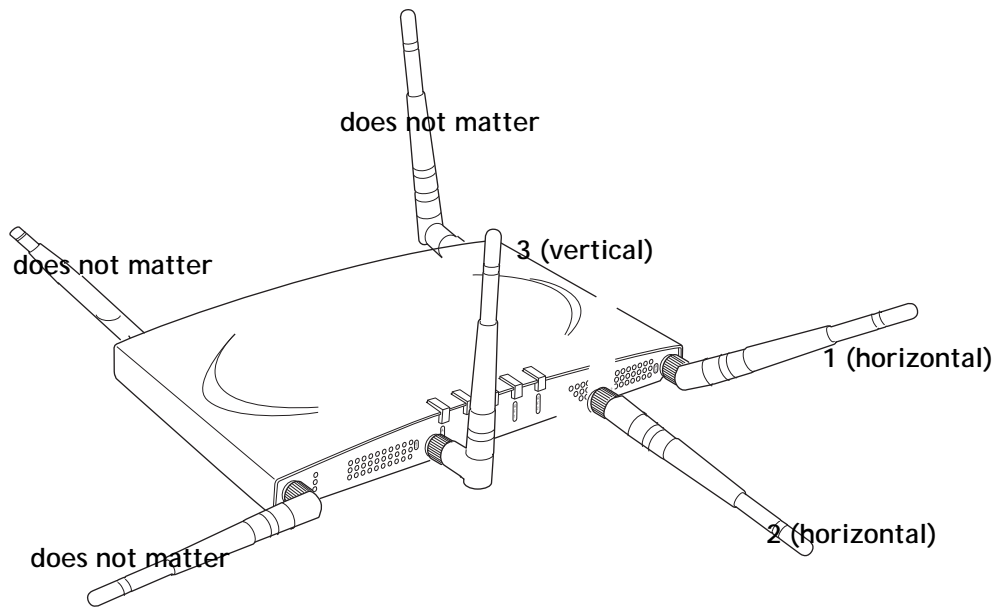
The following antenna connections are used during operation of the AP310.

Radio 1 Antenna Connectors for AP310	Radio2 Antenna Connectors for AP310
Ant1, Ant2, Ant3	NA

Do not leave any antenna connectors unterminated. All connectors on the AP must be terminated with antennas or with 50 ohm Reverse Polarity SMA terminators. (For a list of approved terminators, see http://www.merunetworks.com/merusupport.

The attached antennas must be the same model; if you replace one antenna, replace them all.

Install the Remote Antenna Mount (optional)

Use the optional Meru Remote Antenna Mount (ACC-ANT-MIMO-MNT) for one or both AP300 radios to remotely connect the AP300 antennas. The Remote Antenna Mount allows you to relocate either your current antennas or the optional high-gain dipole antennas to a location with clearer signal paths to the other wireless devices in your network. The Remote Antenna Mount can be installed either below the ceiling tile or on the wall. The default orientation for the mount is suitable for a ceiling mount, but you can attach the mount to a wall with some modifications.

Use one mount per radio; for example AP310 needs one unit, and AP320 needs two units. The Remote Antenna Mount uses low-loss plenum rated LMR195 cable and SMA connectors. To order this unit, contact your Meru sales representative and refer to part number ACC-ANT-MIMO-MNT.

Figure 8: Remote Antenna Mount
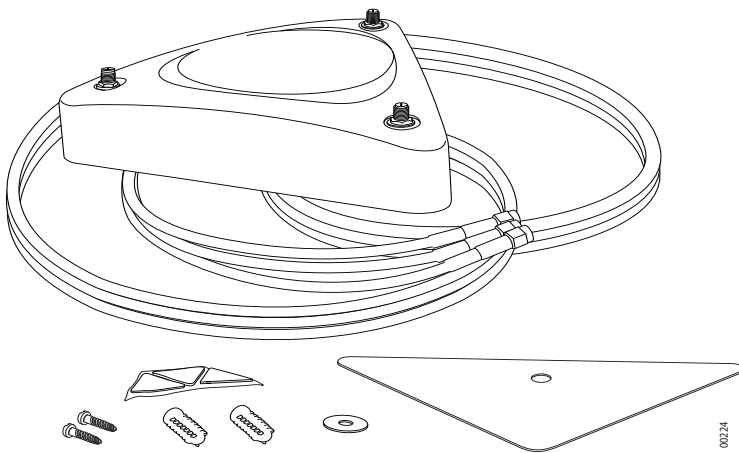
The remote antenna mount kit includes:

- Antenna stand with attached cable. The three antenna SMA female connectors on the Antenna Mount support AP300 antenna diversity. This feature gives the client the ability to automatically choose the antenna receiving the strongest signal.
- Triangular ceiling mount clip for attaching to hanging ceiling (includes bolt assembly)
- Three self-adhesive pads for the bottom of the unit (over the screws)
- Two wall mount screws with anchors
- Ceiling Mount Template
- Installation diagram

Install the Remote Antenna Mount on the Ceiling

To connect the Remote Antenna Mount to the ceiling, refer to the installation diagram from the shipping box while following these steps:

1. Attach the shorter end of the screw to the center hole on the back of the Antenna Mount.
2. Remove the designated ceiling tile.

3. Using the template, drill holes in the ceiling tile.

4. Replace the ceiling tile.

5. Remove a ceiling tile adjacent to the newly drilled tile for access purposes.

6. Feed the Antenna Mount cable through the larger hole in the ceiling tile until the Antenna Mount is flush with the ceiling. The screw should now be visible above the ceiling tile (through the second hole).

7. Place the triangular plate above the ceiling tile with the screw aligned through the plate.

8. Drop the washer onto the screw and tighten the bolt.
   The Antenna Mount is now connected to the ceiling.

9. Replace the adjacent tile.

10. Connect the three Remote Antenna Mount cables to the appropriate connectors on the AP300. Be sure to connect the three antennas that correspond to one radio. Radio 1 uses A1, A2, A3 and Radio 2 uses A4, A5, A6.

```
A5            A6

   ┌──────────────┐
   │              │
   │     Meru     │
   │              │
   └──────────────┘
   A4   A3   A2   A1
```
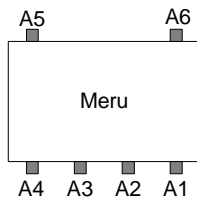
11. Attach three antennas that shipped with AP300 to the three connectors on the triangular remote device. See Figure 8.

Install the Remote Antenna Mount on a Wall

1. Reorient the cable on the Remote Antenna Mount by removing the three screws on the back, removing the small cover, reorienting the cable and then replacing the three screws. Discard the small cover.

2. Connect the three Remote Antenna Mount cables to the appropriate ports on the AP300. Be sure to connect the three antennas that correspond to one radio. Radio 1 uses A1, A2, A3 and Radio 2 uses A4, A5, A6. PSM3x devices only utilize A1, A2, A3, and A5.

```
A5            A6

   ┌──────────────┐
   │              │
   │     Meru     │
   │              │
   └──────────────┘
   A4   A3   A2   A1
```
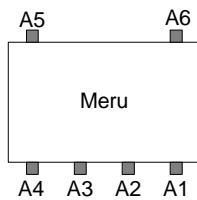
3. Attach three of the antennas that shipped with AP300 to the three ports on the triangular remote device.

4. Orient the connected AP300 horizontally so that you can read the Meru logo without tilting your head at 90 degrees - this orientation provides optimum MIMO performance.

Install External ACC-ANT-MIMO-MNT Antenna with Three Connectors (optional)

You can optionally use an external antenna setup with your AP300 if the controller and APs are running System Director 3.6.1MR4 and later. Meru supports this antenna for use on one radio using 802.11n MIMO. An AP300 with one radio, for example AP310, needs one antenna. An AP300 with two radios, for example AP320, needs two antennas. Radio One antenna cables connect to ports A1, A2, and A3. Radio Two cables connect to ports A4, A5, and A6. There is no preferred cabling connection; all three cables are the same.
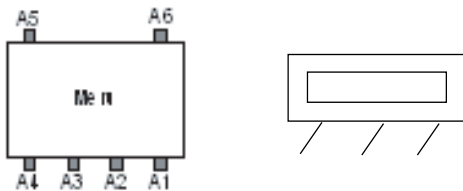
Calculate the antenna gain for the ACC-ANT-MIMO-MNT antenna by referring to the next three charts:

Band of Operation	Gain	Vertical Beamwidth	Horizontal Beamwidth
2.40-2.483 GHz	2.5dB	55 degrees	360 degrees
5.15-5.85 GHz	4dB	60 degrees	360 degrees

Using This Cable Type with 2.4 GHz	Calculate This Loss per Foot
RG174	0.60 dB
RG316	0.48 dB
LMR100	0.39 dB
LMR200	0.17 dB
LMR240	0.13 dB
LMR400	0.066 dB
LMR600	0.043 dB

Using This Cable Type with 5 GHz	Calculate This Loss per Foot
RG174	1.02
RG316	0.76
LMR100	0.59 dB

Using This Cable Type with 5 GHz	Calculate This Loss per Foot
LMR200	0.24 dB
LMR240	0.19 dB
LMR400	0.100 dB
LMR600	0.066 dB

Install Remote ACC-ANT-6ABGN-24 Antenna with Six Connectors (optional)

You can optionally use an external antenna setup with your AP300 if the controller and APs are running System Director 3.6.1MR4 and later. Meru supports this antenna for use on AP300s with two radios, for example AP320. This antenna has six connectors to connect to both radios to a dual-radio AP300 and it supports 802.11n MIMO operation.

The six cables on the ACC-ANT-6ABGN-24 antenna are already tagged with the numbers 1 - 6. Connect the antenna cables to the AP antenna ports as shown here:

Meru AP300 Antenna Connector	Antenna Cable Numbered
A1	6
A2	5
A3	4
A4	3
A5	2
A6	1
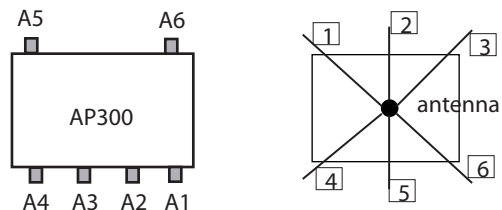
Calculate the antenna gain for the ACC-ANT-6ABGN-24 antenna by referring to the next three charts:

Band of Operation	Gain	Vertical Beamwidth	Horizontal Beamwidth
2.40-2.483 GHz	2.5dB	55 degrees	360 degrees
5.15-5.85 GHz	4dB	60 degrees	360 degrees

Using This Cable Type with 2.4 GHz	Calculate This Loss per Foot
RG174	0.60 dB
RG316	0.48 dB
LMR100	0.39 dB
LMR200	0.17 dB
LMR240	0.13 dB
LMR400	0.066 dB
LMR600	0.043 dB

Using This Cable Type with 5 GHz	Calculate This Loss per Foot
RG174	1.02
RG316	0.76
LMR100	0.59 dB
LMR200	0.24 dB
LMR240	0.19 dB
LMR400	0.100 dB
LMR600	0.066 dB

Install Antennas With One Connector (optional)

You can optionally use an external antenna setup with your AP300 if the controller and APs are running System Director 3.6.1MR4 or 4.0.

When deploying an AP300 with only one antenna per radio, AP300 cannot support 802.11n MIMO operation. Also, any antenna ports that are not used to connect to an antenna must be terminated with 50 ohm Reverse Polarity SMA terminators. (For a list of approved terminators, see http://www.merunetworks.com/merusupport.) Connect the antenna using one cable per radio as described in the table below. These instructions can be used to replace an AP200 existing antenna configuration with an AP300. For these instructions, each port on the AP300 is identified by a label A1 to A6.

AP Has One BG or A Radio, One Antenna

Meru

A3 A2 A1

(BG or A radio antenna)

AP Has Two Radios (BG and A), One Antenna For Each

A5   A6

Meru

A4   A3   A2   A1

(BG radio antenna)
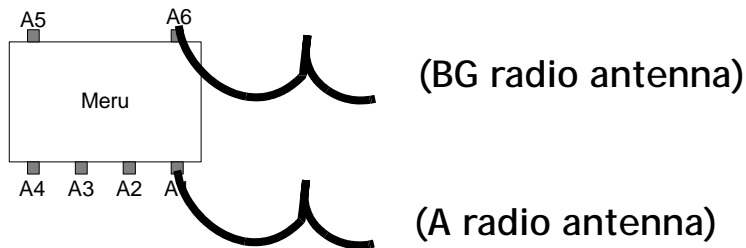
(A radio antenna)

AP Has One Radio, Two Antennas

Meru

A3 A2 A1

(BG or A radio antenna)

(BG or A radio antenna)
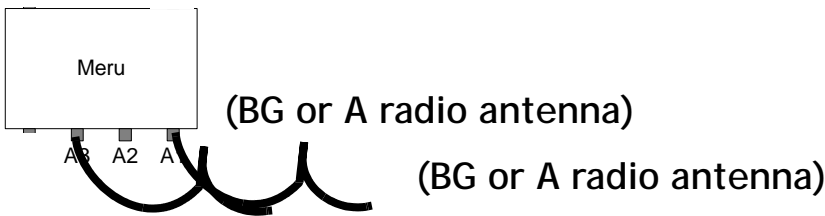
AP Has Two Radios, Four Antennas

A5   A6

Meru

A4 A3 A2 A1

(BG radio antenna)

(BG radio antenna)

(A radio antenna)

(A radio antenna)
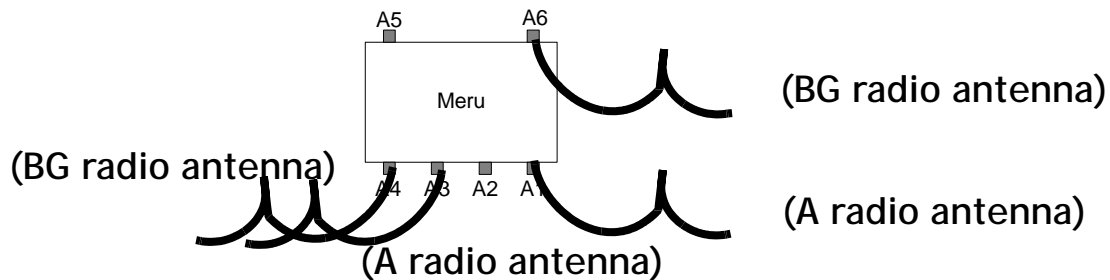
Install the Access Point

AP300 ships with a detachable mounting bracket. The AP300 is designed to be compatible with brackets supplied by Meru and by other vendors as follows. The AP300 mounts directly on the AP150 mounting bracket. If you are replacing AP200s/AP300s, the AP300 bracket can be mounted on the old AP200s/AP300s bracket with included shoulder screws; you don't need to remove the old brackets. AP300 can also be directly mounted on third-party brackets such as Proxim AP4000 and Cisco standard brackets.

You can mount an AP300 in the following ways:

- Mount AP300 Horizontally on a Shelf
- Mount AP300 Vertically on a Wall
- Mount AP300 Below a Suspended Ceiling
- Mount AP300 Above a Suspended Ceiling (Plenum)
- Mount AP300 in a Hoffman Enclosure

Mount AP300 Horizontally on a Shelf

When mounting an AP300 horizontally, remove the mounting bracket. Be sure to position the antennas vertically when an AP300 sits on a surface.

Mount AP300 Vertically on a Wall

✔ **Note:**   If you are replacing AP150s, you can use the existing brackets: the AP150 and AP300 use the same bracket. If you are replacing AP300s, the AP300 bracket can be attached to the old bracket with included shoulder screws; you don't have to remove the old brackets. This bracket will also mount seamlessly into the Proxim AP4000 bracket and standard Cisco brackets.

To mount an AP300 on a wall:

1. Using the bracket holes as a guide, mark the location on the wall for the two AP bracket mounting screws. If possible, center the mounting screws on a wall stud. If you do not center the mounting screws on a wall stud, use plastic wall anchors. Orient the AP300 horizontally so that you can read the Meru logo without tilting your head at 90 degrees - this orientation provides optimum MIMO performance.

2. Drill holes at the locations you marked:
   — 3/16-inch holes if you are using plastic anchors
   — 1/8-inch holes if you are using only the screws

3. If you are using plastic anchors, install them in the holes.

4. Screw in the screws most of the way.

5. Mount the bracket on the screws, placing the circular portion of the keyhole mounts over the screw heads and sliding the bracket down.

6. Connect one end of the Ethernet cable to the switch and the other end to the AP300 Ethernet port.

> ❗ **Caution!**   Be sure to connect the Ethernet cable to the Ethernet port; the cable can mistakenly be plugged into the Console port. If you do this, the AP won't power up.

7. If you are not using a PoE device, connect an external power supply to the power connector and plug it into the wall.

Mount AP300 Below a Suspended Ceiling

The optional suspended ceiling mounting kit (ACC-MNT-SCRMKIT) allows the AP300 mounting bracket to attach to suspended ceiling T-rails (see Figure 9).

✔ **Note:**   To comply with NEC code, attach a grounding wire to any of the screws used to attach the AP300 to the mounting bracket.

Figure 9: Mounting any AP to a Suspended Ceiling Rail using ACC-MNT-SCRMKIT
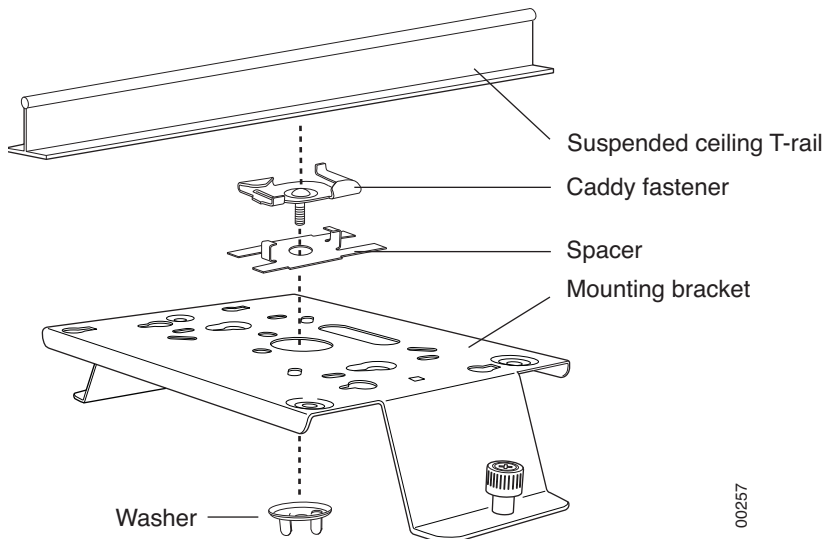
To mount an AP300 below a suspended ceiling:

1. Determine the location on the ceiling rail where the AP will be mounted and remove the ceiling tiles.

2. Place each of the two caddy fasteners on the ceiling T-rail and twist to attach to the rail.

3. Adjust the distance between the caddy fasteners by using the mounting bracket holes as a guide.

4. Tighten the caddy fasteners in place using a standard screwdriver. Do not overtighten.

5. Place each spacer on the caddy fastener stud. The spacer legs should contact the ceiling T-rail.

6. Align the mounting bracket keyholes with the caddy fastener studs and slide the AP300 to the narrow end of the hole.

7. Attach a keps nut to each caddy fastener stud and hand tighten. Do not overtighten.

8. Align the AP300 mounting posts over the circular portion of the keyhole mounts, push the AP in and slide the AP down until it engages with the locking detents (see Figure 9). You should hear it snap in place.

9. For each antenna, loosen the knurled ring at the base of the antenna, orient the antenna and then retighten the ring.

10. Connect one end of the PoE 100BaseT Ethernet cable to the 100/1000 Ethernet connector.

> **!** **Caution!**   Be sure to connect the Ethernet cable to the Ethernet port; the cable can mistakenly be plugged into the Console port. If you do this. the AP won't power up.

Mount AP300 Above a Suspended Ceiling (Plenum)

Use the optional T-bar box hanger mounting kit to mount AP300 above suspended ceiling T-rails (see Figure 11). The installation attaches the T-bar box hanger to the ceiling rails and then the AP300 attaches to the T-bar box hanger. Note that AP300 mounted above the ceiling has about 2-3 dBm less RF coverage than AP300 mounted under the ceiling.

The AP300 with the metal enclosure exposed meets the requirements for fire resistance and low smoke-generating characteristics required by Section 300-22(C) of the National Electrical Code (NEC) for installation in a building's environmental air space.

You may need to modify thicker tiles to support this installation.

Warning! When installed in air-handling spaces, such as above a suspended ceiling, power the AP300 only with a PoE, not a power supply. See Power Supplies for part numbers.

Warning! Any Fast Ethernet (FE) cables installed in air-handling spaces should be suitable under NEC Article 800.50 and marked accordingly for use in plenums and air-handling spaces with regard to smoke propagation, such as CL2-P, CL3-P, MPP (Multi Purpose Plenum), or CMP (Communications Plenum). Use Ethernet cable that meets the requirements for operating in plenums and environmental air space in accordance with Section 300-22(C) of the NEC.

To mount an AP300 above the ceiling with the optional T-bar kit, follow these steps:

1. Determine the location on the ceiling rails where the AP will be mounted and remove the ceiling tile.
2. Unpack the T-bar hanger kit.
3. Remove the mounting bracket plate from the underside of the AP300.
4. Locate the mounting bar (depicted in Figure 10) and the two screws provided for it.

Figure 10: Mounting Bar
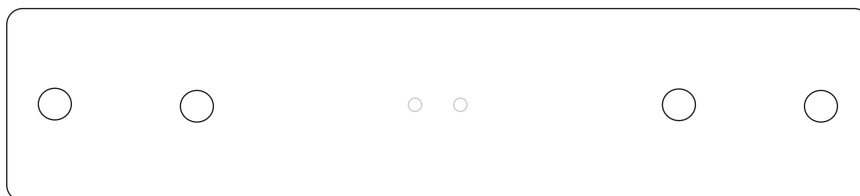
5. Place the mounting bar on top of the crossbar of the mounting bracket, and place the AP300 bracket (which you removed earlier) against the underside of the crossbar. The crossbar should be sandwiched between the mounting bar and the mounting bracket.

6. Insert the screws removed from the mounting bar through the underside of the mounting bracket (therefore screwing upwards through the mounting bar) to attach the bracket to the crossbar. See Figure 11.

Figure 11: Correct Screw Location

00263
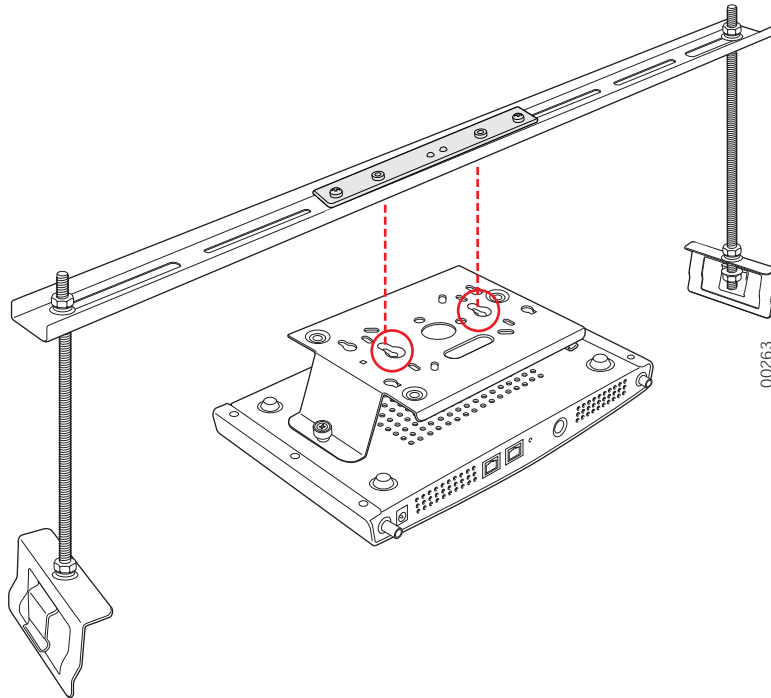
✔ **Note:** The AP300 shown in Figure 11 does not have the external antennas attached in order to aid in installation. These can be connected after mounting.

7. Reattach the AP300 to its mounting bracket using the thumbscrews provided.

8. For each antenna, loosen the knurled ring at the base of the antenna, point the antenna down, then retighten the ring (or attach the antennas, if not already done).

9. Attach the legs of the T-Bar kit to the bars on which the AP is to be mounted by sliding the clips into place on top of the T-Bars.

10. Remove one nut from each leg.

11. Slide the crossbar into place on top of the legs and replace the nuts on top.

12. Connect a drop wire to a building structural element and through the oval hole provided in the bracket mounting clip (on the underside of the AP300). The U.S. National Electrical Safety Code requires this additional support.

13. Connect one end of the PoE Ethernet cable to the Ethernet connector.

> **Caution!** Be sure to connect the Ethernet cable to the Ethernet port; the cable can mistakenly be plugged into the Console port. If you do this. the AP won't power up.

> **Note:** Use a shielded Cat 5e (or greater) Ethernet cable in order to comply with international electromagnetic emissions limits.

14. Check that the AP300 is operating correctly before replacing the ceiling tile to the ceiling. Verify correct operation using the LEDs, as shown in Check AP300 LED Activity.

Mount AP300 in a Hoffman Enclosure

Meru has designed a custom mounting bracket compatible with a Hoffman enclosure (**www.hoffmanonline.com**). This bracket is available exclusively through Meru and orderable as part number ACC-AP300-BHE. To mount an AP300 in a Hoffman enclosure, follow these steps:

1. Place AP300 upside down on a soft flat surface.

2. Remove and discard the wall/ceiling mounting bracket.

3. Attach either the provided antennas or an external antenna.

4. Remove and discard the four rubber feet.

5. Position the Hoffman bracket (ACC-AP300-BHE) onto the back of the AP300 with the four Hoffman mounting screws facing downwards.

Figure 12: Hoffman Bracket ACC-AP300-BHE
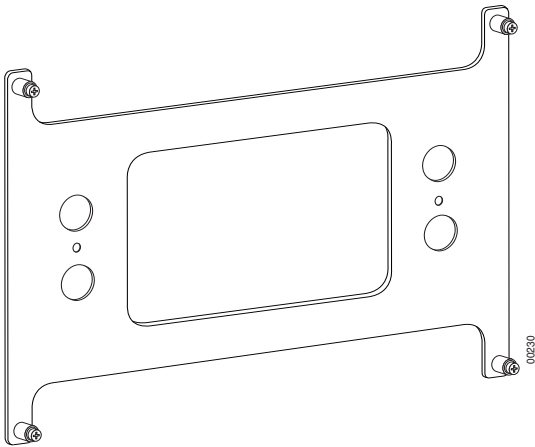
6. Using a Phillips screw driver, attach the bracket using the two supplied 6-32 3/16 SEMS screws.

7. Flip the assembly over and mount into the Hoffman enclosure, attach the Ethernet cable to the AP300 rotating the assembly to place the Ethernet cable within the enclosure.

8. Using a Phillips screw driver, tighten the four bracket screws to the enclosure.

9. Adjust the antennas as needed.

Check AP300 LED Activity

When AP300 first connects to the controller (and any time the access point is rebooted), the AP initializes and is then programmed by the controller. When the AP first powers up, all LEDs are green.

Figure 13: AP300 Status LEDs
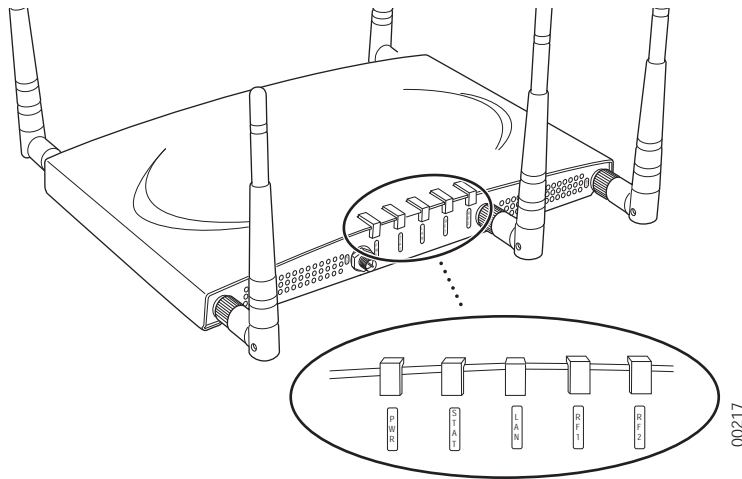
After the AP300 is connected, check the status of the LEDs. The functions of the five LEDs are described below.

AP300/AP320i LED Descriptions

LED	Function	Troubleshooting
Power	off—no power green—presence of power	
Status	off—no power green—booting stage 1 blinking green and off—booting stage 2 blinking green and white—discovering the controller blinking green and blue—downloading a configuration from the controller blinking blue and off—AP is online and enabled, working state blinking red and yellow—failure; consult controller for alarm state	If the status LED is blinking red and yellow, there is an alarm on the AP. Determine what the alarm is by clicking **Monitor > Dashboard > Alarms** and looking at the AP alarms. You can also use the CLI commands **show alarm** and **show log**.
LAN	off—no power or no link green—link status OK (at any speed) green/blinking—activity (at any speed) red—auto negotiation failure	If the LAN LED is red, auto negotiation failed. This means that you have a problem with cabling or with the AP's switch.
Radio 1 Radio 2	off—no radio present green—radio enabled green blinking—data activity yellow—disabled or in scanning mode red—failure	If one of the radio LEDs is yellow, it is either disabled or in scanning mode. To see if the AP is disabled, click **Configuration > Wireless > Radio >** select a radio and then look at Administrative Status, which should be set to **Up**. To see if the AP is in Scanning Mode, click **Configuration > Wireless > Radio >** select a radio and look at AP Modes, which should be set to **Normal Mode**. If one of the radio LEDs is red, the radio failed. Check the alarms (**Monitor > Dashboard > Alarms)**, diagnostics (**Monitor > Diagnostics > Radio)**, and statistics (**Monitor > Dashboard > Radio)** on the AP's controller to determine the cause.

Change LED Appearance

If you want to change the appearance of the LEDS, follow these steps:

1. From the controller, click **Configuration** > **Devices** > **AP**, and then select the AP.

2. Select one of these settings for the LED Mode setting:
   — **Normal:** LEDs are as described below
   — **Node ID:** Not supported in release 4.1
   — **Blink:** Sets all LEDs flashing; this is useful to locate an AP
   — **Dark:** Turns off all LEDs

3. Click **OK**.

Where to Go From Here

Now that the AP1000 is installed, refer to the *Meru System Director Getting Started Guide* for instructions on initializing the hardware. Return to this chapter to check the status of the LEDs once the WLAN is operational.

Chapter 3
Installing AP320i

AP320i is supported by System Director versions 3.6.1 and greater, but full support begins with System Director release 4.x and later. Because of this, when using AP320i with System Director 3.6.1, the unit shows as an AP300, for example AP320 instead of AP320i. All AP320i units still function correctly, they just display as AP300 because AP320i did not exist when System Director 3.6.1 was released.

This chapter describes how to install and configure an AP320i. It contains the following sections:

- Safety Precautions
- Best Practices for an AP320i/AP1000 Network
- Unpack the AP320i
- Determine Power Requirements
- Installing AP320i
- Check AP320i LED Activity
- Where to Go From Here

Safety Precautions

IMPORTANT—Read and follow the regulatory instructions in Appendix B before installing and operating this product.

If an optional power supply is used, it must be one supplied by Meru Networks.

Warning! This product is intended to be supplied by a UL Listed power supply marked Class 2 or LPS and rated minimum 5Vdc, 3A.

The AP320i is only intended for installation in Environment A as defined in IEEE 802.3af. All interconnected equipment must be contained within the same building, including the interconnected equipment's associated LAN connection.

Best Practices for an AP320i/AP1000 Network

Read this section if you have both AP1000 and AP320i active simultaneously on the same network. The following best practices should be followed to get optimal performance from such a mixed network.

- AP320i and AP300 are interchangeable and fully compatible to share a virtual cell. It's like having two AP300s with different antennas. The only difference is that AP320i is detected as a such in the UI of the controller.
- If possible, do not deploy AP1000 and AP320i at the same physical location; we recommend that there be no overlapping coverage between AP1000 and AP300.
- If AP1000 and AP320i do have overlapping coverage, you have two options. Deploy them on seperate channels or make sure the ESS profiles on both AP types are unique. The chart below shows two ESS scenarios, one supported, one not supported.

Supported ESS Scenario	AP1000 Configuration	AP320i Configuration
Two Unique ESS profiles	ESS Profile name in controller is UniqueName1	ESS Profile name in controller is UniqueName2
AP1000 and AP320i SSID string over the air	Meru	Meru

Unsupported ESS Scenario	AP1000 Configuration	AP320i Configuration
Same ESS profiles	ESS Profile name in controller is same name	ESS Profile name in controller is same name
AP1000 and AP320i SSID string over the air	Meru	Meru

Assumptions for the above best practices include:

- AP1000 is using Virtual Port with BSSID Virtual Cell.
- AP320i is using Virtual Port with BSSID Virtual Cell.
- AP1000s and AP320is are on the same channel. (AP1000 and AP320i could also be on different channels.)
- AP1000s and AP320i is are on the same controller. (AP1000 and AP320i could also be on different controllers as long as each controller has a unique controller index.)

Unpack the AP320i

Confirm that the shipping box contains the following:

- AP320i with an attached ceiling mounting bracket
- Wall mount bracket with screws
- Small locking key for ceiling or wall mount locking

Determine Power Requirements

Power requirements vary, depending on what MIMO mode is used. See the chart below for supported power sources for different radio configurations.

Radio 1 MIMO	Radio 2 MIMO	802.3af PoE	802.3at PoE	DC Power
2x2	2x2	●	●	●
2x2	3x3	●	●	●
3x3	2x2	●	●	●
3x3	3x3	Do not recommend	●	●

802.af PoE Usage

When using System Director 3.6/4.0/4.1 and 802.3af PoE, Meru supports radios set to any MIMO settings except 3x3 on dual radios. This is because two radios set to 3x3 MIMO using an 802.3af switch may not have enough power if the cable is too long. Shorter cables frequently work, however. Meru supports:

- Single 3x3 radio
- Dual 2x2 radios
- Dual radio with one set to 2x2 and the other one set to 3x3

When using System Director 4.0/4.1 and 802.3af, AP320i MIMO configuration is limited to the following:

- 3x3 for one radio
- 2x2 for the other radio

802.3at Usage

When using System Director and 802.3at, the following radio combinations are recommended:

- Single or dual 3x3 radio
- Dual 2 x 2 radios
- Dual radio with one set to 2x2 and the other one set to 3x3

For a list of supported PoEs, see the appendix Supported Power Over Ethernet Devices for Meru APs

Additional Equipment

A power source is needed to power the AP320i. See Determine Power Requirements for options. If you want to lock an AP320i to the ceiling or wall, you need a small key like the ones used to lock suitcases.

Installation Type	Order These Additional Items
Horizontal mounting	None
Vertical mounting over a wall stud	None
Vertical mounting on sheetrock	None
Horizontal mounting below a hanging ceiling	None
Reusing an existing bracket from another AP	For connection to Meru AP150 only, order shoulder screws, Meru part number 665-00012 (SCR, PIC.1/4*1/8 10-32 SKT SHLDR SCR 303 STNLS). Connection to other brackets does not require this.

Installing AP320i

Select a Location

All AP320i interconnected equipment must be contained within the same building, including the inter-connected equipment's associated LAN connection. Ceiling mounting is recommended but wall mounting is also supported. In addition, the AP320i should be mounted in a location that meets the following conditions:

- Relatively unobstructed access to the stations the AP serves. Select a location with minimal physical obstructions between the AP and the wireless stations. In an office with cubicles, mounting the APs below a hanging ceiling (plenum is supported) or the wall near the ceiling provides the least obstructed communications path. On a wall, orient the AP320i horizontally so that you can read the Meru logo without tilting your head at 90 degrees - this orientation provides optimum MIMO performance.

- We recommend planning for about 50 clients per radio (or per interference region) if you plan to use Virtual Port and plan to have phones as clients. For a data-only installation, plan up to 128 clients per radio, meaning 256 for AP320i. Refer to the Meru Deployment Guides on the support site for more information.

- Access to wall outlet or a to a Power over Ethernet (PoE) connection to the network switch servicing the controller.

AP320i is designed to provide 180 degree omni-directional coverage as illustrated below. Plan placement with this pattern in mind.

Figure 14: Coverage Pattern for AP320i When Ceiling Mounted

Most installations receive the best coverage using the following guidelines:

- Install APs toward the center of the building.

- Place APs about 80 feet apart.

- Do not install APs near metal objects, such as heating ducts, metal doors, or electric service panels.

- If you install AP320i on a pole, keep in mind that coverage will be 180 degrees. Do not mount two AP320is back to back on a pole to achieve 360 degree coverage, however, because the two units could interfere with each other.

Install the Access Point

✔ The AP320i ships with a detachable ceiling mounting bracket, making the unit ready for ceiling mounting. You can also use the included wall-mount bracket by attaching it to the default ceiling-mount one that comes already attached. Installation directions are provided below.

Mount AP320i in any of the following ways:

- Mount AP320i Below a Suspended Ceiling
- Mount AP320i Above a Suspended Ceiling
- Mount AP320i Vertically on a Wall
- Set AP320i on a Shelf

Mount AP320i Below a Suspended Ceiling

AP320i ships ready to mount on a suspended ceiling; the attached bracket clips to a ceiling rail.

To mount an AP320i below a suspended ceiling, follow these steps:

1. Determine the location on the ceiling rail where the AP will be mounted and remove the ceiling tiles.
2. Align the mounting bracket with the slots indicated in Figure 15 below.

Figure 15: Install AP320i Below a Suspended Ceiling
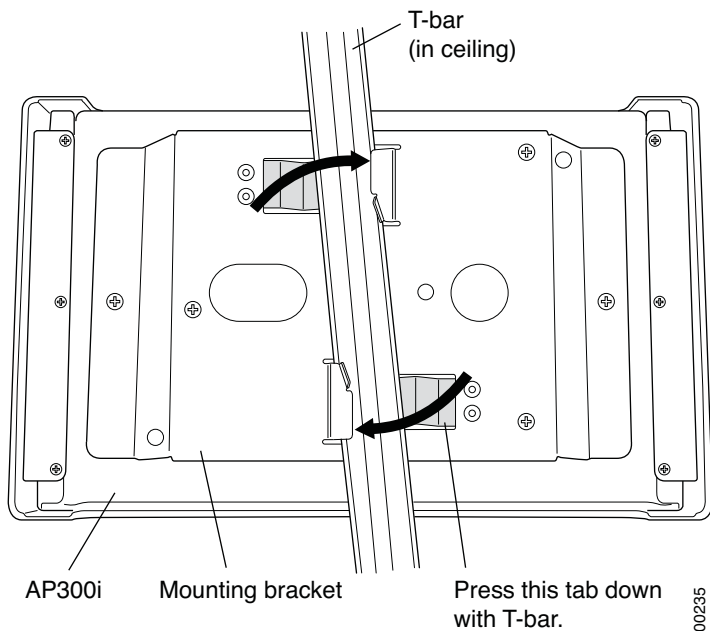
3. Press down on the tab indicated in Figure 15 and rotate the AP320i into place. Note that depending on the date on which the AP was shipped, there may be two tabs on the underside (as shown above).

4. Connect one end of the CAT5 (or greater) Ethernet cable to the 100/1000 Ethernet connector.
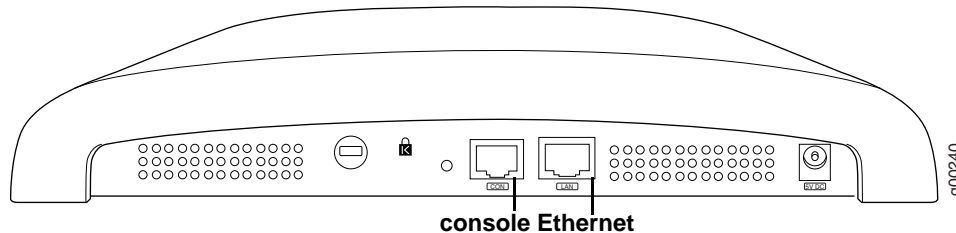
> **!** **Caution!** Be sure to connect the Ethernet cable to the Ethernet port. The cable can mistakenly be plugged into the Console port; if you do this, the AP won't power up.

Figure 16: AP320i Ethernet Port on the Right

console Ethernet

5. Optionally install a small lock (not supplied) to secure the AP320i to the ceiling rail. See Figure 17. To do this, you need the security key that shipped with the AP320i.

Figure 17: Optionally Install Your Own Lock on AP320i

Insert security clip.   Security clip fully inserted.   Lock security clip.

T-bar (in ceiling)

AP300i   Security clip   Mounting bracket
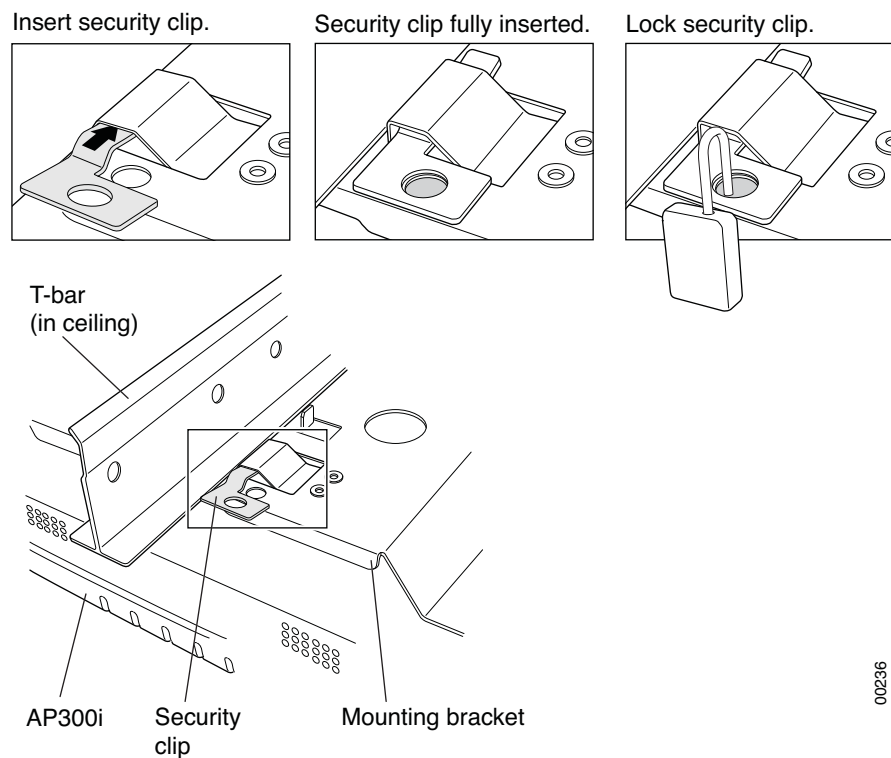
Mount AP320i Above a Suspended Ceiling

> **✔** **Note:** AP320i is not plenum-rated and should only be mounted above ceilings in non-plenum air space, such as a return airflow for air conditioning.

Use the optional T-bar box hanger mounting kit to mount AP320i above suspended ceiling T-rails. The installation attaches the T-bar box hanger to the ceiling rails and then the AP320i attaches to the T-bar box hanger. Note that AP320i mounted above the ceiling has about 2-3 dBm less RF coverage than AP320i mounted under the ceiling.

You may need to modify thicker tiles to support this installation.

> **Warning!** When installed in air-handling spaces, such as above a suspended ceiling, power the AP320i only with a PoE, not a power supply. See Power Supplies for part numbers.

To mount an AP320i above the ceiling with the optional T-bar kit, follow these steps:

1. Determine the location on the ceiling rails where the AP will be mounted and remove the ceiling tile.

2. Unpack the T-bar hanger kit.

3. Attach the mounting bar (depicted in Figure 18) to the mounting brace (which looks like a small handle) with the crossbar of the mounting kit sandwiched between them. See Figure 19.
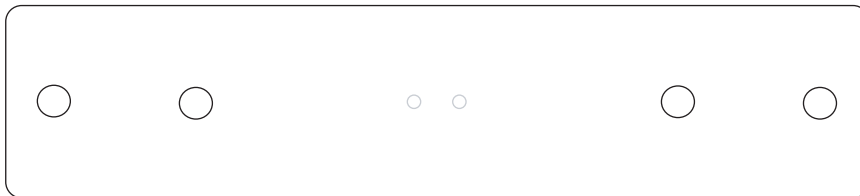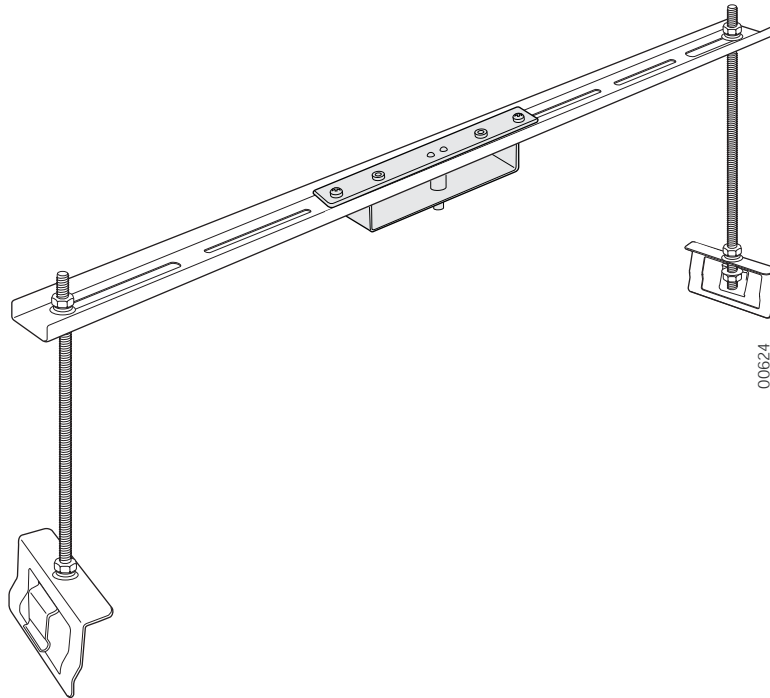
Figure 18: Mounting Bar

Figure 19: Assembled Mounting Bracket

4. Gently press the bracket attached to the AP320i against the mounting brace and rotate it into place until the locking mechanism clicks. Note that this is essentially the same process as depicted in **Figure 21**.

5. Remove a nut from each leg of the T-Bar kit and slide the crossbar on top of them.

6. Replace the nuts removed to lock the crossbar into place on the legs.

7. Attach the clips on either side of the T-Bar kit to the ceiling tile rails on which the full setup is to be mounted.

8. Connect a drop wire to a building structural element and through the hole provided in the bracket mounting clip (on the underside of the AP320). The U.S. National Electrical Safety Code requires this additional support.

9. Connect one end of the PoE Ethernet cable to the Ethernet connector.

> **!** **Caution!** Be sure to connect the Ethernet cable to the Ethernet port; the cable can mistakenly be plugged into the Console port. If you do this. the AP won't power up.

> **✔** **Note:** Use a shielded Cat 5e (or greater) Ethernet cable in order to comply with international electromagnetic emissions limits.

Check that the AP320i is operating correctly before replacing the ceiling tile to the ceiling. Verify correct operation using the LEDs, as shown in **Check AP320i LED Activity**.
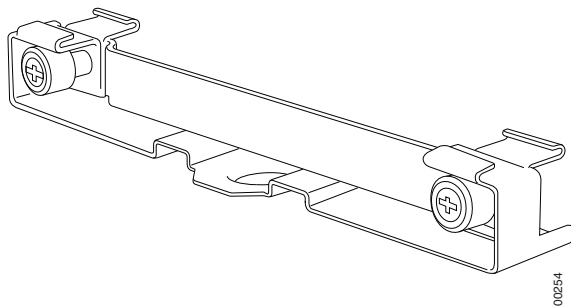
Mount AP320i Below a Recessed Ceiling

The optional recessed ceiling mounting kit allows the AP320i mounting bracket (which is attached to the AP when it is shipped) to be attached to a recessed ceiling rail by extending the distance from the rail to the AP. This kit can be adjusted to fit either a wide or thin rail size.

> ✔
>
> **Note:** The recessed ceiling mounting kit is part number ACC-MNT-SCRMKIT-02 prior to AP revision N. As of revision N, however, the AP ships with a slightly different mounting bracket and utilizes ACC-MNT-SCRMKIT-03 for recessed mounting. Be sure to order the correct part number as associated with your AP revision. Refer to Figure 20 for examples.

Figure 20: ACC-MNT-SCRMKIT-02 and -03
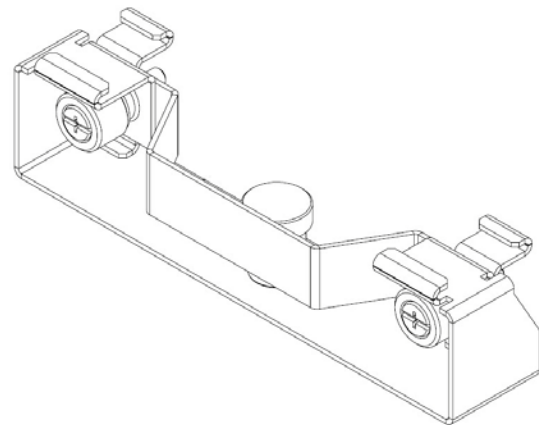
ACC-MNT-SCRMKIT-02   ACC-MNT-SCRMKIT-03

To mount AP320i below a recessed ceiling, follow these steps:

1. Determine the width of the ceiling rail to be used. This will tell you whether you need to adjust the extender bracket. If the ceiling rail is wider (23.8mm), you do not have to adjust anything; continue to step 3.
2. For a narrow ceiling rail (22.2mm), adjust the bracket. Remove the two screws shown in Figure 20 and flip one side over. This will result in a narrower channel. Tighten the screws.
3. Attach the bracket to the AP by rotating it into place as shown in Figure 21.

Figure 21: Rotate AP320i into Place on the Recessed Ceiling Rail
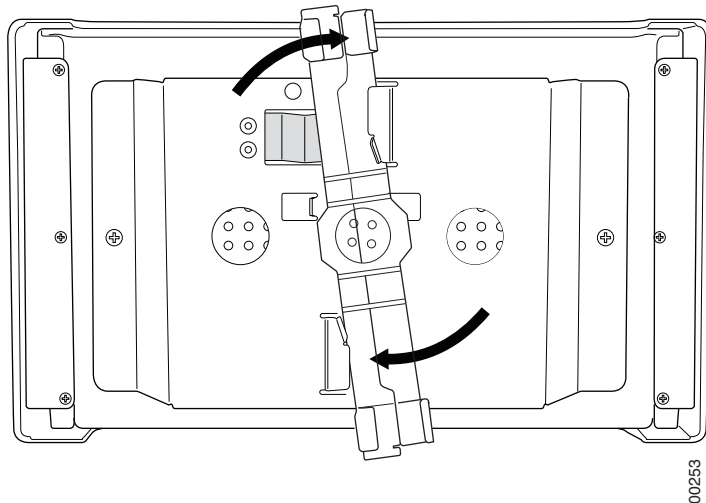
> ✔ **Note:** Figure 21 depicts ACC-MNT-SCRMKIT-02 being used. This same procedure is used for ACC-MNT-SCRMKIT-03 as well.

4. Attach the bracket shown in Figure 22 to the ceiling rail. Loosen the two screws enough to slip the ceiling rail into the channel and then tighten the screws.

Figure 22: Tighten the Brackets to Fit the T-Bar
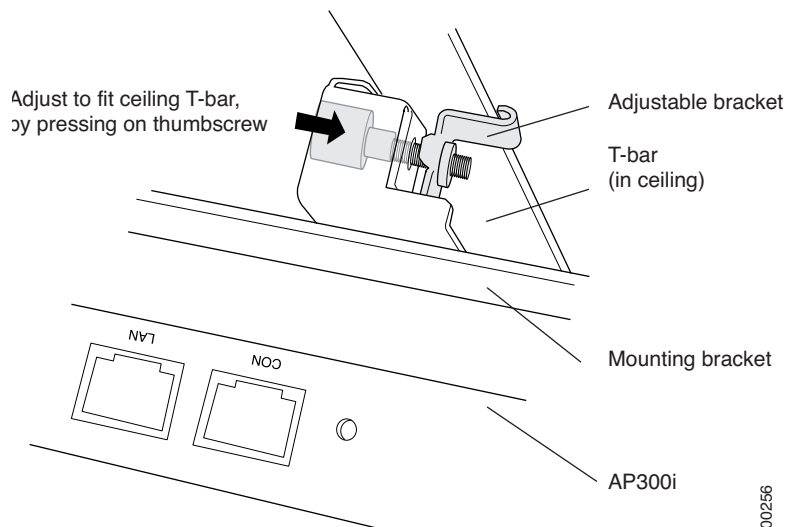
Mount AP320i on an Interlude/Silhouette T-Bar

The optional mounting kit for ceilings with Interlude / Silhouette T-bar (ACC-MNT-SCRMKIT-04) allows the AP320i (as of Revision N) to attach to this type of ceiling by extending the distance from the ceiling rail to the AP. See Figure 23.

Figure 23: Interlude Tile Bracket
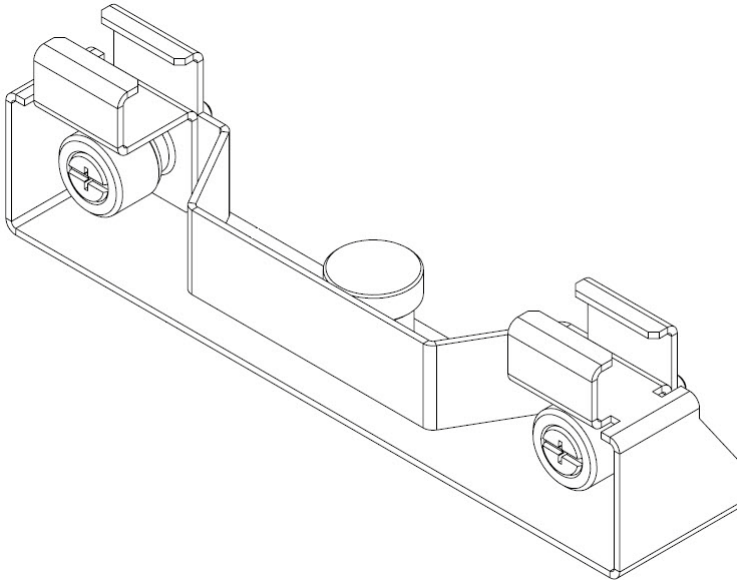
✔ **Note:** The interlude mounting bracket can only be used for APs post-revision N.

The mounting procedure for the interlude bracket is identical to that described in Mount AP320i Below a Recessed Ceiling. Essentially, fit the bracket to the ceiling T-bar and twist the AP into place on it. Refer to the previous section for step-by-step instructions.

Mount AP320i Vertically on a Wall

Note that your AP320i may utilize one of two different wall mount brackets (depending on the product revision). Prior to revision N, the bracket twisted into position with the AP (shown in Figure 24). The updated bracket (post revision N) slides into place with three mounting screws. For the former bracket, follow the instructions below. For the updated version, refer to Using the Updated AP320i Wall Mount Bracket.

The AP320i ships with a ceiling mount bracket already connected to the unit and an additional separate wall bracket. When wall mounting a unit, you will attach the wall mount bracket to the wall, then attach the ceiling bracket (including AP320i) to the wall bracket. If you are replacing an AP200, the AP320i wall bracket can be mounted on top of the old bracket using shoulder screws (not included); you don't need to remove the old bracket. If you are replacing an AP150 or AP300, the AP320i can also be mounted on top of the old bracket after removing the ceiling mount bracket that ships attached by default (no additional screws required).

To mount an AP320i on sheetrock or wall studs, follow these steps:

1. Using the wall bracket holes as a guide, mark the location on the wall for two AP bracket mounting screws. Orient the connected AP320i horizontally so that you can read the Meru logo without tilting your head at 90 degrees - this orientation provides optimum MIMO performance.

Figure 24: AP320i Wall Bracket
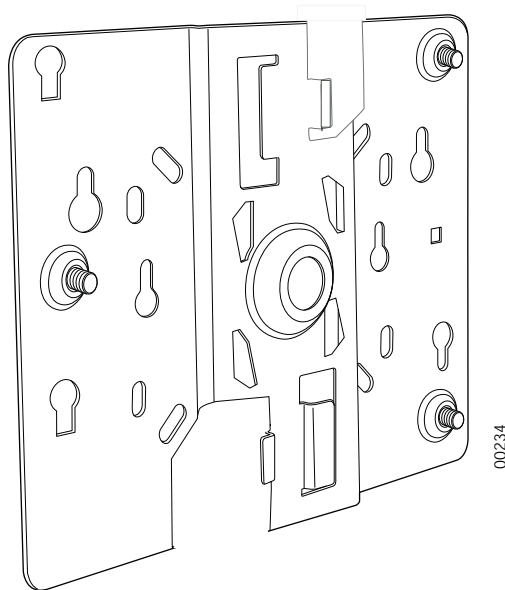
00234

If possible, center the mounting screws on a wall stud. If you do not center the mounting screws on a wall stud, use plastic wall anchors.

2. Drill holes at the locations you marked:
  — 3/16-inch holes if you are using plastic anchors
  — 1/8-inch holes if you are using only the screws

3. If you are using plastic anchors, install them in the holes.

4. Screw in the screws most of the way.

5. Mount the bracket on the screws, placing the circular portion of the keyhole mounts over the screw heads and sliding the bracket down. Tighten the screws to lock the bracket in place.

6. Connect one end of the Ethernet cable to the switch and the other end to the AP320i Ethernet port.

> **!** **Caution!**   Be sure to connect the Ethernet cable to the Ethernet port. The cable can mistakenly be plugged into the Console port; if you do this. the AP won't power up.

Figure 25: AP320i Ethernet Port on the Right
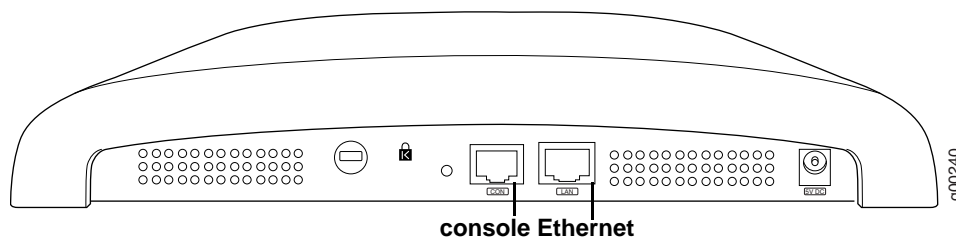
g00240

console Ethernet

7. If you are not using a PoE device, connect an external power supply to the power connector and plug it into the wall.

8. Align the tabs on the wall bracket with the tabs on the ceiling bracket and then rotate the AP320i clockwise to secure it to the wall. See Figure 26 below.

Figure 26: Mount AP320i on a Wall

Align tabs on Wall bracket with tabs on the Mounting bracket.

Twist to secure the AP300i to the wall.

Tabs

Wall bracket (mounted on wall)

Mounting bracket (attached)

AP300i

00237

9. Optionally, lock the AP320i bracket by inserting the provided locking key and applying a small lock. See Figure 27 below.

Figure 27: AP320i Locked to a Wall
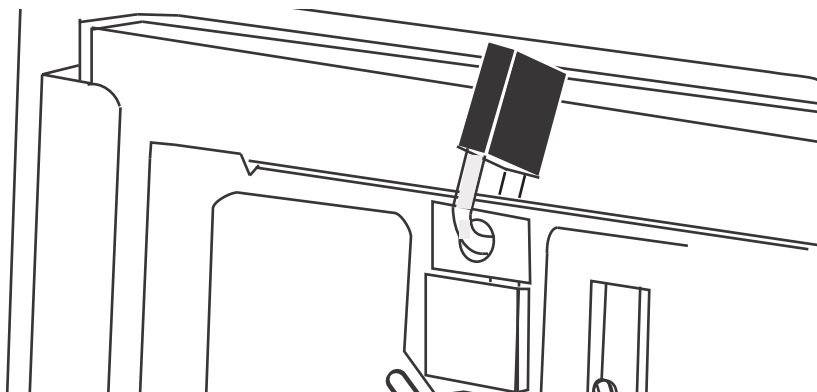
Note that you can also attach this bracket to an existing AP200 bracket on the wall. See Figure 28 below.

Figure 28: Using an Existing AP200 Bracket to Attach AP320i

AP300i

ceiling mount bracket

optional shoulder screw

AP200 bracket on a wall
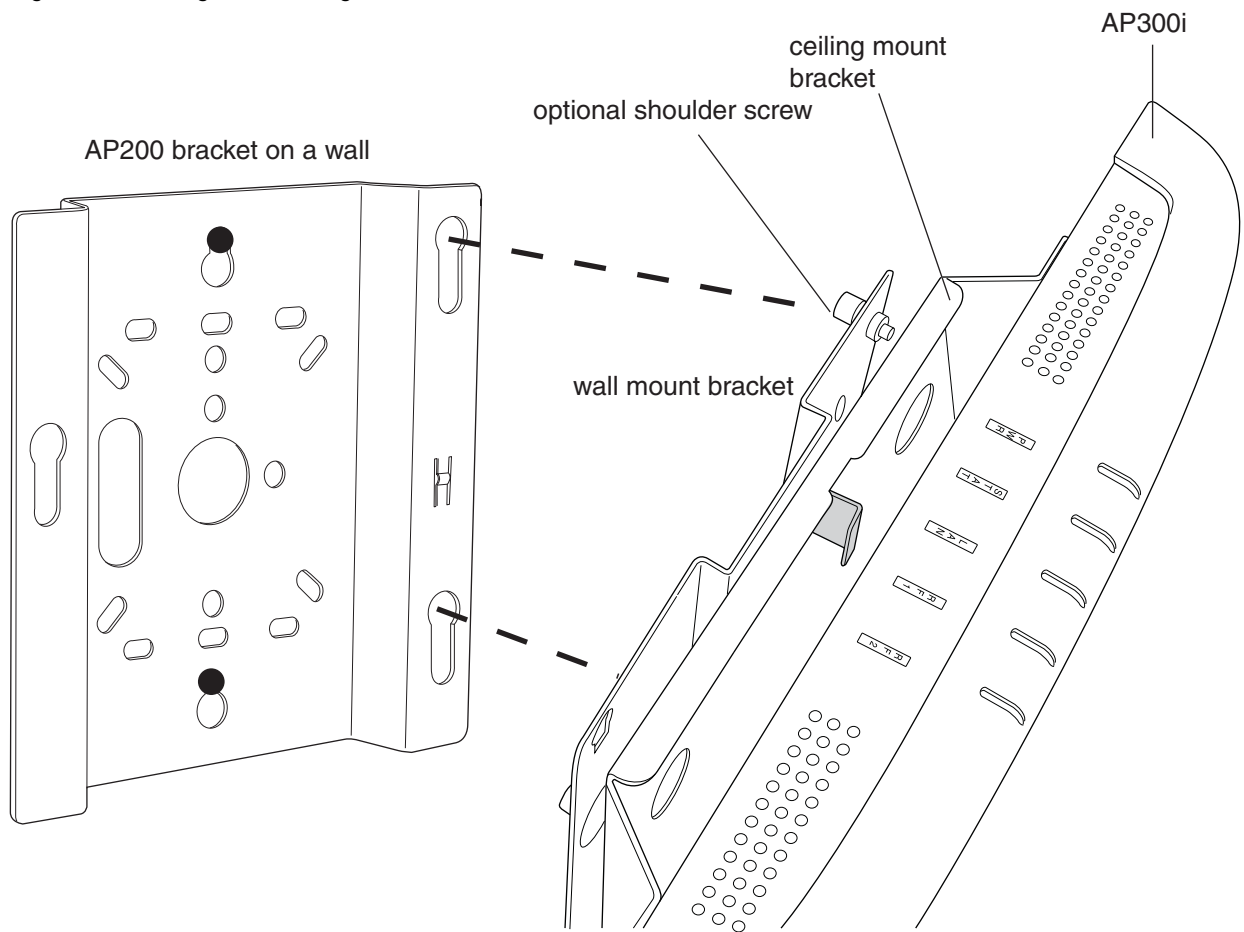
wall mount bracket

Using the Updated AP320i Wall Mount Bracket

As of product revision N, the AP320 ships with a bracket that differs from that illustrated in Figure 24. The updated wall mount bracket attaches to the bracket that comes attached to the AP itself via three mounting screws that are provided in the box.

	Note:	If you are replacing an AP200, the AP320i ceiling bracket can be mounted on top of the old bracket using shoulder screws; you don't need to remove the old bracket. If you are replacing an AP150 or AP300, the AP320i can also be mounted on top of the old bracket once the ceiling mount bracket that it ships with by default is removed (no additional screws required).

To mount the AP320i using the new bracket:

1. Attach the three screws to their corresponding locations (highlighted in red below) on the default bracket (which ships attached to the AP).

Figure 29: Wall Mount Screw Locations
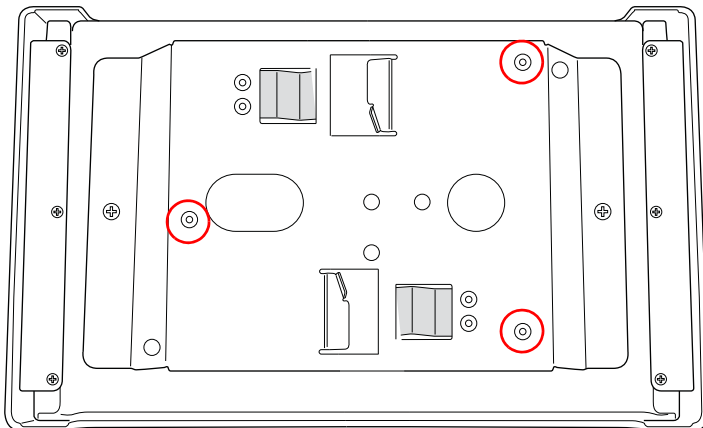
2. Using the wall mount bracket as a guide, mark locations for the two screws that will hold the wall bracket in place. If possible, center the mounting screws on a wall stud. If you do not center the mounting screws on a wall stud, use plastic wall anchors.

3. Drill holes at the locations you marked:
   — 3/16-inch holes if you are using plastic anchors
   — 1/8-inch holes if you are using only the screws

4. Screw in the screws most of the way.

5. Mount the wall bracket on the screws, placing the circular portion of the keyhole mounts over the screw heads and sliding the bracket down. Tighten the screws to lock the bracket in place.

6. Connect one end of the Ethernet cable to the switch and the other end to the AP320i Ethernet port.

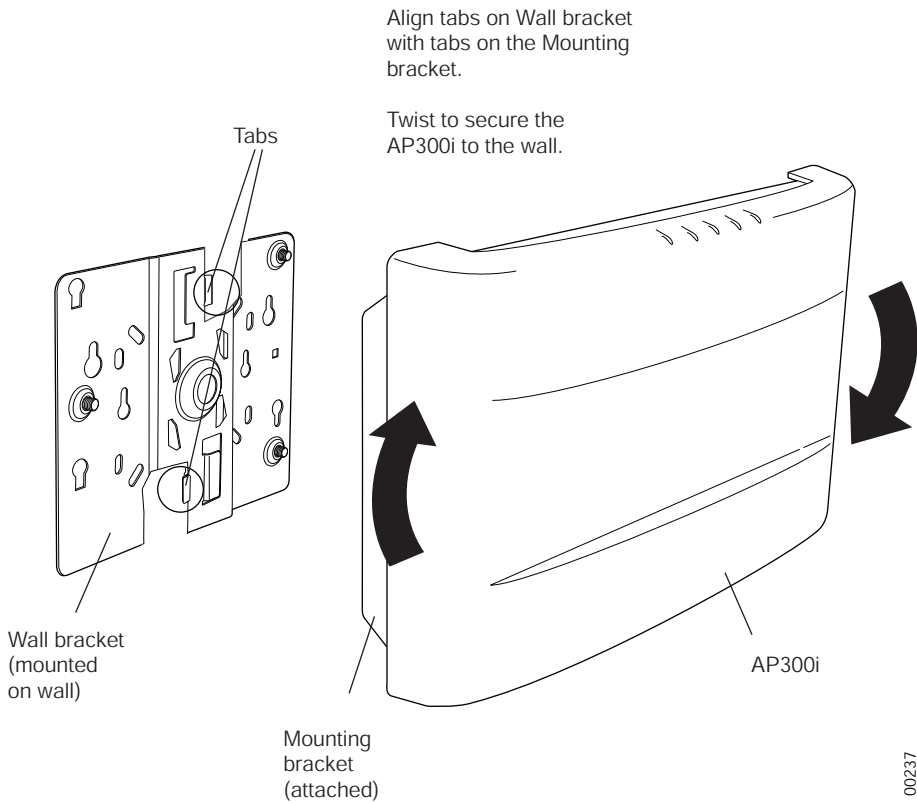|	**Caution!**	Be sure to connect the Ethernet cable to the Ethernet port. The cable can mistakenly be plugged into the Console port; if you do this. the AP won't power up.

Figure 30: AP320i Ethernet Port on the Right
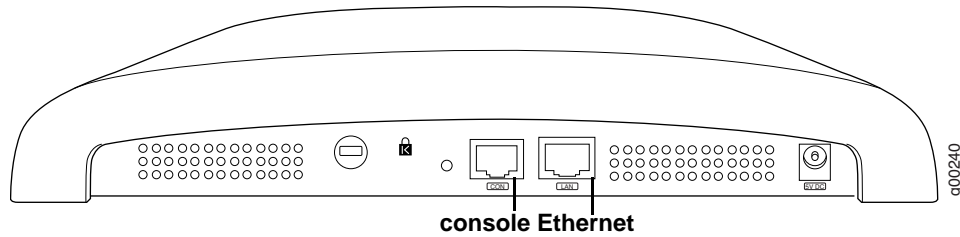
console Ethernet

7. If you are not using a PoE device, connect an external power supply to the power connector and plug it into the wall.

**8.** Using the three screws on the underside of the AP320i mounting bracket (inserted in Step 1 earlier), align the AP with the wall mount bracket. Refer to Figure 31.

Figure 31: Wall Mount Bracket Alignment Holes
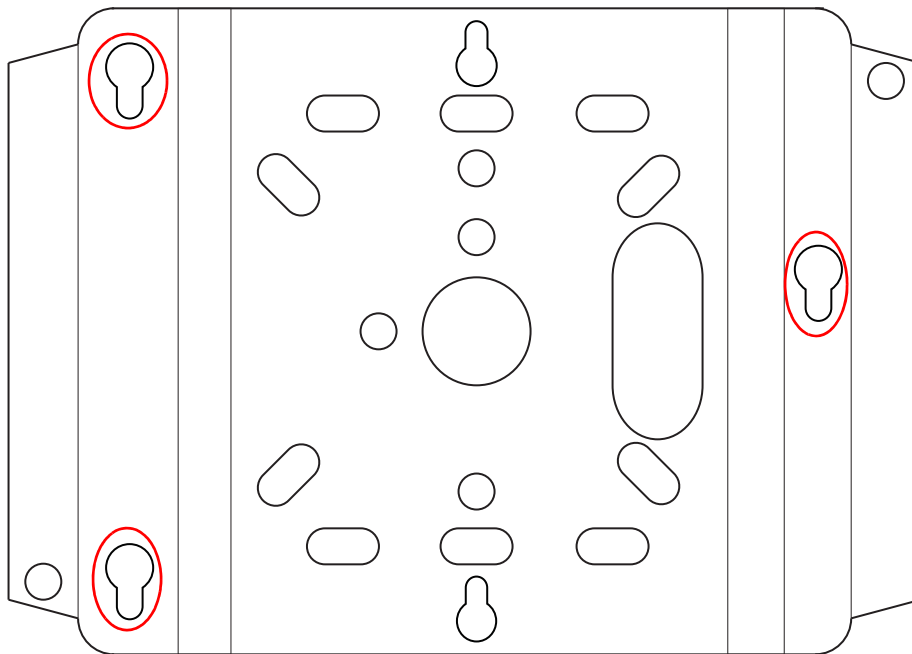
9. Press the AP into place and slide it downwards to lock the screws into their corresponding holes.

10. Optionally, lock the brackets together with a small lock by running it through the two holes that lined up towards the top-left or bottom-right sides of the bracket.

Set AP320i on a Shelf

You can remove the mounting bracket(s) before setting AP320i on a shelf by simply unscrewing the screws that attach it to the underside of the AP. The AP ships with rubber feet on the underside to ensure that it doesn't slide or move at all when deployed on a flat surface.

Figure 32 demonstrates how to remove the AP from a ceiling-mounted installation in the case that it needs to be moved to a shelf or flat surface.

Figure 32: Remove the AP320i Ceiling Mount Bracket
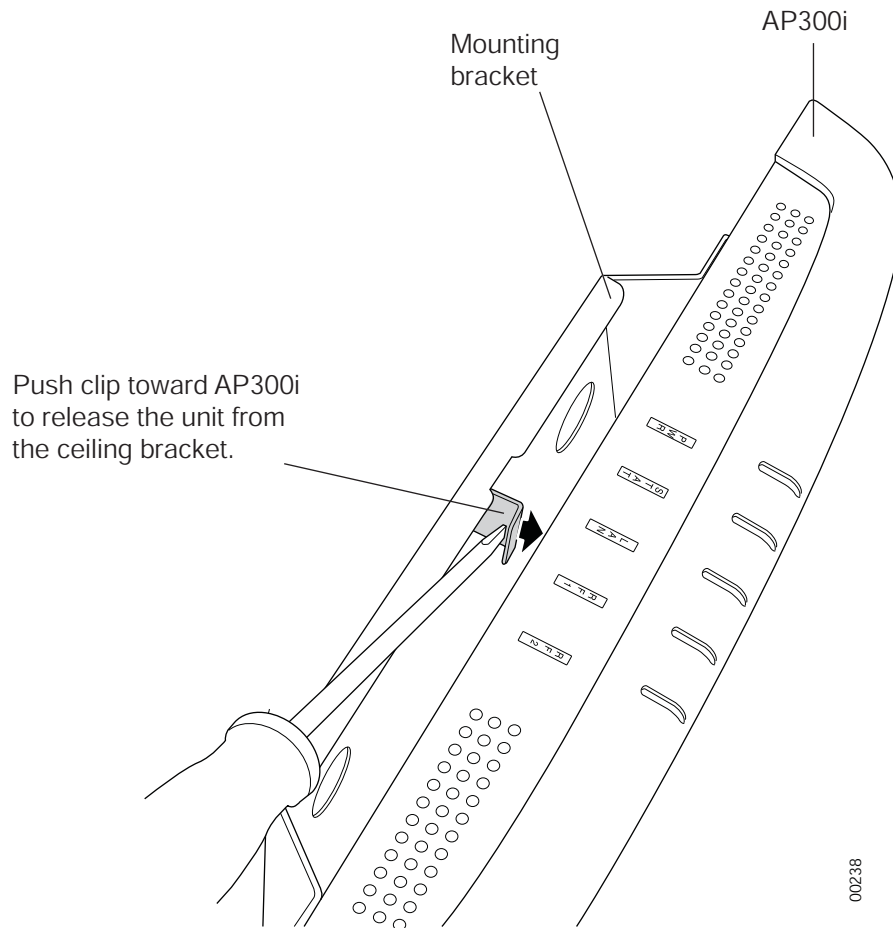
Check AP320i LED Activity

When AP320i first connects to the controller (and any time the access point is rebooted), the AP initial-izes and then is programmed by the controller. When the AP first powers up, all LEDs are green. There-after, the Status LED color reflects the various operating states.

Figure 33: AP320i Status LEDs
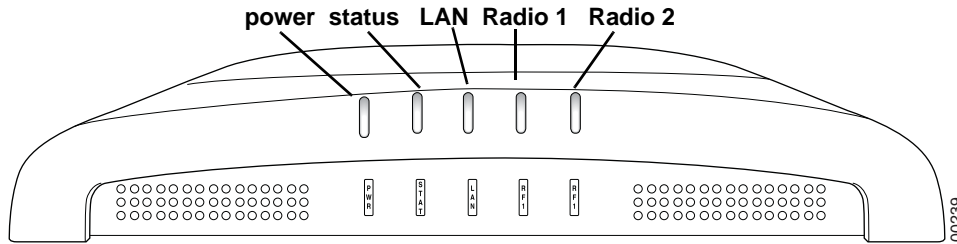
After the AP320i is connected, check the status of the LEDs. The functions of the five LEDs are described below.

AP300/AP320i LED Descriptions

LED	Function	Troubleshooting
Power	off—no power green—presence of power	
Status	off—no power green—booting stage 1 blinking green and off—booting stage 2 blinking green and white—discovering the controller blinking green and blue—downloading a configuration from the controller blinking blue and off—AP is online and enabled, working state blinking red and yellow—failure; consult controller for alarm state	If the status LED is blinking red and yellow, there is an alarm on the AP. Determine what the alarm is by clicking **Monitor > Dashboard > Alarms** and looking at the AP alarms. You can also use the CLI commands **show alarm** and **show log**.
LAN	off—no power or no link green—link status OK (at any speed) green/blinking—activity (at any speed) red—auto negotiation failure	If the LAN LED is red, auto negotiation failed. This means that you have a problem with cabling or with the AP's switch.
Radio 1 Radio 2	off—no radio present green—radio enabled green blinking—data activity yellow—disabled or in scanning mode red—failure	If one of the radio LEDs is yellow, it is either disabled or in scanning mode. To see if the AP is disabled, click **Configuration > Wireless > Radio >** select a radio and then look at Administrative Status, which should be set to **Up**. To see if the AP is in Scanning Mode, click **Configuration > Wireless > Radio >** select a radio and look at AP Modes, which should be set to **Normal Mode**. If one of the radio LEDs is red, the radio failed. Check the alarms (**Monitor > Dashboard > Alarms)**, diagnostics (**Monitor > Diagnostics > Radio)**, and statistics (**Monitor > Dashboard > Radio)** on the AP's controller to determine the cause.

Change LED Appearance

 If you want to change the appearance of the LEDS, follow these steps:

1. From the controller, click **Configuration** > **Devices** > **AP**, and then select the AP.

2. Select one of these settings for the LED Mode setting:
   — **Normal:** LEDs are as described below
   — **Node ID:** Not supported in release 4.1
   — **Blink:** Sets all LEDs flashing; this is useful to locate an AP
   — **Dark:** Turns off all LEDs

3. Click **OK**.

Where to Go From Here

Now that the AP320i is installed, go to the *Meru System Director Getting Started Guide* for instructions on initializing the hardware. Return to this chapter to check the status of the LEDs once the WLAN is operational.

Chapter 4
Installing AP332e

This chapter describes how to install and configure an AP332e. It contains the following sections:

- Safety Precautions
- Unpack the AP332e
- Installation Requirements
- Install the AP332e
- Check AP332e LED Activity
- Where to Go From Here

Safety Precautions

IMPORTANT—Read and follow the regulatory instructions in Appendix B before installing and operating this product.

If an optional power supply is used, it must be one supplied by Meru Networks.

Warning! This product is intended to be supplied by a UL Listed power supply marked Class 2 or LPS and rated minimum 12Vdc, 2A. For Power over Ethernet, an 802.3at connection must be used.

The AP332e is intended only for installation in Environment A as defined in IEEE 802.3af. All interconnected equipment must be contained within the same building, including the interconnected equipment's associated LAN connection.

Unpack the AP332e

Confirm that the AP332e shipping package contains these items:

- AP332e
- Wall mount bracket
- Two ceiling mount brackets (for varying sized ceiling structures)
- Six antennas
- Screws for the mounting bracket

Installation Requirements

An array of holes on the mounting bracket allows the AP332e to be mounted on the wall and over junction boxes or molly bolts. There are holes for passing the PoE Ethernet or external power supply cable through the bracket if the bracket is mounted on a junction box.

The AP332e has a security cable slot so you can lock the AP332e with a standard security cable, such as those used to secure laptop computers.

The AP332e ships with included ceiling and wall mounting brackets to be used for varying types of lcations, such as on T-bars or over junction boxes. For mounting above ceiling tiles, purchase optional mounting kits:

- Above Suspended Ceiling Mounting Kit (T-Bar Hanger): ACC-MNT-ASCMKIT
- Above hanging ceiling tiles. Suitable for use in environmental air space in accordance with the Section 332e-22(c) of the National Electric Code and Sections 2- 128.12 - 010 (3) and 12 - 100 of the Canadian Electrical Code. Part 1. C22. 1. Note that in order to comply with these standards, the plastic cover on the AP must be removed.

Additional Equipment

A power source is needed to power the AP332e. The AP332e requires an 802.3at power source when operating with PoE. If this is not available, 12V DC power (2A rated) must be supplied.

Antenna Mappings

See Table 3 to determine which radio is associated with each antenna.

Table 3: Antenna Mappings

Antenna	Radio/Channel
1	Radio 1
2	Radio 1
3	Radio 1
4	Radio 2
5	Radio 2
6	Radio 2

Install the AP332e

Select a Location
Attach the Provided Antennas
Install the Access Point

Select a Location

All AP332e interconnected equipment, including the associated LAN connection, must be contained within the same building. In addition, the AP332e location should meet the following conditions:

● Relatively unobstructed access to the stations the AP serves. Select a location with minimal physical obstructions between the AP and the wireless stations. In an office with cubicles, mounting the APs below a hanging ceiling (plenum is supported) or the wall near the ceiling provides the least obstructed communications path. On a wall, orient the AP332e horizontally so that you can read the Meru logo without tilting your head at 90 degrees - this orientation provides optimum MIMO performance.

● Access to wall outlet or a to a Power over Ethernet (PoE) connection to the network switch servicing the controller.

● We recommend planning for about 50 clients per radio (or per interference region) if you plan to use Virtual Port and plan to have phones as clients. For a data-only installation, plan up to 128 clients per radio, meaning 256 for AP320 and 128 for other AP332e models. Refer to the Meru Deployment Guides on the support site for more information.

AP332e is designed to provide 360 degree omni-directional coverage as illustrated below. Plan placement with this pattern in mind.

Figure 34: Coverage Pattern for AP332e When Ceiling Mounted
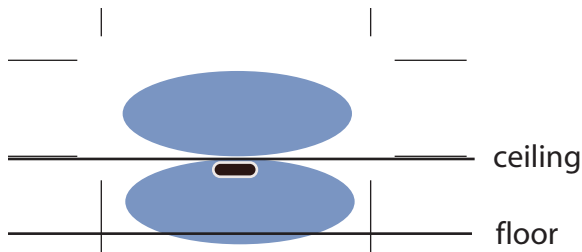
Most installations receive the best coverage using the following guidelines:

- Install APs toward the center of the building.
- Place APs about 80 feet apart.
- Do not install APs near metal objects, such as heating ducts, metal doors, or electric service panels.

Attach the Provided Antennas

All AP332es have six external antenna ports, labeled 1 - 6. These units operate with six antennas attached, even though some configurations don't use all six. Instead of attaching an antenna, you can cap unused antenna connectors with 50 ohm Reverse Polarity SMA terminators. (For a list of approved terminators, see http://www.merunetworks.com/merusupport.) To achieve the best performance from your AP332e, position antennas at a 90 degree angle relative to each other. The antennas do not have to be oriented exactly as shown in the figure, but it is important to maintain the relative angles. If for some reason you are unable to maintain those angles, the network still operates, but you may experience up to 20% drop in throughput depending on the antenna orientation.

Do not leave any antenna connectors unterminated. All connectors on the AP must be terminated with antennas or with 50 ohm Reverse Polarity SMA terminators. (For a list of approved terminators, see http://www.merunetworks.com/merusupport.

The attached antennas must be the same model; if you replace one antenna, replace them all.

Install the Access Point

AP332e ships several different mounting bracket components to allow for a variety of mounting options. You can mount an AP332e in the following ways:

- Mount AP332e Horizontally on a Shelf
- Mount AP332e Vertically on a Wall
- Mount AP332e Below a Suspended Ceiling
- Mount AP332e on a Dropped Ceiling Bevel Tile
- Mount AP332e on an Interlude T-Bar
- Mount AP332e Above a Suspended Ceiling

Mount AP332e Horizontally on a Shelf

When mounting an AP332e horizontally, simply place it on the desired surface and connect power and network cables.

Mount AP332e Vertically on a Wall

The AP332 ships with a metal bracket that can be used to mount it on a wall. This bracket is used in conjunction with the plastic **650-00232 15/16" T-Bar Adapter/Wall Mount** bracket to easily lock the AP into place.

To mount an AP332e on a wall:

1. Place the metal bracket against the wall. It should be oriented such that the indicator text for wall-mounting is pointing upwards (see **Figure 35**).

Figure 35: AP332 Wall Bracket
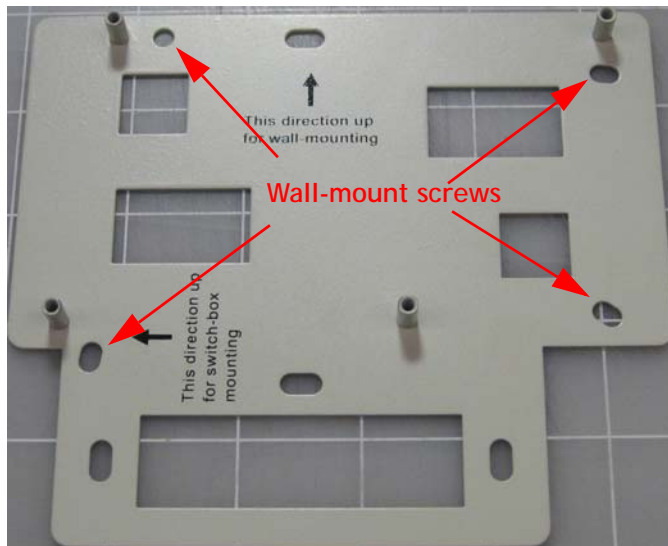
2. Attach the bracket to the wall using screws at the appropriate screw locations as indicated in **Figure 35**. Recommend #6, #8 (M3, M3.5).

3. Locate the **650-00232 15/16" T-Bar Adapter/Wall Mount** component and attach it to the raised screw locations on the Wall Mount plate. See **Figure 36**.

Figure 36: Attaching the AP Mount to the Wall Mount
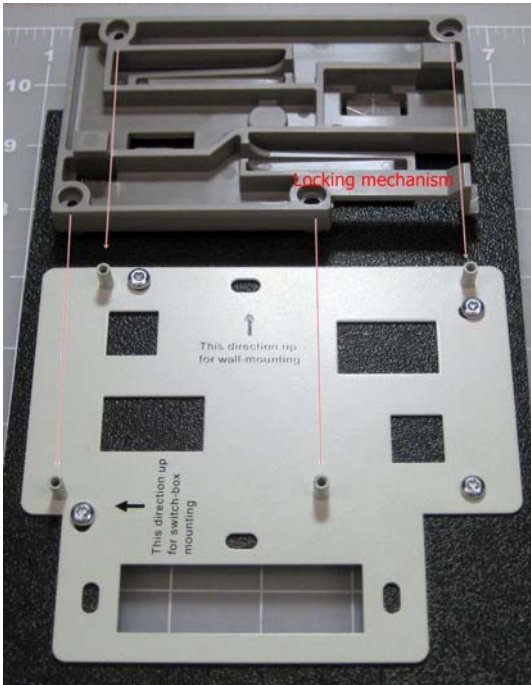
4. Screw the plastic component into place on the metal bracket.

5. Run the Ethernet and power cable (if using one) through the rectangular opening at the bottom of the Wall Mount bracket and connect them to their corresponding ports on the underside of the AP.

6. Press the Receiving Slots on the underside of the AP (indicated below) to the corresponding tabs ("Mounting Pins") on the plastic bracket. See Figure 37.

Figure 37: Attaching the AP to the Wall Mount
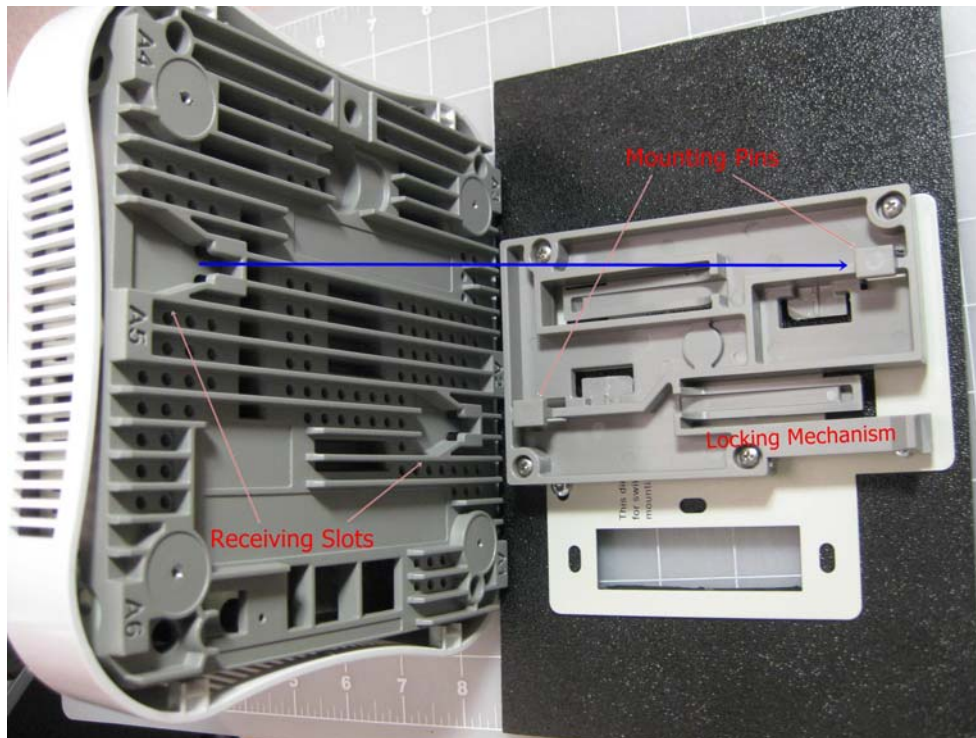
> ✔ **Note:** Figure 37 shows an AP332i model being attached to the bracket, but the process is identical for either AP.

7. Slide the AP horizontally to lock the tabs into place.

8. If not already connected, you may now connect the Ethernet cable and DC power (if used) and verify that the AP comes online.

Mount AP332e Below a Suspended Ceiling

The provided ceiling mounting brackets allow the AP332e to attach to suspended ceiling T-rails. The AP ships with two different ceiling mounting bracket options to accomodate varying sizes of ceiling T-rails. Be sure to attach the correctly-sized bracket to your AP prior to attempting to deploy it. Note that each plastic bracket contains descriptive text to indicate the ceiling T-rail size for which it is designed.

To mount an AP332e below a suspended ceiling:

1. Determine the location on the ceiling rail where the AP will be mounted and remove the ceiling tiles.

2. Attach the AP to the mounting bracket by pressing the bracket's Mounting Pins (shown in Figure 37) to the AP's Receiving Slots and sliding the bracket until it locks in place.

3. Press the AP and bracket against the rail and twist to lock it into place.

4. Connect one end of the CAT5 (or greater) Ethernet cable with PoE to the 100/1000 Ethernet connector on the underside of the AP.

5. Verify that the AP comes online and then replace the ceiling tiles removed in Step 1.

Mount AP332e on a Dropped Ceiling Bevel Tile

The mounting procedure for a ceiling that has recessed supports and lowered tiles is similar to that of mounting on a suspended ceiling. However, this procedure requires a specialized mounting bracket (ACC-MNT-SCRMKIT-03), as shown in Figure 38.

Figure 38: Dropped Bevel Tile Mounting Bracket

1. Remove the ceiling tile alongside which the AP will be mounted.

2. Locate the **650-00232 15/16" T-Bar Adapter/Wall Mount** and attach the AP to the mounting bracket by pressing the bracket's Mounting Pins (shown in Figure 37) to the AP's Receiving Slots and sliding the bracket until it locks in place.

3. Push down on the thumbscrews provided on the mounting bracket and clip it to the ceiling bar that will support the AP.

4. Tighten the screws to ensure that the mechanism stays locked in place.

5. Gently press the underside of the AP (with bracket attached) against the Dropped Bevel Tile Mounting bracket indicated above and twist to lock them together.

6. Connect one end of the CAT5 (or greater) Ethernet cable with PoE to the 100/1000 Ethernet connector on the underside of the AP.

7. Verify that the AP comes online and then replace the ceiling tiles removed in Step 1.

Mount AP332e on an Interlude T-Bar

The mounting procedure for a ceiling that has interlude T-Bar supports is similar to that of mounting on a suspended ceiling. However, this procedure requires a specialized mounting bracket (ACC-MNT-SCRMKIT-04), as depicted in Figure 39.

Figure 39: T-Bar Mounting Bracket

1. Remove the ceiling tile alongside which the AP will be mounted.

2. Locate the **650-00232 15/16" T-Bar Adapter/Wall Mount** and attach the AP to the mounting bracket by pressing the bracket's Mounting Pins (shown in Figure 37) to the AP's Receiving Slots and sliding the bracket until it locks in place.

3. Push down on the thumbscrews provided on the mounting bracket and clip it to the ceiling bar that will support the AP.

4. Tighten the screws to ensure that the mechanism stays locked in place.

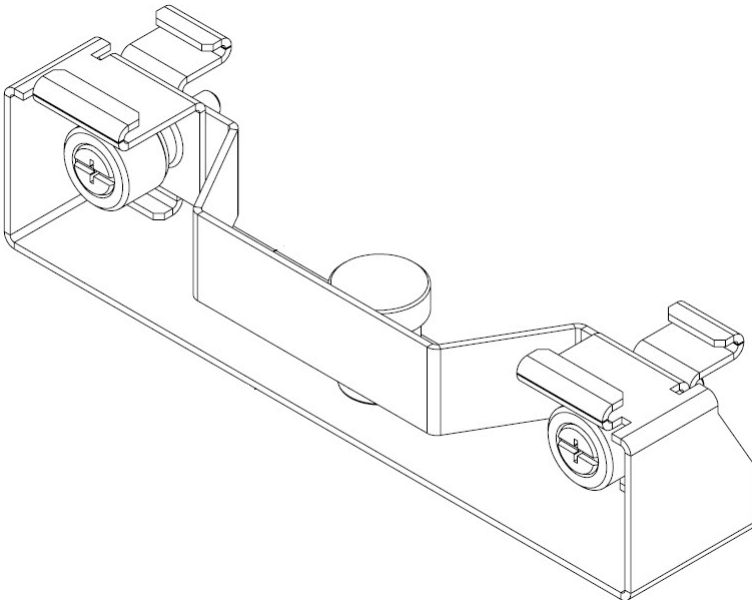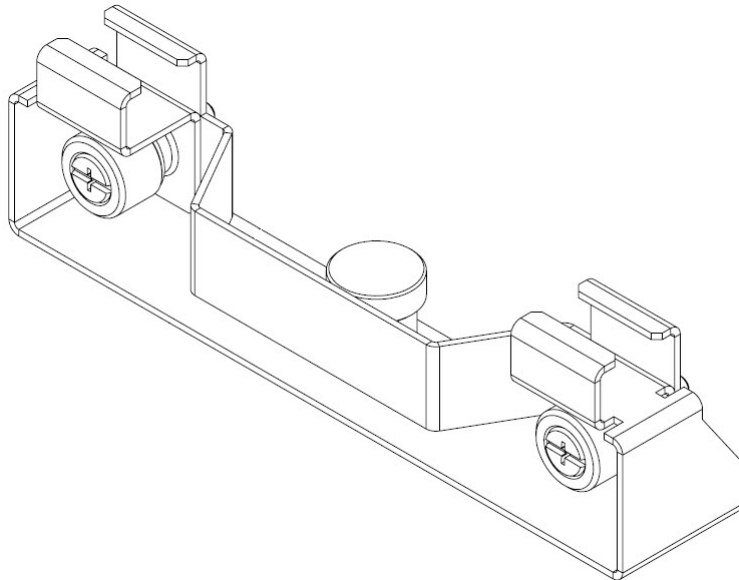5. Gently press the underside of the AP (with bracket attached) against the T-Bar Mounting bracket indicated above and twist to lock them together.

6. Connect one end of the CAT5 (or greater) Ethernet cable with PoE to the 100/1000 Ethernet connector on the underside of the AP.

7. Verify that the AP comes online and then replace the ceiling tiles removed in Step 1.

Mount AP332e Above a Suspended Ceiling

✔ **Note:** AP332e is not plenum-rated and should only be mounted above ceilings in non-plenum air space, such as a return airflow for air conditioning.

Use the optional T-bar box hanger mounting kit to mount AP332e above suspended ceiling T-rails. The installation attaches the T-bar box hanger to the ceiling rails and then the AP332e attaches to the T-bar box hanger. Note that AP332e mounted above the ceiling has about 2-3 dBm less RF coverage than AP332e mounted under the ceiling.

You may need to modify thicker tiles to support this installation.

> **Warning!** When installed in air-handling spaces, such as above a suspended ceiling, power the AP332e only with a PoE, not a power supply.

To mount an AP332e above the ceiling with the optional T-bar kit, follow these steps:

1. Determine the location on the ceiling rails where the AP will be mounted and remove the ceiling tile.

2. Unpack the T-bar hanger kit.

3. Attach the mounting bar (depicted in Figure 40) to the mounting brace (which looks like a small handle) with the crossbar of the mounting kit sandwiched between them. See Figure 41.

Figure 40: Mounting Bar

Figure 41: Assembled Mounting Bracket

4. Locate the **650-00232 15/16" T-Bar Adapter/Wall Mount** and attach the AP to the mounting bracket by pressing the bracket's Mounting Pins (shown in **Figure 37**) to the AP's Receiving Slots and sliding the bracket until it locks in place.

5. Gently press the underside of the AP against the mounting brace and rotate it into place until the locking mechanism clicks.

6. Attach the legs for the mounting kit to the T-Bars in the ceiling by sliding the clips down onto each respective bar.

7. Remove the top nut from each leg.

8. Lower the crossbar (with the AP attached) onto the legs and screw the nuts back on top of the bar.

9. Connect one end of the PoE Ethernet cable to the Ethernet connector on the AP.

> ✔ **Note:** Use a shielded Cat 5e (or greater) Ethernet cable in order to comply with international electromagnetic emissions limits.

Check that the AP332e is operating correctly before replacing the ceiling tile to the ceiling. Verify correct operation using the LEDs, as shown in **Check AP332e LED Activity**.

Check AP332e LED Activity

When AP332e first connects to the controller (and any time the access point is rebooted), the AP initializes and then is programmed by the controller. When the AP first powers up, the LED is green. Thereafter, its color indicates its operating status.

Figure 42: AP332e Status LED
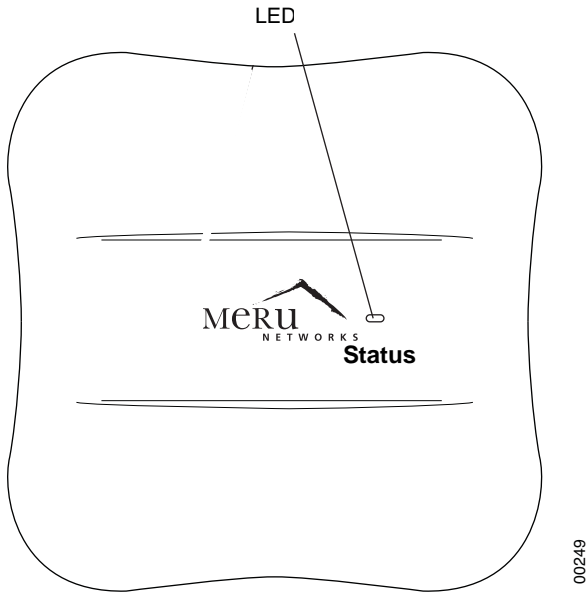
After the AP332e is connected, check the status of the LED. Its indicator state is described below.

AP332e LED Description

LED	Color	State:
Status	off	AP is off - either there is no power or the LEDs are set to **Off** on the controller. Check the LED setting on the controller by clicking **Configuration** > **Devices** > **AP**, selecting the AP and then checking the setting for LED Mode.
	cyan	AP is booting stage 1.
	green blinking	AP is booting stage 2.
	green/white alternating	AP is discovering the controller.
	green/blue alternating	AP is downloading a configuration from the controller.
	slow blue blinking	AP is online and enabled.
	rapid blue blinking	AP is online and enabled and there is activity on one or both radios.
	red/yellow alternating	Some AP failure occurred; check the controller for more details about the alarm by clicking **Monitor** > **Alarms** > **Pending Alarms**.
	blue/yellow alternating	AP is online and enabled and one or both radios are either scanning or an admin has taken the radio(s) down.

Change LED Appearance

If you want to change the appearance of the LEDS, follow these steps:

1. From the controller, click **Configuration** > **Devices** > **AP**, and then select the AP.

2. Select one of these settings for the LED Mode setting:
   — **Normal**: LEDs are as described above
   — **Blink**: Sets all LEDs flashing; this is useful to locate an AP
   — **Dark**: Turns off all LEDs

3. Click **OK**.

Where to Go From Here

Now that the AP332e is installed, go to the *Meru System Director Getting Started Guide* for instructions on initializing the hardware. Return to this chapter to check the status of the LEDs once the WLAN is operational.

Chapter 5
Installing AP332i

AP332i is supported by System Director versions 5.3 and greater. This chapter describes how to install and configure an AP332i. It contains the following sections:

- Safety Precautions
- Unpack the AP332i
- Installing AP332i
- Check AP332i LED Activity
- Where to Go From Here

Safety Precautions

IMPORTANT—Read and follow the regulatory instructions in Appendix B before installing and operating this product.

If an optional power supply is used, it must be one supplied by Meru Networks.

⚡	**Warning!**	This product is intended to be supplied by a UL Listed power supply marked Class 2 or LPS and rated minimum 12Vdc, 2A. For Power over Ethernet, an 802.3at connection must be used.

The AP332i is only intended for installation in Environment A as defined in IEEE 802.3af. All interconnected equipment must be contained within the same building, including the interconnected equipment's associated LAN connection.

Unpack the AP332i

Confirm that the shipping box contains the following:

- AP332i

- Wall mount bracket
- Two ceiling mount brackets (for varying sized ceiling structures)
- Screws for the mounting bracket
- 12V power adapter

Additional Equipment

A power source is needed to power the AP332i. The AP332i requires an 802.3at power source when operating with PoE. If this is not available, 12V DC power (2A rated) must be supplied.

Installing AP332i

Select a Location

All AP332i interconnected equipment must be contained within the same building, including the inter-connected equipment's associated LAN connection. Ceiling mounting is recommended but wall mounting is also supported. In addition, the AP332i should be mounted in a location that meets the following conditions:

- Relatively unobstructed access to the stations the AP serves. Select a location with minimal physical obstructions between the AP and the wireless stations. In an office with cubicles, mounting the APs below a hanging ceiling (plenum is supported) or the wall near the ceiling provides the least obstructed communications path. On a wall, orient the AP332i horizontally so that you can read the Meru logo without tilting your head at 90 degrees - this orientation provides optimum MIMO performance.
- We recommend planning for about 50 clients per radio (or per interference region) if you plan to use Virtual Port and plan to have phones as clients. For a data-only installation, plan up to 128 clients per radio, meaning 256 for AP332i. Refer to the Meru Deployment Guides on the support site for more information.
- Access to wall outlet or a to a Power over Ethernet (PoE) connection to the network switch servicing the controller.

AP332i is designed to provide 180 degree omni-directional coverage as illustrated below. Plan placement with this pattern in mind.

Figure 43: Coverage Pattern for AP332i When Ceiling Mounted

ceiling

floor

Most installations receive the best coverage using the following guidelines:

- Install APs toward the center of the building.
- Place APs about 80 feet apart.
- Do not install APs near metal objects, such as heating ducts, metal doors, or electric service panels.
- If you install AP332i on a pole, keep in mind that coverage will be 180 degrees. Do not mount two AP332is back to back on a pole to achieve 360 degree coverage, however, because the two units could interfere with each other.

Install the Access Point

AP332i ships several different mounting bracket components to allow for a variety of mounting options. You can mount an AP332i in the following ways:

- Mount AP332i Horizontally on a Shelf
- Mount AP332i Vertically on a Wall
- Mount AP332i Below a Suspended Ceiling
- Mount AP332i on a Dropped Ceiling Bevel Tile
- Mount AP332i on an Interlude T-Bar
- Mount AP332i Above a Suspended Ceiling

Mount AP332i Horizontally on a Shelf

When mounting an AP332i horizontally, simply place it on the desired surface and connect power and network cables.

Mount AP332i Vertically on a Wall

The AP332 ships with a metal bracket that can be used to mount it on a wall. This bracket is used in conjunction with the plastic **650-00232 15/16" T-Bar Adapter/Wall Mount** bracket to easily lock the AP into place.

To mount an AP332i on a wall:

1. Place the metal bracket against the wall. It should be oriented such that the indicator text for wall-mounting is pointing upwards (see **Figure 44**).

Figure 44: AP332 Wall Bracket
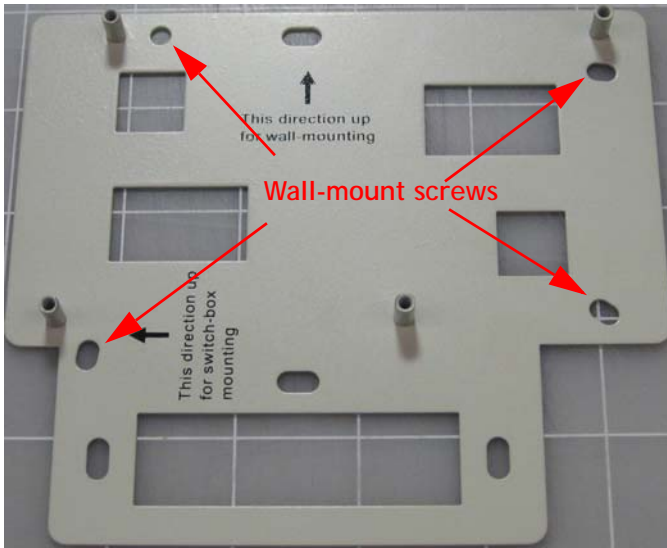
2. Attach the bracket to the wall using screws at the appropriate screw locations as indicated in **Figure 44**. Recommend #6, #8 (M3, M3.5).

3. Locate the **650-00232 15/16" T-Bar Adapter/Wall Mount** component and attach it to the raised screw locations on the Wall Mount plate. See **Figure 45**.

Figure 45: Attaching the AP Mount to the Wall Mount

4. Screw the plastic component into place on the metal bracket.

5. Run the Ethernet and power cable (if using one) through the rectangular opening at the bottom of the Wall Mount bracket and connect them to their corresponding ports on the underside of the AP.

6. Press the Receiving Slots on the underside of the AP (indicated below) to the corresponding tabs ("Mounting Pins") on the plastic bracket. See Figure 46.

Figure 46: Attaching the AP to the Wall Mount
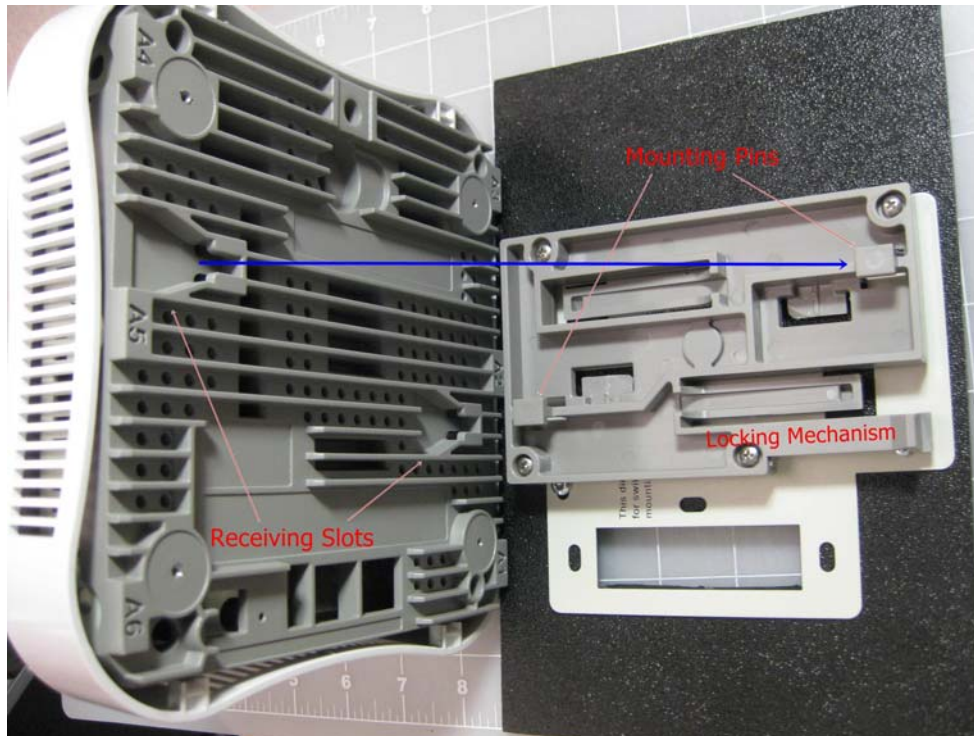
7. Slide the AP horizontally to lock the tabs into place.

8. If not already connected, you may now connect the Ethernet cable and DC power (if used) and verify that the AP comes online.

Mount AP332i Below a Suspended Ceiling

The provided ceiling mounting brackets allow the AP332i to attach to suspended ceiling T-rails. The AP ships with two different ceiling mounting bracket options to accomodate varying sizes of ceiling T-rails. Be sure to attach the correctly-sized bracket to your AP prior to attempting to deploy it. Note that each plastic bracket contains descriptive text to indicate the ceiling T-rail size for which it is designed.

To mount an AP332i below a suspended ceiling:

1. Determine the location on the ceiling rail where the AP will be mounted and remove the ceiling tiles.

2. Attach the AP to the mounting bracket by pressing the bracket's Mounting Pins (shown in Figure 46) to the AP's Receiving Slots and sliding the bracket until it locks in place.

3. Press the AP and bracket against the rail and twist to lock it into place.

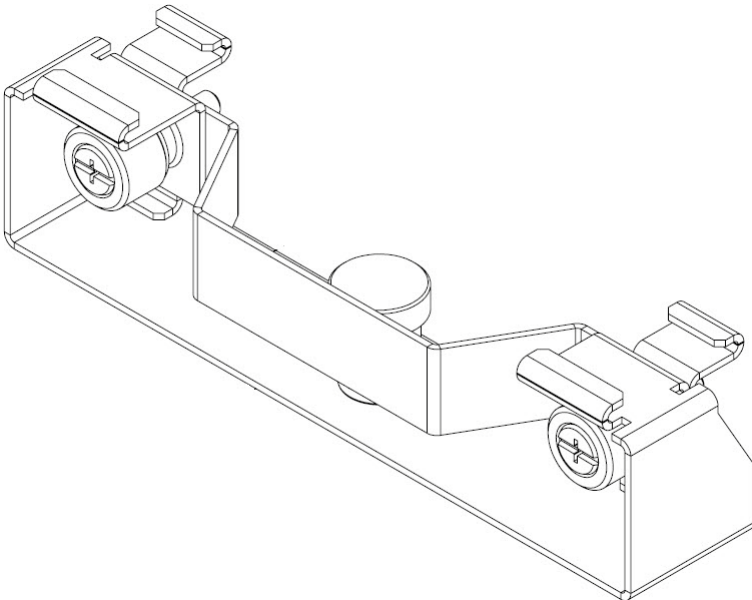4. Connect one end of the CAT5 (or greater) Ethernet cable with PoE to the 100/1000 Ethernet connector on the underside of the AP.

5. Verify that the AP comes online and then replace the ceiling tiles removed in Step 1.

Mount AP332i on a Dropped Ceiling Bevel Tile

The mounting procedure for a ceiling that has recessed supports and lowered tiles is similar to that of mounting on a suspended ceiling. However, this procedure requires a specialized mounting bracket (ACC-MNT-SCRMKIT-03), as shown in Figure 47.

Figure 47: Dropped Bevel Tile Mounting Bracket

1. Remove the ceiling tile alongside which the AP will be mounted.

2. Locate the **650-00232 15/16" T-Bar Adapter/Wall Mount** and attach the AP to the mounting bracket by pressing the bracket's Mounting Pins (shown in Figure 46) to the AP's Receiving Slots and sliding the bracket until it locks in place.

3. Push down on the thumbscrews provided on the mounting bracket and clip it to the ceiling bar that will support the AP.

4. Tighten the screws to ensure that the mechanism stays locked in place.

5. Gently press the underside of the AP (with bracket attached) against the Dropped Bevel Tile Mounting bracket indicated above and twist to lock them together.

6. Connect one end of the CAT5 (or greater) Ethernet cable with PoE to the 100/1000 Ethernet connector on the underside of the AP.

7. Verify that the AP comes online and then replace the ceiling tiles removed in Step 1.

Mount AP332i on an Interlude T-Bar

The mounting procedure for a ceiling that has interlude T-Bar supports is similar to that of mounting on a suspended ceiling. However, this procedure requires a specialized mounting bracket (ACC-MNT-SCRMKIT-04), as depicted in Figure 48.
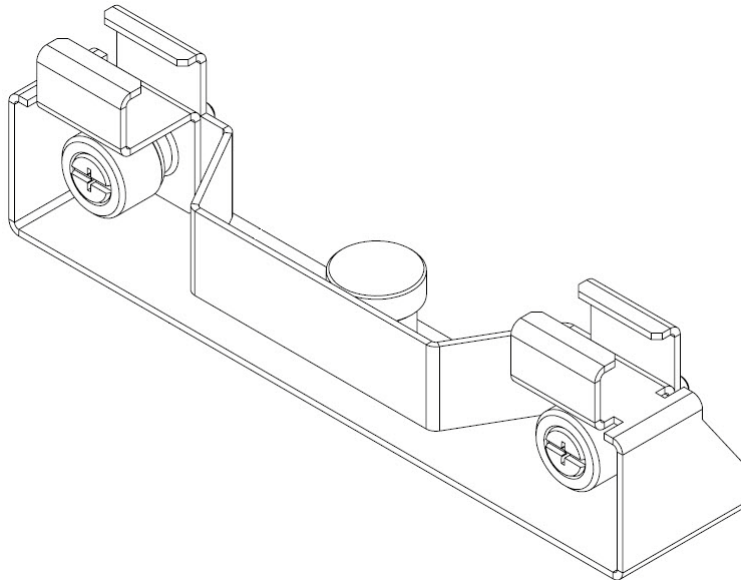
Figure 48: T-Bar Mounting Bracket

1. Remove the ceiling tile alongside which the AP will be mounted.

2. Locate the **650-00232 15/16" T-Bar Adapter/Wall Mount** and attach the AP to the mounting bracket by pressing the bracket's Mounting Pins (shown in Figure 46) to the AP's Receiving Slots and sliding the bracket until it locks in place.

3. Push down on the thumbscrews provided on the mounting bracket and clip it to the ceiling bar that will support the AP.

4. Tighten the screws to ensure that the mechanism stays locked in place.

5. Gently press the underside of the AP (with bracket attached) against the T-Bar Mounting bracket indicated above and twist to lock them together.

6. Connect one end of the CAT5 (or greater) Ethernet cable with PoE to the 100/1000 Ethernet connector on the underside of the AP.

7. Verify that the AP comes online and then replace the ceiling tiles removed in Step 1.

Mount AP332i Above a Suspended Ceiling

✔ Note: AP332i is not plenum-rated and should only be mounted above ceilings in non-plenum air space, such as a return airflow for air conditioning.

Use the optional T-bar box hanger mounting kit to mount AP332i above suspended ceiling T-rails. The installation attaches the T-bar box hanger to the ceiling rails and then the AP332i attaches to the T-bar box hanger. Note that AP332i mounted above the ceiling has about 2-3 dBm less RF coverage than AP332i mounted under the ceiling.

You may need to modify thicker tiles to support this installation.

> **Warning!** When installed in air-handling spaces, such as above a suspended ceiling, power the AP332i only with a PoE, not a power supply.

To mount an AP332i above the ceiling with the optional T-bar kit, follow these steps:

1. Determine the location on the ceiling rails where the AP will be mounted and remove the ceiling tile.
2. Unpack the T-bar hanger kit.
3. Attach the mounting bar (depicted in Figure 49) to the mounting brace (which looks like a small handle) with the crossbar of the mounting kit sandwiched between them. See Figure 50.

Figure 49: Mounting Bar

Figure 50: Assembled Mounting Bracket

Mounting Bar

Mounting Brace

Clips attach to T-bar

4. Locate the **650-00232 15/16" T-Bar Adapter/Wall Mount** and attach the AP to the mounting bracket by pressing the bracket's Mounting Pins (shown in **Figure 46**) to the AP's Receiving Slots and sliding the bracket until it locks in place.

5. Gently press the underside of the AP against the mounting brace and rotate it into place until the locking mechanism clicks.

6. Attach the legs for the mounting kit to the T-Bars in the ceiling by sliding the clips down onto each respective bar.

7. Remove the top nut from each leg.

8. Lower the crossbar (with the AP attached) onto the legs and screw the nuts back on top of the bar.

9. Connect one end of the PoE Ethernet cable to the Ethernet connector on the AP.

> ✔ **Note:** Use a shielded Cat 5e (or greater) Ethernet cable in order to comply with international electromagnetic emissions limits.

Check that the AP332i is operating correctly before replacing the ceiling tile to the ceiling. Verify correct operation using the LEDs, as shown in **Check AP332i LED Activity**.

Check AP332i LED Activity

When AP332i first connects to the controller (and any time the access point is rebooted), the AP initializes and then is programmed by the controller. When the AP first powers up, the LED is green. Thereafter, its color indicates its operating status.

Figure 51: AP332i Status LED
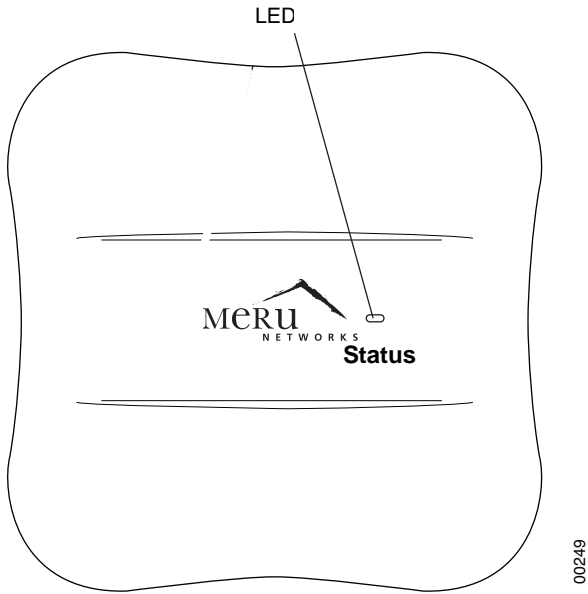
After the AP332i is connected, check the status of the LED. Its indicator state is described below.

AP332i LED Description

LED	Color	State:
Status	off	AP is off - either there is no power or the LEDs are set to **Off** on the controller. Check the LED setting on the controller by clicking **Configuration** > **Devices** > **AP**, selecting the AP and then checking the setting for LED Mode.
	cyan	AP is booting stage 1.
	green blinking	AP is booting stage 2.
	green/white alternating	AP is discovering the controller.
	green/blue alternating	AP is downloading a configuration from the controller.
	slow blue blinking	AP is online and enabled.
	rapid blue blinking	AP is online and enabled and there is activity on one or both radios.
	red/yellow alternating	Some AP failure occurred; check the controller for more details about the alarm by clicking **Monitor** > **Alarms** > **Pending Alarms**.
	blue/yellow alternating	AP is online and enabled and one or both radios are either scanning or an admin has taken the radio(s) down.

Change LED Appearance

If you want to change the appearance of the LEDS, follow these steps:

1. From the controller, click **Configuration** > **Devices** > **AP**, and then select the AP.

2. Select one of these settings for the LED Mode setting:
    — **Normal**: LEDs are as described above
    — **Blink**: Sets all LEDs flashing; this is useful to locate an AP
    — **Dark**: Turns off all LEDs

3. Click **OK**.

Where to Go From Here

Now that the AP332i is installed, go to the *Meru System Director Getting Started Guide* for instructions on initializing the hardware. Return to this chapter to check the status of the LEDs once the WLAN is operational.

Appendix A
Cautions and Warnings

The cautions and warnings that appear in this manual are listed below in English, German, French, and Spanish. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment."

Cautions

A Caution calls your attention to a possible hazard that can damage equipment.

"Vorsicht" weist auf die Gefahr einer möglichen Beschädigung des Gerätes in.

Une mise en garde attire votre attention sur un risque possible d'endommagement de l'équipement. Ci-dessous, vous trouverez les mises en garde utilisées dans ce manuel.

Un mensaje de precaución le advierte sobre un posible peligro que pueda dañar el equipo. Las siguientes son precauciones utilizadas en este manual.

!

Caution!   When changing the orientation of the antennas, be sure to slightly loosen the knurled ring before moving the antenna. Retighten the ring afterward. Otherwise, you might damage the internal cabling in the AP.

Vorsicht!   Bei einer Neuausrichtung der Antennen muss vor Bewegung der Antenne der Rändelring leicht gelockert werden. Anschließend den Ring wieder festziehen. Anderenfalls können die internen Kabel im AP beschädigt werden.

Mise en garde   En cas de modification d'orientation des antennes, veiller à desserrer légèrement la bague moletée avant de réorienter l'antenne. Resserrer ensuite la bague, faute de quoi le câblage interne du point d'accès pourrait être endommagé.

Precaución!   Al cambiar la orientación de las antenas, asegúrese de aflojar ligeramente el anillo estriado antes de mover la antena. Luego vuelva a apretar el anillo. De otro modo, podría dañar el cableado interno del punto de acceso.

! **Caution!**   Be sure to connect the Ethernet cable to the Ethernet port; the cable can mistakenly be plugged into the Console port.

Vorsicht!   Darauf achten, dass das Ethernetkabel am Ethernetanschluss und nicht versehentlich am Konsolenanschluss angeschlossen wird.

Mise en garde   Veiller à bien connecter le câble Ethernet au port Ethernet et non pas au port Console.

Precaución!   Asegúrese de conectar el cable Ethernet al puerto Ethernet, porque por error se puede enchufar en el puerto de la consola.

! **Caution!**   The radiated output power of the access points is well below the FCC radio frequency exposure limits. However, the Meru Access Point should be used in such a manner that the potential for human contact during normal operation is minimized. To avoid the possibility of exceeding the FCC radio frequency exposure limits, you should keep a distance of at least 20 cm between you (or any other person in the vicinity) and the Access Point antennas.

Vorsicht!   Die abgestrahlte Ausgangsleistung von Geräten von Meru Networks, Inc. liegt weit unter den Hochfrequenz-Expositionsgrenzwerten der FCC. Die Meru Access Point Zugangspunkte von Meru Networks, Inc. sollten jedoch so verwendet werden, dass das Potenzial für Kontakt mit Menschen während des normalen Betriebs auf ein Mindestmaß beschränkt wird. Um die Möglichkeit einer Überschreitung der FCC-Hochfrequenz-Expositionsgrenzwerte zu vermeiden, ist ein Abstand von mindestens 20 cm zwischen Ihnen (bzw. einer anderen Person in der Nähe) und den Zugangspunkt-Antennen zu wahren.

Mise en garde   La puissance de rayonnement émise par les équipements Meru Networks, Inc. est très inférieure aux limites d'exposition aux fréquences radio définies par la FCC. Toutefois, les points d'accès de la série Meru Access Point de Meru Networks, Inc. doivent être utilisés de façon à éliminer tout risque de contact humain en fonctionnement normal. Pour éviter de dépasser les limites d'exposition aux fréquences radio définies par la FCC, il est impératif de préserver en permanence une distance supérieure ou égale à 20 cm entre l'utilisateur (ou toute personne se trouvant à proximité) et les antennes du point d'accès.

Precaución!   La potencia de radiación de los dispositivos de Meru Networks, Inc. está muy por debajo de los límites de exposición a radiofrecuencia estipulados por la FCC. No obstante, los puntos de acceso de la serie Meru Access Point de Meru Networks, Inc. deben usarse de tal manera que se minimice la posibilidad de contacto para el usuario durante la operación normal. Para evitar la posibilidad de exceder los límites de exposición a radiofrecuencia establecidos por la FCC, el usuario (o cualquier otra persona en torno) debe mantenerse a una distancia de al menos 20 cm respecto a las antenas del punto de acceso.

Caution!   Exposure to Radio Frequency Radiation.

The installer of this radio equipment must ensure that the antenna is located or pointed such that it does not emit an RF field in excess of Health Canada limits for the general population; consult Safety Code 6, obtainable from Health Canada's website http://www.hc-sc.gc.ca/rpb.

Vorsicht!   Exposure to Radio Frequency Radiation.

The installer of this radio equipment must ensure that the antenna is located or pointed such that it does not emit an RF field in excess of Health Canada limits for the general population; consult Safety Code 6, obtainable from Health Canada's website http://www.hc-sc.gc.ca/rpb.

Mise en garde   Exposition aux rayonnements à fréquence radioélectrique

L'installateur de cet équipement radio doit veiller à positionner et orienter l'antenne de telle sorte qu'elle n'émette pas un champ radioélectrique supérieur aux limites définies par Santé Canada pour la population générale. Consulter le Code de sécurité n° 6, disponible sur le site Web de Santé Canada à l'adresse http://www.hc-sc.gc.ca/rpb.

Precaución!   Exposición a la radiación de radiofrecuencia.

El instalador de este equipo de radio debe cerciorarse de que la antena está local-izada u orientada de tal manera que no emita un campo de radiofrecuencia superior a los límites estipulados por Health Canada para la población; consulte el Código de Seguridad 6 que podrá encontrar en el página web de Health Canada, http://www.hc-sc.gc.ca/rpb.

Warnings

A warning calls your attention to a possible hazard that can cause injury or death. The following are the warnings used in this manual.

"Achtung" weist auf eine mögliche Gefährdung hin, die zu Verletzungen oder Tod führen können. Sie finden die folgenden Warnhinweise in diesem Handbuch:

Un avertissement attire votre attention sur un risque possible de blessure ou de décès. Ci-dessous, vous trouverez les avertissements utilisés dans ce manuel.

Una advertencia le llama la atención sobre cualquier posible peligro que pueda ocasionar daños personales o la muerte. A continuación se dan las advertencias utilizadas en este manual.

Warning! With plastic covers removed, this product is suitable for use in environmental air space in accordance with the Section 300-22(c) of the National Electric Code and Sections 2- 128.12 - 010 (3) and 12 - 100 of the Canadian Electrical Code. Part 1. C22. 1. For other countries, consult local authorities for regulations.

Achtung! Bei abgenommener Kunststoffabdeckung ist dieses Produkt zur Verwendung in einem Umgebungsluftraum gemäß Abschnitt 300-22(c) des National Electric Code und Abschnitt 2- 128.12 - 010 (3) und 12 - 100 des Canadian Electrical Code Teil 1. C22.1 geeignet. Die Vorschriften für andere Länder sind bei den örtlichen Behörden erhältlich.

Avertissement Sous réserve que ses couvercles de plastique soient déposés, cet appareil est adapté à une utilisation dans les vides de construction des bâtiments selon la section 300-22(c) du code NEC (National Electric Code) et les sections 2- 128.12 - 010 (3) et 12 - 100 du Code électrique du Canada, partie 1. C22. 1. Pour tous les autres pays, consulter les organismes de réglementation locaux.

Advertencia Una vez desprendidas las cubiertas de plástico, este producto es adecuado para su uso en el espacio aéreo circundante en conformidad con la sección 300-22(c) del National Electric Code (Código Eléctrico Nacional de EE.UU.) y las secciones 2- 128.12 - 010 (3) y 12 - 100 del Código Eléctrico de Canadá. Parte 1. C22. 1. En otros países, consulte a las autoridades locales competentes para informarse acerca de las normativas vigentes.

Warning! Any Fast Ethernet (FE) cables installed in air-handling spaces should be suitable under NEC Article 800.50 and marked accordingly for use in plenums and air-handling spaces with regard to smoke propagation, such as CL2-P, CL3-P, MPP (Multi Purpose Plenum), or CMP (Communications Plenum).

Achtung! Alle Fast-Ethernet (FE)-Kabel, die in Lüftungsräumen installiert werden, sollten gemäß NEC Artikel 800.50 geeignet sein und entsprechend zur Verwendung in Hohlräumen (Plenum) und Lüftungsräumen im Hinblick auf Rauchausbreitung gekennzeichnet sein, z.B. CL2-P, CL3-P, MPP (Multi Purpose Plenum) oder CMP (Communications Plenum).

Avertissement Les câbles Fast Ethernet (FE) installés dans un vide d'air doivent correspondre aux critères de l'article 800.50 du code NEC et identifiés en conséquence comme adaptés à une utilisation dans les vides de construction des bâtiments en matière de propagation de la fumée (marquages CL2-P, CL3-P, MPP (Multi Purpose Plenum) ou CMP (Communications Plenum)).

Advertencia Todos los cables Fast Ethernet (FE) instalados en espacios aéreos deben cumplir con el artículo 800.50 del NEC y estar marcados adecuadamente para su uso en espacios aéreos y plenums en lo concerniente a la propagación de humo, tales como CL2-P, CL3-P, MPP (Plenum multifuncional), o CMP (Plenum de comunicaciones).

Warning! Inside antennas must be positioned to observe minimum separation of 20 cm. (~ 8 in.) from all users and bystanders. For the protection of personnel working in the vicinity of inside (downlink) antennas, the following guidelines for minimum distances between the human body and the antenna must be observed.

The installation of the indoor antenna must be such that, under normal conditions, all personnel cannot come within 20 cm. (~ 8.0 in.) from any inside antenna. Exceeding this minimum separation will ensure that the employee or bystander does not receive RF-exposure beyond the Maximum Permissible Exposure according to FCC CFR 47, section 1.1310 i.e. limits for General Population/Uncontrolled Exposure.

Achtung! Innenantennen müssen so positioniert werden, dass ein Mindestabstand von 20 cm (ca. 8 Zoll) zu allen Benutzern und anderen Personen gewahrt wird. Zum Schutz von Personal, das in der Nähe von Innenantennen (Downlink) arbeitet, sind die folgenden Richtlinien für Mindestabstand zwischen dem menschlichen Körper und der Antenne zu beachten.

Die Innenantenne muss so installiert werden, dass sich unter normalen Bedingungen kein Personal bis auf weniger als 20 cm (ca. 8 Zoll) an eine Innenantenne annähern kann. Durch Überschreitung dieses Mindestabstands wird sichergestellt, dass Mitarbeiter oder andere Personen keiner RF-Exposition über die maximal zulässige Exposition (MPE; Maximum Permissible Exposure) gemäß FCC CFR 47, Abschnitt 1.1310 (Grenzwerte für die allgemeine Bevölkerung/unkontrollierte Exposition) ausgesetzt werden.

Avertissement Les antennes intérieures doivent être positionnées de façon à respecter une distance minimum de 20 cm par rapport aux utilisateurs et aux tiers. Pour la protection du personnel travaillant à proximité des antennes intérieures (liaison descendante), respecter les directives suivantes pour assurer des distances minimales entre les êtres humains et les antennes.

Toute antenne intérieure doit être installée de telle sorte que, dans des conditions normales, le personnel ne puisse s'en approcher à moins de 20 cm. Cette distance minimale est destinée à garantir qu'un employé ou un tiers ne sera pas exposé à un rayonnement radioélectrique supérieur à la valeur maximale autorisée, telle qu'elle est définie dans les limites d'exposition non contrôlées pour la population par la réglementation de la FCC CFR 47, section 1.1310.

Advertencia   Las antenas interiores deben colocarse de manera que se observe una separación mínima de 20 cm. (~ 8 pulg.) respecto a todos los usuarios y circunstantes. Para la protección del personal que trabaje en las inmediaciones de las antenas interiores (receptoras), deben observarse las siguientes directrices relativas a la distancia mínima entre el cuerpo humano y la antena.

La instalación de la antena interior debe efectuarse de tal modo que, en condiciones normales, ningún miembro del personal pueda acercarse a menos de 20 cm. (~ 8,0 pulg.) de cualquier antena interior. El cumplimiento de este mínimo de separación asegura que el empleado o circunstante no recibirá exposición a radiofrecuencia por encima de la Exposición Máxima Permisible conforme a la normativa FCC CFR 47, sección 1.1310, es decir, los límites asignados a la Exposición Incontrolada/Población Civil.

Warnings

Appendix B
Regulatory Information

The Meru Access Point (APs) must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product. For country-specific approvals, see below. Meru Networks, Inc. is not responsible for any radio or television interference caused by unauthorized modification of APs, or the substitution or attachment of connecting cables and equipment other than that specified by Meru Networks, Inc. The correction of interference caused by such unauthorized modification, substitution or attachment is the responsibility of the user. Meru Networks, Inc. and its authorized resellers or distributors are not liable for any damage or violation of government regulations that may arise from the user failing to comply with these guidelines.

For AP300/320i

Radio

- FCC Part 15
- Canada RSS210
- EN 300 328 V1.6.1 (11/2004)
- EN 301 893 V1.3.1 (08/2005)
- Japan Technical Regulations

EMC

- FCC Part 15
- EN 301 489-17 V1.2.1 (08/2002)
- Japan VCCI

Safety

Prolonged exposure to RF radiation can be hazardous. Switch off unit power before service or installation procedures.

Limits for Occupational/Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm2)	Averaging Time |E|2, |H|2 or S (minutes)
1500-100,000			5	6

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm2)	Averaging Time |E|2, |H|2 or S (minutes)
1500-100,000			1.0	30

Note: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

Note: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

Frequencies Blocked for Regulatory Compliance

802.11a frequencies 5.25-5.35 GHz and 5.47-5.725 GHz have been blocked for DFS compliance.

USA

Underwriters Laboratories

Use only with Listed I.T.E. equipment.

Notices

The unit is intended for installation in Environment A as defined in IEEE 802.3.af. All interconnected equipment must be contained within the same building, including the interconnected equipment's associated LAN connection.

Suitable for use in environmental air space in accordance with Section 300-22(c) of the National Electrical Code, and Sections 2-128, 12-010(3) and 12-100 of the Canadian Electrical Code, Part 1, C22.1.

FCC Radiation Exposure Statement

!

Caution!

The radiated output power of the Meru Networks devices is well below the FCC radio frequency exposure limits. However, the Access Point should be used in such a manner that the potential for human contact during normal operation is minimized. When installing and operating these devices, keep a minimum distance of 20 cm (8 inches) between the antennas and any persons/users in the vicinity.

Radio Frequency Interference Requirements

✔

Note:

Meru Access Points

All devices except the OAP180 are indoor devices. The FCC requires indoor use for the frequency range 5.15 GHz to 5.25 GHz to reduce the potential for harmful interference to co-channel Mobile Satellite systems.

High-power radars are allocated as primary users of the 5.25 to 5.35 GHz and 5.65 to 5.85 GHz bands. These radar stations can cause interference with or damage to these devices, or both.

Interference Statement

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

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy. If the equipment is not installed and used in accordance with the instructions, the equipment may cause harmful interference to radio communications. There is no guarantee, however, that such 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 taking one or more 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 to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Note: The Meru Access Point must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product. Any other installation or use may violate FCC Part 15 regulations. Modifications not expressly approved by Meru Networks, Inc. could void your authority to operate the equipment.

This device must not be co-located or operating in conjunction with any other antenna or transmitter.

For products available in the USA and Canadian markets, only channels 1 through 11 can be operated. Selection of other channels is not authorized.

Canada. Industry Canada (IC)

The Class B digital portion of this apparatus complies with Canadian standard ICES-003.

These devices comply with RSS210 of Industry Canada.

Per RSS 210 A9.5 point 7:

(i) the device for the band 5150-5250 MHz is only for indoor usage to reduce potential for harmful interference to co-channel mobile satellite systems;
(ii) the maximum antenna gain permitted (for devices in the bands 5250-5350 MHz and 5470-5725 MHz) to comply with the e.i.r.p. limit; and
(iii) the maximum antenna gain permitted (for devices in the band 5725-5825 MHz) to comply with the e.i.r.p. limits specified for point-to-point and non point-to-point operation as appropriate, as stated in section A9.2(3).
In addition, users should also be cautioned to take note that high-power radars are allocated as primary users (meaning they have priority) of the bands 5250-5350 MHz and 5650-5850 MHz and these radars could cause interference and/or damage to LE-LAN devices.
(iv) These devices are not permitted to operate in the 5600 - 5650 MHz band.

For products available in the USA and Canadian markets, only channels 1 through 11 can be operated. Selection of other channels is not authorized.

Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of this device.

This device and its listed antenna(s) must not be co-located or operated in conjunction with any other antenna or transmitter

L'utilisation de ce dispositif est autorisée seulement aux conditions suivantes: (1) il ne doit pas produire de brouillage et (2) l'utilisateur du dispositif doit étre prêt à accepter tout brouillage radioélectrique reçu, même si ce brouillage est susceptible de compromettre le fonctionnement du dispositif.

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

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

To prevent radio interference to the licensed service, this device is intended to be operated indoors and away from windows to provide maximum shielding. Equipment (or its transmit antenna) that is installed outdoors is subject to licensing.

Pour empecher que cet appareil cause du brouillage au service faisant l'objet d'une licence, il doit etre utilze a l'interieur et devrait etre place lin des fenetres afin de Fournier un ecram de blindage maximal. Si le matriel (ou son antenne d'emission) est installe a l'exterieur, il doit faire l'objet d'une licence.

!

Caution!

Exposure to Radio Frequency Radiation.

The installer of this radio equipment must ensure that the antenna is located or pointed such that it does not emit an RF field in excess of Health Canada limits for the general population; consult Safety Code 6, obtainable from Health Canada's website http://www.hc-sc.gc.ca/rpb.

This equipment complies with IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the antennas and any persons/users in the vicinity.

✔

Note:

Meru Access Points

These devices are restricted to indoor use because they operate in the 5.15 to 5.25 GHz frequency range. Industry Canada requires such products to be used indoors for the frequency range 5.15 GHz to 5.25 GHz to reduce the potential for harmful interference to co-channel Mobile Satellite systems.

Access Points have been designed to operate with the antennas listed below. Antennas not included in this list are strictly prohibited for use with these devices. The required antenna impedance is 50 ohms.

AP Antennas with Gain

AP Model	Antenna Type	Gain (2.4 GHz)	Gain (5 GHz)
AP300	Dual-Band Omni-Directional MN-ACC-ANTabg-W	2 dBi	3 dBi
AP300	Dual-Band Omni-Directional ACC-ANT-ABGN-23	2 dBi	3 dBi
AP300	High-Gain Dipole Omni-Directional ACC-ANT-ABGN47O	4.7dBi	4.7dBi
AP150	Dual-Band Omni-Directional SAA04-220050	2 dBi	3 dBi

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

Europe—EU Declaration of Conformity and Restrictions

This equipment is marked with either the CE Mark, the alert symbol, and the notified body's number and can be used throughout the European Community. This mark indicates compliance with the R&TTE Directive 1999/5/EC and the relevant parts of the following technical specifications.
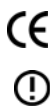
This equipment is marked with either the CE Mark, the alert symbol, and the notified body's number and can be used throughout the European Community. This mark indicates compliance with the R&TTE Directive 1999/5/EC and the relevant parts of the following technical specifications.

EN 300 328. Electromagnetic Compatibility and Radio Spectrum Matters (ERM). Wideband transmission systems, data transmission equipment operating in the 2.4 GHz ISM (Industrial, Scientific, and Medical frequency bands in the range of 902–928 MHz, 2.4–2.485 GHz, and 5.15–5.25 GHz) band and using spread spectrum modulation techniques, harmonized EN standards covering essential requirements under article 3.2 of the R&TTE directive.

EN 301 893. Broadband Radio Access Networks (BRAN). 5 GHz high-performance RLAN, harmonized EN standards covering essential requirements of article 3.2 of the R&TTE directive.

EN 301 489-17. Electromagnetic Compatibility and Radio Spectrum Matters (ERM). Electromagnetic Compatibility (EMC) Standard for Radio Equipment and Services, Part 17 Specific Conditions for Wideband Data and HIPERLAN Equipment.

EN 55022 Statement (applicable to AP201 Rev 2, AP208 Rev 2 only). This is to certify that the above models are shielded against the generation of radio interference in accordance with the application of Council Directive 2004/108/EC, Annex I, 1a. Conformity is declared by the application of EN 55 022 Class B (CISPR 22). Compliance is dependent upon the use of Cat 5e shielded data cables.

EN 60950-1. Safety of Information Technology Equipment.

EN 50385. 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.

! Marking by the alert symbol indicates that usage restrictions apply.

(!) Marking by the alert symbol indicates that usage restrictions apply.

Meru Networks, Inc. declares that their Access Points comply with the essential requirements and other relevant provisions of Directive 1999/5/EC.

Meru Networks, Inc. vakuuttaa täten että Access Points tyyppinen laite on direktiivin 1999/5/EY oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen.

Hierbij verklaart Meru Networks, Inc. dat het toestel Access Points in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 1999/5/EG.

Bij deze verklaart Meru Networks, Inc. dat deze Access Points voldoet aan de essentiële eisen en aan de overige relevante bepalingen van Richtlijn 1999/5/EC.

Par la présente, Meru Networks, Inc. déclare que l'appareil Access Points est conforme aux exigences essentielles et aux autres dispositions pertinentes de la directive 1999/5/CE.

Par la présente, Meru Networks, Inc. déclare que ce Access Points est conforme aux exigences essentielles et aux autres dispositions de la directive 1999/5/CE qui lui sont applicables.

Härmed intygar Meru Networks, Inc. att denna Access Points står I överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 1999/5/EG.

Undertegnede Meru Networks, Inc. erklærer herved, at følgende udstyr Access Points overholder de væsentlige krav og øvrige relevante krav i direktiv 1999/5/EF.

Hiermit erklärt Meru Networks, Inc. dass sich dieser/diese/dieses Access Points in Übereinstimmung mit den grundlegenden Anforderungen und den anderen relevanten Vorschriften der Richtlinie 1999/5/EG befindet.

Hiermit erklärt Meru Networks, Inc. die Übereinstimmung des Gerätes Access Points mit den grundlegenden Anforderungen und den anderen relevanten Festlegungen der Richtlinie 1999/5/EG.

Con la presente Meru Networks, Inc. dichiara che questo Access Points è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 1999/5/CE.

Por medio de la presente Meru Networks, Inc. declara que el Access Points cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 1999/5/CE.

Meru Networks, Inc. declara que este Access Points está conforme com os requisitos essenciais e outras disposições da Directiva 1999/5/CE.

Hawnhekk, Meru Networks, Inc. jiddikjara li dan Access Points jikkonforma mal-htigi-jiet essenzjali u ma provvedimenti ohrajn relevanti li hemm fid-Dirrettiva 1999/5/EC.

Käesolevaga kinnitab Meru Networks, Inc. seadme Access Points vastavust direktiivi 1999/5/EÜ põhinõuetele ja nimetatud direktiivist tulenevatele teistele asjako-hastele sätetele.

Alulírott, Meru Networks, Inc. nyilatkozom, hogy a Access Points megfelel a vonat-kozó alapvető követelményeknek és az 1999/5/EC irányelv egyéb előírásainak.

Meru Networks, Inc. týmto vyhlasuje, e Access Points splna základné poiadavky a všetky príslušné ustanovenia Smernice 1999/5/ES.

Meru Networks, Inc. tímto prohlašuje, e tento Access Points je ve shode se základními poadavky a dalšími príslušnými ustanoveními smernice 1999/5/ES.

Šiuo Meru Networks, Inc. deklaruoja, kad šis Access Points atitinka esminius reikala-vimus ir kitas 1999/5/EB Direktyvos nuostatas.

Ar šo Meru Networks, Inc. deklare, ka Access Points atbilst Direktivas 1999/5/EK butiskajam prasibam un citiem ar to saistitajiem noteikumiem.

Niniejszym, Meru Networks, Inc., deklaruje, ze Access Points spelnia wymagania zasadnicze oraz stosowne postanowienia zawarte Dyrektywie 1999/5/EC.

These products are intended to be used in all countries of the European Economic Area with the following restrictions:

IEEE 802.11a Restrictions

- These products are for indoor use only (5150–5250 MHz).
- To ensure compliance with local regulations, be sure to set your Access Point to the country in which you are using the Access Point.
- The Meru Access Point products can be used only indoors in the following countries: Austria, Belgium, Bulgaria, Czech Republic, Germany, Cyprus, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, The Netherlands, Norway, Portugal, Poland, Romania, Spain, Slovak Republic, Slovenia, Sweden, Switzerland, Turkey, and United Kingdom.

EEE 802.11b/g Restrictions

- France—In all Metropolitan départements, wireless LAN frequencies can be used under the following conditions, either for public or private use:

  Indoor use: maximum power (EIRP) of 100 mW for the entire 2400–2483.5 MHz frequency band.

Japan

EN 55022 Statement (applicable to AP201 Rev 2, AP208 Rev 2 only). This is to certify that the above models are shielded against the generation of radio interference in accordance with the application of Council Directive 2004/108/EC, Annex I, 1a. Conformity is declared by the application of EN 55022 Class B (CISPR 22). Compliance is dependent upon the use of shielded data cables.

Model AP300

Model AP300 module rev 1

003WWA080094   003GZA080095   003XWA080096

Model AP150

003NY06122 0000   003GZ06030 0000   003WY06046 0000

Singapore

For the AP201 Rev 2, AP208 Rev 2, and OAP180, the following approval information applies:

```
Complies with
IDA Standards
DA103798
```

For the AP300 series, the following approval information applies:

```
Complies with
IDA Standards
DB102245
```

Manufacturing Information

The AP150, AP1000, and AP300 are built in Taiwan. Factory information is provided under NDA and upon request.

AP300 Plenum Requirements

When installing APs in an air-handling space, as described in Article 300.22(C) of the NEC (2005), the unit should only be powered by the Ethernet port (PoE), not by the AC-powered power supply.

When the product is installed in air-handling spaces, the cables employed should be suitable under NEC Articles 300.22 and 725 and marked accordingly, for use in plenums and air-handling spaces with regard to smoke propagation, such as CL2-P, CL3-P, MPP or CMP.

The products should be installed in accordance with all applicable, local regulations and practices.

Appendix C
Supported PoEs

Supported Power Over Ethernet Devices for Meru APs

PoE	Description
ACC-POE-AT-1AC	Mid-Span High Power pre-802.3at PoE injector (1 Port, 110V/220V AC input). Ideal for Meru AP300, AP300i, or AP1000; backward compatible with 802.3af, also works with Meru AP150.
ACC-POE-AT-12AC	Mid-Span 802.3af+ High Power PoE injector (12 Port, 110V/220V AC input), 19" rack mountable, remote management capable. Ideal for Meru AP300, AP300i, or AP1000.
ACC-POE1-24AC	Mid-Span 802.3af PoE injector (24 Port, 110V/220V AC input). Ideal for Meru AP300, AP300i, or AP1000.
ACC-POE1-24ACDC	Mid-Span 802.3af PoE injector (24 Port, 110V/220V AC or 48V DC input) - Note only supports 20 access points?? Ideal for Meru AP300, AP300i, or AP1000.

Appendix D
Optional External Antennas

This appendix provides quick overviews regarding several external antennas that are supported in conjunction with AP300 models. Each model provides brief instructions on antenna installation.

ACC-ANT-ABGN-23

Suspended-ceiling mounting clips are provided on the rear panel of the antenna package. Make two small slots in the tile to pass the feedlines, then install the antenna on the tile-support rail, as shown in Figure 52.

Figure 52: Basic I-Beam Installation

Ceiling grid I-beam
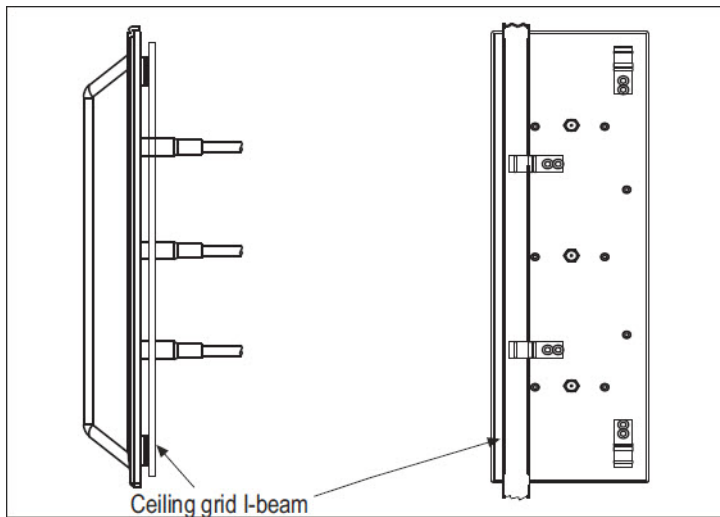
For installations using recessed-edge tiles, use the supplied plastic recessed tile adapter clips. Snap clips onto the ceiling-tile grid then mount the antenna to the clips, as shown in Figure 53.

Figure 53: Recessed Tile Installation
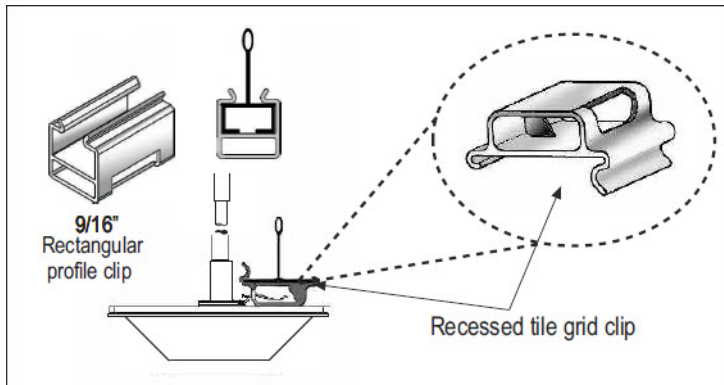
For 9/16" rectangular profile grids, install the supplied clips in the same manner.

ACC-ANT-O6ABGN-0606-O

Users can install this antenna model on a beam (using one or two clamps, as needed), or mounted on a pole with the included L-bracket. Examples of each are displayed in Figure 54 and Figure 55.

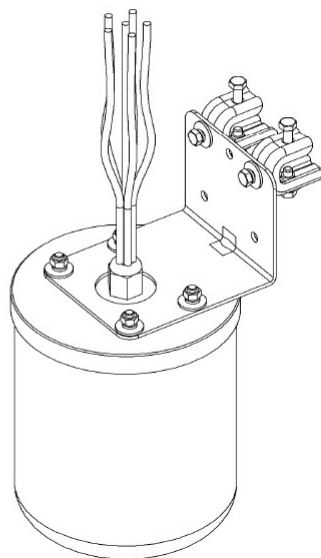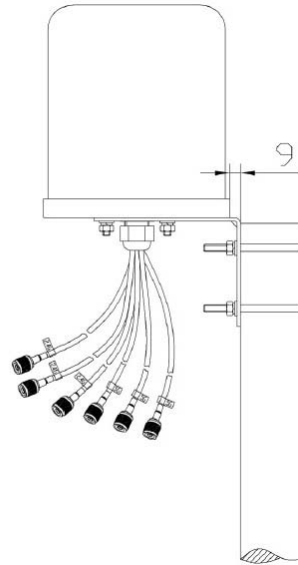**Figure 54: Installation on a Beam**
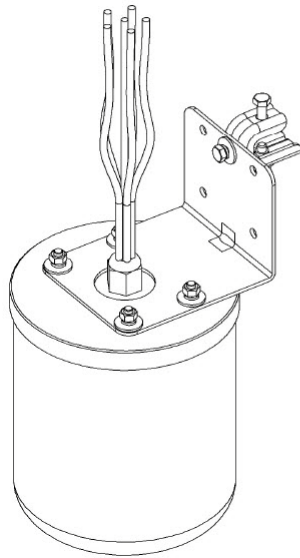
Single Beam Clamp   **Double Beam Clamp**

Figure 55: Installation on a Pole
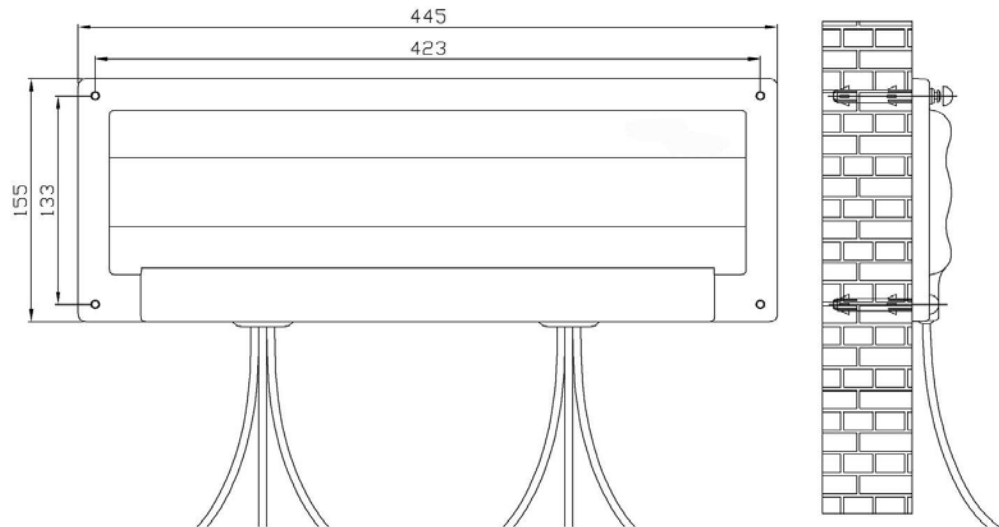

ACC-ANT-O6ABGN-0607-PT

This antenna model can be easily mounted onto a flat surface using the provided drywall screws, as shown in Figure 56. Simply drill the four holes required for the screws at the corners and then screw the antenna to the surface.

Figure 56: Installation on a Flush Wall

Alternatively, the user can install the antenna on a raised pole using the provided flexible wall/mast mount, as depicted in Figure 57.

Figure 57: Installation on a Pole
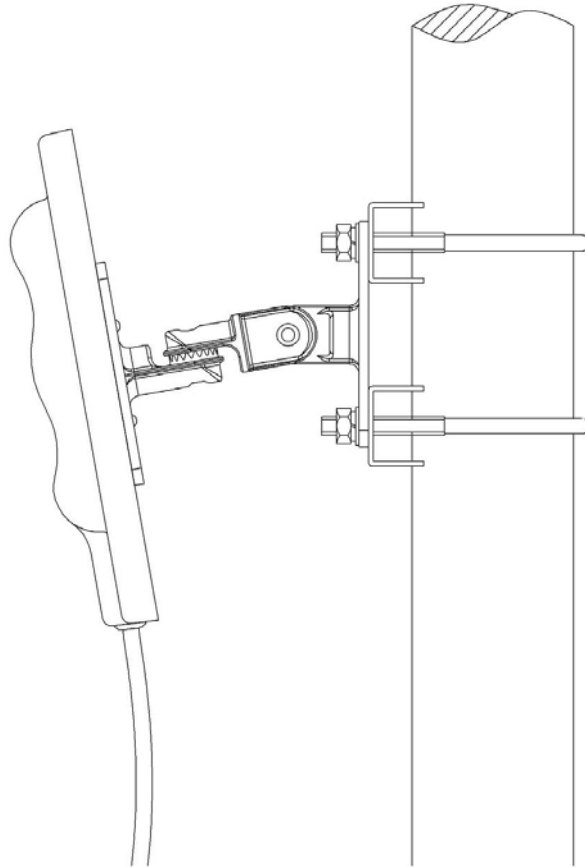
ACC-ANT-O1BG-1300-PN

This antenna comes with a convenient L-bracket that can be used in conjunction with the pole-mounting setup, as shown in Figure 58 and Figure 59.

Figure 58: L-Bracket Attached to Antenna

Figure 59: L-Bracket Attached to Pole
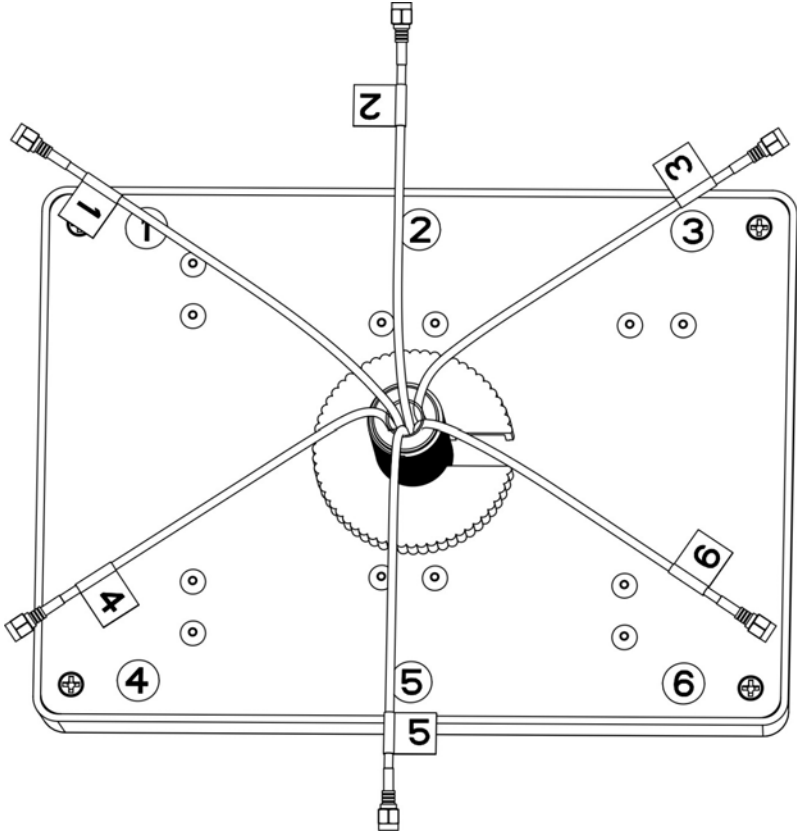

The completely mounted antenna is displayed in .

Figure 60: Fully-Mounted Antenna

ACC-ANT-6ABGN-24

This MIMO omnidirectional antenna can be easily deployed on any flat surface. See Figure 61 for antenna lead configuration.

Figure 61: Antenna Leads

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