Meru AP300

Installation Guide

September 14, 2007

Contents

About This Guide

- This guide describes the various options for configuring the Meru AP300 and the wireless LAN. The architecture and fundamental operations of system are described.

Audience

This guide is intended for network administrators configuring and maintaining the Meru AP300. Familiarity with the following concepts is helpful when configuring the Meru Wireless LAN System:

- Network administration, including:
  — Internet Protocol (IP) addressing and routing
  — Dynamic Host Configuration Protocol (DHCP)
  — Configuring Layer 2 and Layer 3 switches (if required by your switch)
- IEEE 802.11n (Wi-Fi) concepts, including:
  — ESSIDs
  — WEP
- Network Security (optional)
  — WPA
  — 802.1X
  — RADIUS
  — X.509 certificates

Other Sources of Information

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

Meru Publications

- *Meru AP300 Install Guide*
- *Meru System Director Release Notes*

- *Meru Access Point and Radio Switch Installation Guide*
- *Meru Controller Installation Guide*
- *Meru System Director Command Reference*
- *Meru System Director Getting Started Guide*

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.

Guide to Typographic Conventions

This guide uses the following typographic conventions in paragraph text to help you identify information:

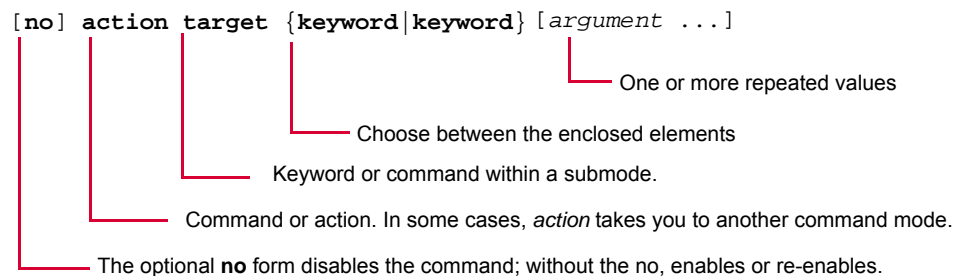|	
Bold text	Identifies commands and keywords in syntax descriptions that are entered literally.
Italic text	Used for new terms, emphasis, and book titles; also identifies arguments for which you supply values in syntax descriptions.
`Courier font`	Identifies file names, folder names, computer screen output, and text in syntax descriptions that you are required to type.
`Ctrl-`	Denotes that the Ctrl key should be used in conjunction with another key, for example, Ctrl-D means hold down the Ctrl and press the D key. Keys are shown in capitals, but are not case sensitive.
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

Syntax Notation

In example command syntax descriptions and examples, the following text elements and punctuation are used to denote user input and computer output for the command. In general, `Courier font` is used for command input and output at the command line; **bold** indicates required text and *italics* indicates values that are to be replaced.

bold	Required command, keywords, and punctuation.
italic	Arguments or file names where you substitute a value.
no	The optional no form of the command disables the feature or function.
[ ]	Optional elements are enclosed by square brackets.
{ }	Braces indicates that one of the enclosed elements must be used.
		Choices among elements are separated by vertical bars.
[{}]	A required choice within an optional element.
...	The preceding argument can be repeated.

The following figure shows a sample of syntax notation.

[**no**] **action target** {**keyword**|**keyword**} [*argument* ...]

One or more repeated values

Choose between the enclosed elements

Keyword or command within a submode.

Command or action. In some cases, *action* takes you to another command mode.

The optional **no** form disables the command; without the no, enables or re-enables.

✔ **Note:** Many commands have a default setting or value, listed in the Default section of the command page.

Contacting Meru

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

http://www.merunetworks.com

Click **Support** to view Meru Customer Services and Support information.

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 Customer Services and Support provide end users and channel partners with the following:

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

Chapter 1
AP300 Series Introduction

The Meru AP300 Access Point delivers high performance, full-speed, draft 2.0 compatible 802.11n connectivity while simultaneously supporting legacy 802.11a/b/g devices. The Meru Networks family of AP300 Access Points is supported by System Director Release 3.4.SR3 and later.
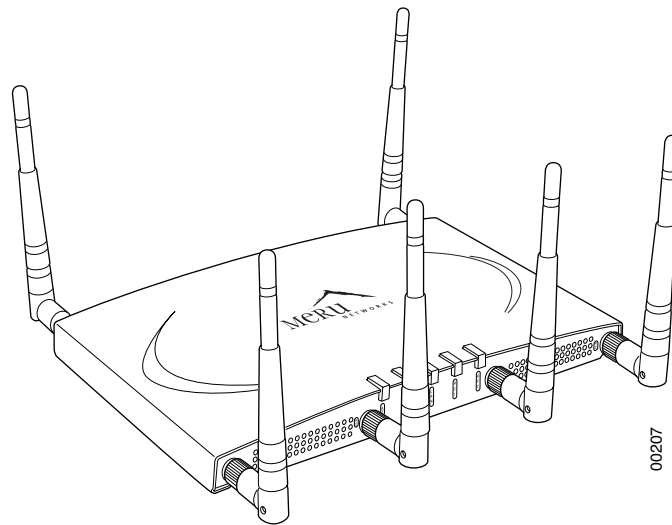

Figure 1: AP300

Key product features 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 theoretical throughput.
- Dual-band external antenna options optimized for MIMO mode
- Plug and Play deployment using centralized Meru Controller platforms
- Multi-layered security including standard WPA2, 802.11i security such as automatic traffic inspection

This access point is available in three different configurations:

- AP320: Two 802.11n radios with 3x3 MIMO mode streams
- AP310: Single 802.11n radio with 3x3 MIMO mode stream
- AP311: Single 802.11n radio with 3x3 MIMO mode stream and single 802.11a/b/g radio (upgradeable)

Each of these Access points may be powered by a standard 802.3af for 2x2 MIMO Mode. For 3x3 full channel mode, use either a power supply or a a 802.3at PoE device.

Hardware Specification

The AP300 hardware platform features:

- 10/100/1000 Ethernet port, copper
- 1 serial/console port (reserved)
- DC power input (5 Volts)
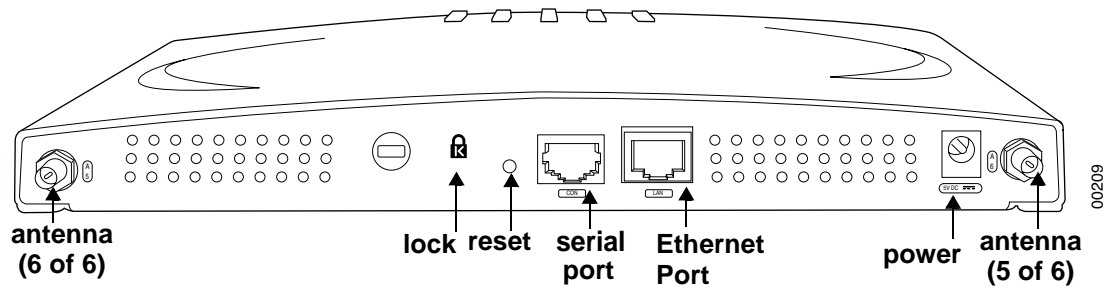- 6 RPSMA external antenna connectors

Figure 2: AP300

AP300 Product Overview

The Meru AP300 Series, supported by System Director release 3.4.SR3 and later, includes the following features:

- Air Traffic Control technology for 802.11n devices and legacy a/b/g devices
- 3x3 MIMO (Multiple Input, Multiple Output) technology with three dedicated, configurable input/output streams that deliver data rates up to 300 Mbps
- Software upgradeable radios for maximum investment protection
- Meru channel span architecture which requires no channel planning or configuration
- Six standard multiband, omni-directional antennas for AP320 and AP311. Three standard multiband, omni-directional antennas for AP310.
- Powered by 5 volt DC input, 802.11af compliant PoE device, or 802.11at compliant PoE device.

Chapter 2
Installing the AP300

This chapter describes how to physically install the Meru AP300. It contains the following sections:

Safety Precautions

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

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

! **Caution!**   The AP300 is not certified for plenum installations, and should not be installed in the plenum space.

Document Number: 3.5.1 Rev 1

Unpack the AP300

The Meru AP300 series consists of the 3 models shown in Table 1. Depending which model you are installing, you will have either six or three antennas. Drawings in this chapter show six antennas.

Table 1: Meru AP300 Radios and Antennas

Model	1st Radio	2nd Radio
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	a/b/g with 3 dual band omni-directional antennas (upgrade-able)
AP310	a/b/g/n with 3 dual band omni-directional antennas	NA

Confirm that the AP300 shipping package contains these items:

- AP300 with attached mounting bracket
- Six (AP320, AP311) or three (AP310) antennas
- Power supply

Determine Power Requirements

Your power requirements will vary, depending on which AP300 radios are deployed and what mode is used. See Table 2.

Table 2: AP300 Power Options

AP300 Configuration	Power Options
1 radio – b/g mode	Either a power supply (included) or PoE 802.3af
1 radio – n-mode	Either a power supply (included) or PoE 802.3af
2 radios – 1 b/g-mode, 1 n mode	For 2x2 MIMO mode, use either a power supply (included) or PoE 802.3af. For 3x3 MIMO mode, use either a power supply (included) or a PoE 802.3at.
2 radios – both in n mode	For 2x2 MIMO mode, use either a power supply (included) or PoE 802.3af. For 3x3 MIMO mode, use either a power supply (included) or a PoE 802.3at.

Installation Requirements

The AP300 standard mounting bracket can be removed. The AP300 is also designed to be used with brackets supplied by other vendors; if you use a bracket other than an AP150 bracket (which is identical), you need to obtain three shoulder screws (see Appendix A). Meru APs can be mounted on Cisco 1230 series brackets, but the Cisco 1240 and 1250 series brackets are new and not compatible with the Meru bracket.

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. See Figure 3.
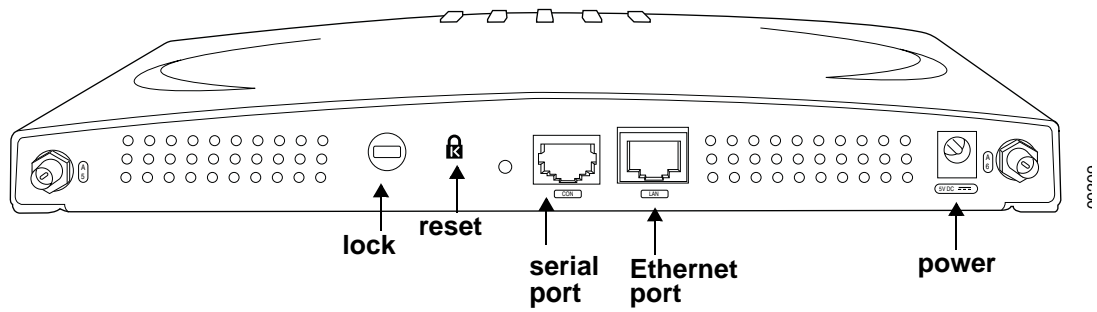
Figure 3: AP300 Bottom View

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.

To complete this installation, you need the items listed in Table 3.

Table 3: AP300 Installation Items

Installation Type	Consumable 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
Horizontal mounting below a hanging ceiling	• Two caddy fasteners • Two plastic spacers • Two keps nuts (with attached lock washer) • Mounting bracket
Using existing Cisco 1230 series brackets	• special screws - see Appendix A

Table 4: AP300 Installation Tools

Installation Type	Tools Required
Horizontal mounting	None
Vertical mounting over a wall stud	• Drill • 1/8"drill bit • Screwdriver • 1/8"Allen wrench
Vertical mounting on sheetrock	• Drill • 3/16" drill bit • Screwdriver • 1/8"Allen wrench
Horizontal mounting below a hanging ceiling	• Screwdriver • Wrench or pliers • 1/8"Allen wrench
Using existing Cisco 1230 series brackets	• Screwdriver

Additional Equipment

A power source is provided with the AP300. If you want to use a PoE, you need to provide one of the following:

● 802.3af compliant PoE device (for 2x2 mode)

● 802.3at compliant PoE device (needed for 3x3 mode)

Install the Access Points

Select a Location

The AP300 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. In addition, the AP300 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 testing is not complete at this time) or the wall near the ceiling provides the least obstructed communications path. For an external power supply connection, ensure the power source is near to where the AP300 will be mounted.

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

Most installations receive the best coverage using the following guidelines:

- Install APs toward the center of the building.
- Do not install APs near metal objects, such as heating ducts, metal doors, or electric service panels.
- Relative to the ground, orient the antenna up or down, not sideways.

✔ **Note:** The previous guidelines are general guidelines. Each site has its own unique environment. Place access points accordingly.

Attach the AP300 Antennas

The AP300 has six external antenna ports, labeled 1 - 6. AP320 and AP311 use all six antennas. AP310 uses three antennas (1 - 3). Make sure that all external antennas and their associated wiring are located entirely indoors. The external antennas are not suitable for outside use.

Figure 4: AP320 Antennas 1-6

Attach Standard Antennas

All standard attached antennas must be the same model. If you replace one antenna, replace them all. These antennas are supported:

- Antenna Standard multiband, omni-directional white antenna (included)
- Standard Antenna Gain ~ 2.2 dBi for 2.4 GHz,and 3 dBi for 5 GHz
- RP SMA connectors for external antenna options

Make sure that all external antennas and their associated wiring are located entirely indoors. The external antennas shipped are not suitable for outside use.
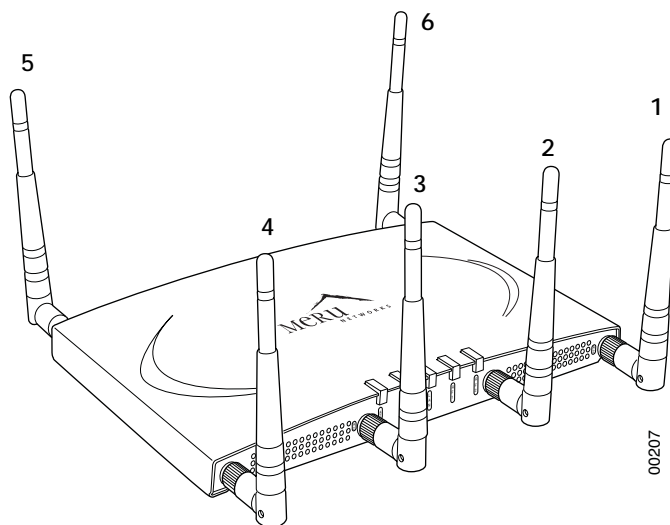
Attach the antennas to the connectors on the AP300 (see Figure 5). Rotate the knurled ring at the base of the antenna clockwise to attach the antenna. The ring should be finger-tight.
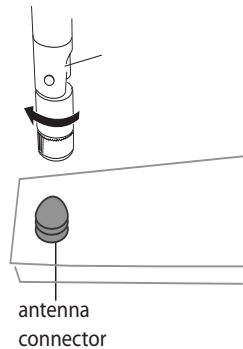
antenna
connector

Figure 5: AP300 Antenna Connection

! **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.

Attach Remote Antennas

Remote antenna testing is not complete at this time.

Mount the Access Point

You can mount an AP300 in the following ways:

- Horizontally on a surface, for example set the AP300 on a shelf
- Vertically on a wall
- In the ceiling (plenum testing is not complete at this time)

Mount AP300 Horizontally

When mounting an AP300 horizontally, remove the mounting bracket. Be sure to position the antennas vertically when an AP300 sits on a surface. See Figure 6.

Figure 6: Horizontal AP300

Mount AP300 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 AP200s, the AP300 bracket can be attached to the old bracket with shoulder screws (see Appendix A); you don't have to remove the old brackets.
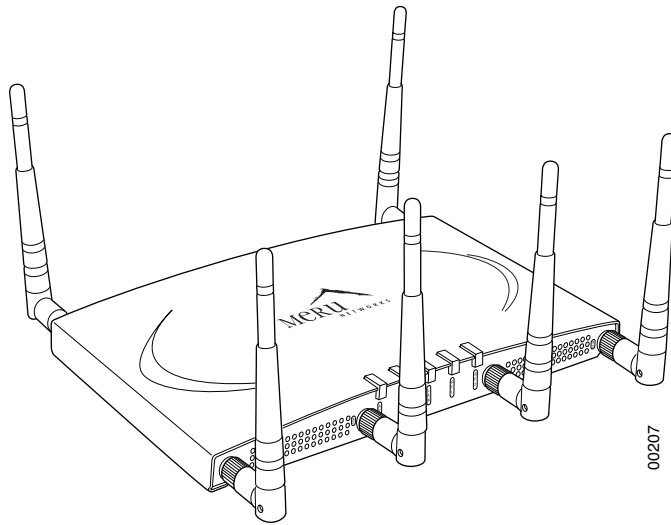
The AP300 ships with the mounting bracket attached. To mount an AP300 on a wall:

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.

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 AP300 Ethernet port shown in Figure 7.
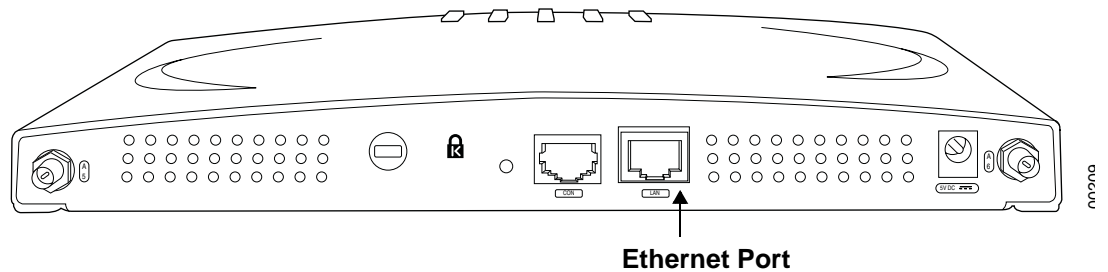
Ethernet Port

Figure 7: Connect AP300 to LAN

7. Either connect an external power supply to the power connector and plug it into the wall, or connect an appropriate PoE power device to the Ethernet port (see Figure 7).

Check AP300 LED Activity

After the AP300 is connected, the LEDs should light (see Figure 8).

power status LAN RF1 RF2

Figure 8: AP300 Status LEDs

The functions of the five LEDs are described in Table 5.

When the AP300 is first connected to the controller and any time the access point is rebooted thereafter, the AP initializes with and then is programmed by the controller. When the AP is first powered up, all LEDs are green. Thereafter, the Status LED (see Figure 8) color reflects the various operating states (Table 5).

Table 5: AP300 LED Descriptions

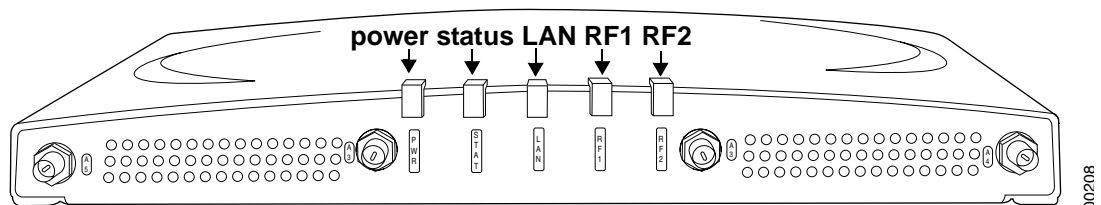| LED	Function
Power	off—no power green—presence of power
Status	off—no power green—booting stage 1 blinking green and off—booting stage 2 blinking green and white—discovering the controller blinking green and blue—downloading a configuration from the controller blinking blue and off—AP is online and enabled, working state blinking red and yellow—failure; consult controller for alarm state
LAN	off—no power, or no link green—link status OK (at any speed) green/blinking—activity (at any speed) red—auto negotiation failure
Radio 1 Radio 2	off—no radio present green—radio enabled green blinking—data activity yellow—disabled or in scanning mode red—failure

Configure AP300 Software

You can configure both the power source the AP300 will use and the channel width the AP300 will use. The default power source is 802.3af, and the default channel width is 20 MHz; these are the lowest (and slowest) settings. Increase range and throughput by changing MIMO mode to 3x3. The power supply option that you select determines whether or not you can use 3x3 MIMO. Be sure to change the power supply setting to either a DC power supply (provided) or a 802.11at PoE before changing MIMO mode to 3x3.

Configure AP300 Using the CLI

Use the CLI command **configure ap** to set the Power Supply Type and **configure interface Dot11Radio** to set the Channel Width, and MIMO Mode. For example:

1. Access the controller from a browser by entering the IP address of the controller.

2. Switch to configuration mode by entering **terminal configuration** at the CLI prompt. The prompt changes to *controller name (config)*.

3. Select an AP by entering the command *ap #*. For example:

```
default(config)# ap 1 *******changes to ap config****
default(config-ap)# ? *******help lists options****
boot-script Configure boot script for this AP.
building Building location for this AP.
connectivity Manage AP connectivity.
contact Contact person for this AP.
dataplane-mode Determine whether the data packets go through the
controller or not.
default Reset to default values
description Description of AP.
do Executes an IOSCLI command.
end Save changes, and return to privileged EXEC mode.
exit Save changes, and return to global configuration mode.
floor Floor location for this AP.
high-density-enable Enable high density.
led Configure LED settings.
link-probing-duration Duration AP waits before rebooting when
controller link is down.
location Location of this AP.
mac-address Assign a new MAC address or pre-provision AP.
model Assign AP HW type.
no Disables various parameters.
power-supply Power Supply mode for this AP.
show Displays various parameters related to this AP.
```

4. Set the power supply with the CLI command **power supply**. For example:

```
default(config-ap)# power-supply ? *******help lists options****
5V-DC 5V-DC for AP Power.
802.3-af 802.3af Power Over Ethernet.
802.3-at 802.3-at Power Over Ethernet.
dual-802.3-af dual-802.3-af Power Over Ethernet.
default(config-ap)# power-supply 5V-DC ***changes power to 5V***
```

5. Exit configuration mode with the CLI command **exit**.\

6. Switch to radio channel configuration with the CLI command **interface Dot11Radio #
    #.** For example:

```
default(config-ap)# exit
default(config)# interface Dot11Radio 1 1 ***switches to radio channel
config***
default(config-if-802)# ? ****help lists options*****
admin-mode               Administrative Mode.
antenna-property         Manage external wireless interface antennas.
antenna-selection        Antenna configuration.
channel                  Configure the channel ID.
channel-width            Configure the Channel Width for 802.11n
default                  Set various parameters to the default value.
do                       Executes an IOSCLI command.
end                      Save changes, and return to privileged EXEC
mode.
exit                     Save changes, and return to global configuration
mode.
fixed-channel            Fix channel so it cannot be changed by auto-
channel configuration.
mimo-mode                Configure the MIMO mode
```

```
mode                   AP mode configuration.
no                     Disables various parameters.
power                  Transmit power in the format low,medium,high.
For example, 20,20,20.
preamble-short         Enables short preamble.
protection-cts-mode    B/G protection mechanism.
protection-mode        bg protection mode.
rf-mode                Configure the Radio Frequency mode (802.11a, b,
g, bg, an
, or bgn).
show                   Displays various parameters related to this
wireless interface.
```

7. Change channel width from 20 MHz (default) to 40 MHz with the CLI command **channel-width**. For example:

```
default(config-if-802)# channel-width ? ***help shows options***
20-mhz                  20 MHz.
40-mhz-extension-channel-above 40 MHz Extension channel above.
40-mhz-extension-channel-below 40 MHz Extension channel below.
default(config-if-802)# channel-width above 40 MHz Extension channel
****changes channel width****
```

8. Change MIMO Mode from 2x2 (default) to 3x3 with the **mimo-mode 3x3** command. For example:

```
default(config-if-802)# mimo-mode 3x3 *****changes MIMO ****
default(config-if-802)# end
default#
default
```

Configure AP300 Using the GUI

Follow these steps to change Power Supply Type, Channel Width, and MIMO Mode using the GUI:

1. Enter the IP address of the controller in your browser. You see the controller GUI interface.

2. From the controller GUI, click **Configuration** > **Devices** > **APs**. The AP Table shown in is displayed.
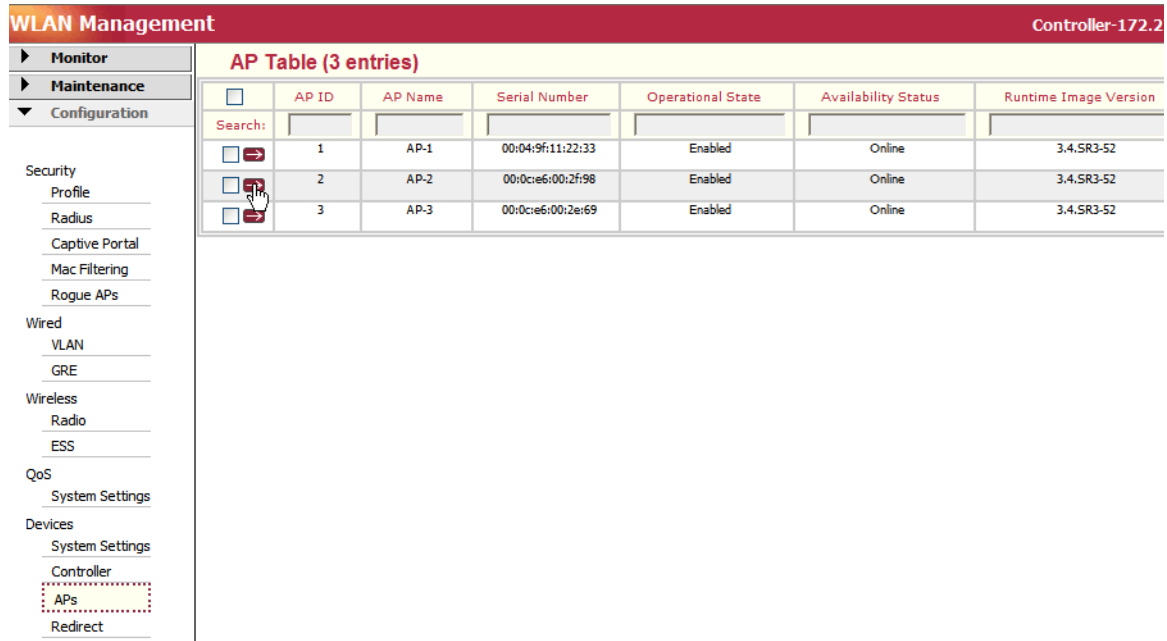
Figure 9: AP Table Configuration Window

3. Click the arrow that corresponds to the AP300 to change. The AP configuration for that AP is displayed. See **Figure 10**.
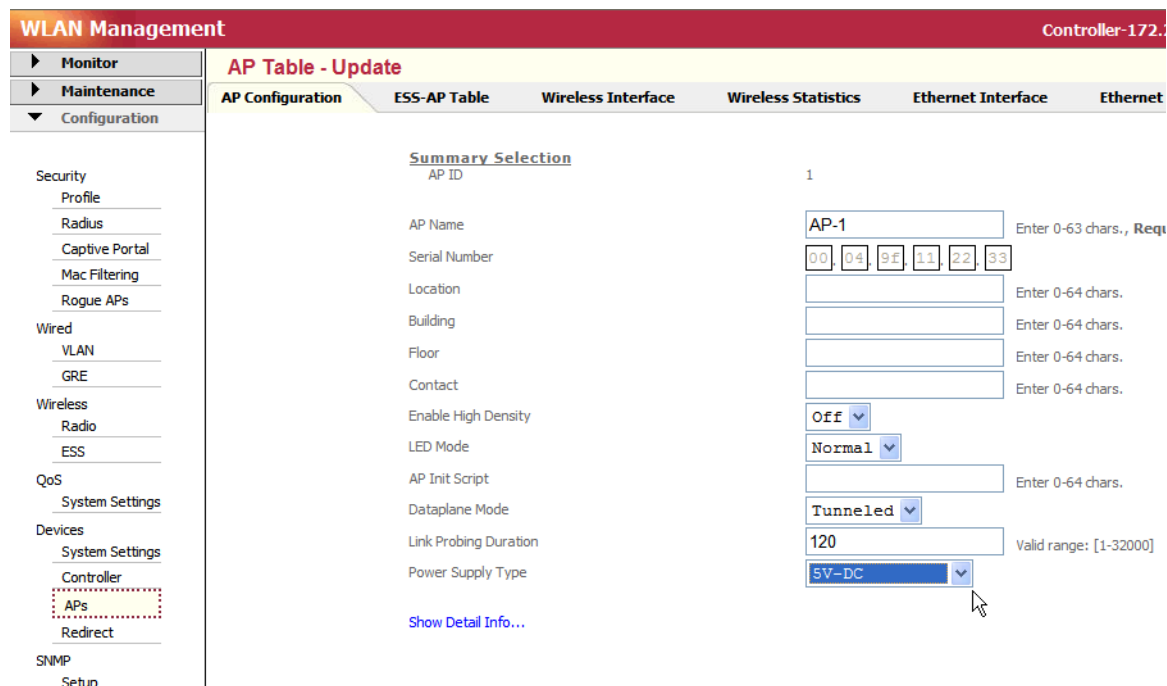

Figure 10: Changing Power Supply Type

4. Click the **Power Supply Type** drop-down list and select one of the following options. The included DC power block corresponds to the option **5V DC**.

— **802.3-af**: Default power supply. Select this when using a traditional PoE. This power supply type only supports 2x2 MIMO mode.

— **802.3-at**: Select when using a higher-powered, next generation PoE. This power supply type supports 3x3 MIMO mode.

— **5V-DC**: Select when AP300 is plugged into a wall outlet. This power supply type supports 3x3 MIMO mode.

— **dual-802.3**: Select when using a dongle that combines power from two traditional PoEs. This power supply type supports 3x3 MIMO mode.

5. Click **OK**.

6. Next, configure MIMO mode and Channel Width. Click the **Wireless Interface** tab. You see the Wireless Interface Configuration window shown in Figure 11.

Figure 11: Wireless Interface Tab - Set MIMO Mode and Channel Width

✔ **Note:** The Short Preamble Setting affects 11b clients only. The Protection Mechanism setting has no effect at this time.

7. Configure RF Band Selection by selecting a value from the drop-down list. To configure the band as N only, select a setting that includes N and change the data rates setting to make only N viable.

8. Configure MIMO mode by clicking the drop-down list and selecting either **2x2** or **3x3**. Be sure you have already configured an appropriate power source for 3x3 MIMO Mode. 3x3 MIMO Mode produces higher reliability, range, and speed but both settings (**2x2** and **3x3**) should approach 320 mbps.

9. Configure Channel Width by clicking the drop-down list and selecting either **40 MHz Extension channel above** or **40 MHz Extension channel below**. The 'channel above' and 'channel below' are relative to the value set in the Channel control setting (see Figure 11, the third setting from the top). This configures the channel bonding.

10. Click **OK**.

Troubleshooting

- If an AP320 continually reboots or demonstrates other unusual behavior, and MIMO Mode is set to 3x3, there may be a mismatch of power and MIMO Mode. Make sure that you have an appropriate power source configured, as well as attached to an AP320 with MIMO Mode set to 3x3.

- When RF band selection is set to 802.11n, the security mode can only be set at **clear**, **wpa2** or **wpa2psk**. This is an 802.11n restriction.

- The ChannelWidth field value **40 Mhz-extension-channel-above** is only applicable if the extension channel above is available in the country code. For example, A_EXT_CHANNELS=36:40 case, 40 Mhz-extension-channel-above configuration is valid for channel number 36. Currently we support extension channels in only the US country code. In addition, the default channel numbers for RF mode BG or A mode are changed in the US country code (DEFAULT_B_CHANNEL=6, DEFAULT_A_CHANNEL=36).

Appendix A
AP300 Brackets

The AP300 is designed to be used with brackets supplied by other vendors. Meru APs are compatible with the Cisco 1230 series brackets, but the 1240 and 1250 series brackets are new and not compatible. If you reuse a Cisco 1230 series bracket, follow these steps:

1. Obtain three of the screws shown in Figure 12.
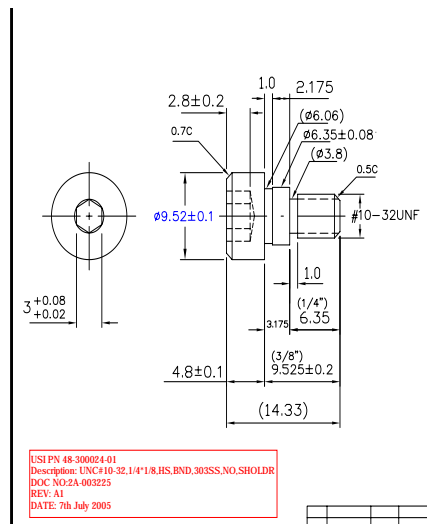
Figure 12: Shoulder Screw (specification front and side)

2. Insert the three screws into the locations indicated in Figure 13.
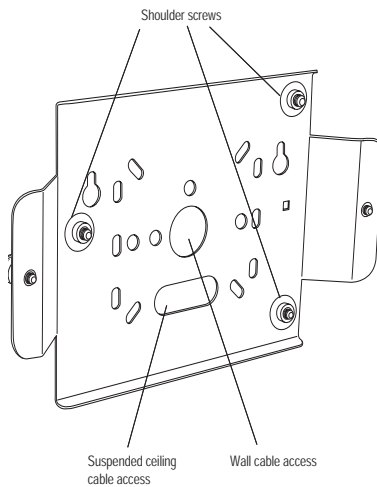
Figure 13: Location of Shoulder Screws

3. Slide the Meru bracket with shoulder screws onto the Cisco bracket.

Appendix B
Specifications

This chapter provides specifications for Meru Access Points and contains the following sections:

- Wireless Interface for All APs
- Ethernet Interface for All Meru APs
- Physical Description for All Meru APs

Wireless Interface for All Meru APs

Table 6: Wireless Interface Specifications

Feature	Details
Wireless Standards	- 802.11a, 802.11b, 802.11g, 802.11n
Antennas	- Two to six external antennas. Omni-directional and directional antennas for specific coverage requirements
Wireless Medium Access	- Wi-Fi Compliant 802.11 MAC standard
Power Management	- Power-save mode for clients in both QoS mode and non-QoS mode
Frame Size	- Peak frame size of > 2346 bytes - Fragmentation and reassembly of 802.11/Ethernet frames
Client Activities Supported	- Active scanning and passive scanning - Pre-authentication - Power-save mode supported

Ethernet Interface for All Meru APs

Feature	Detail
Wireline Standard	• One Ethernet (IEEE 802.3) interface, supporting half-duplex and full-duplex modes • Supports the Power over Ethernet (PoE) IEEE 802.3af standard

Physical Description for All Meru APs

Physical specifications for Meru Access Points are provided in the access point Data Sheet. Contact your Meru sales engineer for a copy of the document.

Appendix C
Regulatory Information

The Meru Networks, Inc. Meru Access Points (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.

USA — Federal Communications Commission (FCC)

FCC Radiation Exposure Statement

! **Caution!** The radiated output power of the Meru Networks, Inc. devices is well below the FCC radio frequency exposure limits. However, the Meru Networks, Inc. Meru Access Points 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.

Radio Frequency Interference Requirements

Interference Statement

Note:

Meru Networks Meru Access Point

These devices are restricted to indoor use because they operate in the 5.15 to 5.25 GHz frequency range. The FCC 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.

These devices comply with Part 15 of the FCC Rules. Operation of the devices is subject to the following two conditions: (1) The devices may not cause harmful interference, and (2) The devices must accept any 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:

- Relocate this device.
- Increase the separation between the device and the receiver.
- Connect the device into an outlet on a circuit different from that of other electronics.
- Consult the dealer or an experienced radio technician for help.

Note:

The Meru Networks 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.

Canada. Industry Canada (IC)

This device complies with RSS210 of Industry Canada.

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.

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.

✔ **Note:** **Meru Networks 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.

Appendix D
Channels

This appendix provides the access point radio channels supported by the world's regulatory domains.

IEEE 802.11a

The channel identifiers, channel center frequencies, and regulatory domains of each IEEE 802.11a 20-MHz-wide channel are listed in Table 7.

Table 7: IEEE 802.11a Channels

Channel Number	Frequency in MHz	Regulatory Domains	
		Americas	Japan
34	5170	-	X
36	5180	X	-
38	5190	-	X
40	5200	X	-
42	5210	-	X

Table 7: IEEE 802.11a Channels (Continued)

Channel Number	Frequency in MHz	Regulatory Domains	
		Americas	Japan
44	5220	X	-
46	5230		
48	5240		
52	5260		
56	5280		
60	5300		
64	5320		
149	5745	X	-
153	5765	X	-
157	5785	X	-
161	5805	X	-
165	5825	X	-

IEEE 802.11b/g

The channel identifiers, channel center frequencies, and regulatory domains of each IEEE 802.11b/g channel are listed in Table 8.

✔ **Note:** Mexico is included in the Americas regulatory domain; however, channels 1 through 8 are for indoor use only while channels 9 through 11 can be used indoors and outdoors. Users are responsible for ensuring that the channel set configuration complies with the regulatory standards of Mexico.

Table 8: IEEE 802.11b/g Channels

Channel Number	Frequency in MHz	Regulatory Domains				
		Americas	EMEA	Israel	China	Japan
1	2412	X				X
2	2417	X				X
3	2422	X				X
4	2427	X				X
5	2432	X				X
6	2437	X				X
7	2442	X				X
8	2447	X				X
9	2452	X				X
10	2457	X				X
11	2462	X				X
12	2467	-				X
13	2472	-				X
14	2484	-				X (for 802.11b only)

IEEE 802.11n

The channel identifiers, channel center frequencies, and regulatory domains of each IEEE 802.11b/g channel are listed in Table 9.

Table 9: IEEE 802.11n Channels

Channel Number	Frequency in MHz	Regulatory Domains			
		North America	ETSI	Japan (-P)	China
1	2412	X		X	
2	2417	X		X	
3	2422	X		X	
4	2427	X		X	
5	2432	X		X	
6	2437	X		X	
7	2442	X		X	
8	2447	X		X	
9	2452	X		X	
10	2457	X		X	
11	2462	X		X	
12	2467	-		X	

Channel Number	Frequency in MHz	Regulatory Domains			
		North America	ETSI	Japan (-P)	China
13	2472	-		X	
14	2484	-			
36	5180	X		X	
40	5200	X		X	
44	5220	X		X	
149	5745	X	-	-	X
153	5765	X	-	-	X
157	5785	X	-	-	X
161	5805	X	-	--	X

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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.

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

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