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BreezeMAX Wi² and BreezeACCESS Wi²

System Manual

PRELIMINARY

Document History

Topic	Description	Date Issued
This is the document's first Release		December 2006

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Disposal of Electronic and Electrical Waste

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Compliances

Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

■ Reorient or relocate the receiving antenna

■ Increase the separation between the equipment and receiver

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

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

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

IMPORTANT NOTE: FCC Radiation Exposure Statement

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

EC Conformance Declaration CE1177①

Hereby, Alvarion, declares that this device is in compliance with the essential requirements and other relevant provisions of the R&TTE Directive of the European Union (1999/5/EC).This device will be sold in the following EEA countries:Austria, Italy, Belgium, Liechtenstein, Denmark, Luxembourg, Finland, Netherlands, France, Norway, Germany, Portugal, Greece, Spain, Iceland, Sweden, Ireland, United Kingdom, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Slovakia, Poland, Slovenia.

EC Conformance Declaration

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

■ EN 60950 (IEC 60950) - Product Safety

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

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

Countries of Operation & Conditions of Use in the European Community

This device is intended to be operated in all countries of the European Community. Requirements for outdoor operation, license requirements and allowed channels of operation apply in some countries as described below:

NOTE

The user must use the configuration utility provided with this product to ensure the channels of operation are in conformance with the spectrum usage rules for European Community countries as described below.

■ This device requires that the user or installer properly enter the current country of operation in the command line interface as described in the user guide, before operating this device.

■ This device will automatically limit the allowable channels determined by the current country of operation. Incorrectly entering the country of operation may result in illegal operation and may cause harmful interference to other system. The user is obligated to ensure the device is operating according to the channel limitations, outdoor restrictions and license requirements for each European Community country as described in this document.

■ This device may be operated *indoors or outdoors* in all countries of the European Community using the 2.4 GHz band: Channels 1 - 13, except where noted below.

◇ In Italy the end-user must apply for a license from the national spectrum authority to operate this device outdoors.

◇ In Belgium outdoor operation is only permitted using the 2.46 - 2.4835 GHz band: Channel 13.

◇ In France outdoor operation is only permitted using the 2.4 - 2.454 GHz band: Channels 1 - 7.

Safety Compliance

Power Cord Safety

Please read the following safety information carefully before installing the device:

WARNING

Installation and removal of the unit must be carried out by qualified personnel only.

- The unit must be connected to an earthed (grounded) outlet to comply with international safety standards.

- Do not connect the unit to an A.C. outlet (power supply) without an earth (ground) connection.

- The appliance coupler (the connector to the unit and not the wall plug) must have a configuration for mating with an EN 60320/IEC 320 appliance inlet.

- The socket outlet must be near to the unit and easily accessible. You can only remove power from the unit by disconnecting the power cord from the outlet.

- This unit operates under SELV (Safety Extra Low Voltage) conditions according to IEC 60950. The conditions are only maintained if the equipment to which it is connected also operates under SELV conditions.

France and Peru only

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

IMPORTANT

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

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

About This Manual

This manual describes the BreezeMAX Wi^2 and BreezeACCESS Wi^2 unit and details how to install, operate and manage the access point.

This manual is intended for technicians responsible for installing, setting and operating the BreezeMAX Wi^2 and BreezeACCESS Wi^2, and for system administrators responsible for managing the system.

This manual contains the following chapters and appendices:

■ **Chapter 1 - Product Description** - Describes the Wi^2 unit and its functionality.

■ **Chapter 2 - Installation** - Describes how to install the Wi^2 and how to connect to subscriber's equipment.

■ **Chapter 3 - Initial Configuration** - Describes how to initially configure the access point in order to test basic link operation .

■ **Chapter 4 - System Configuration** - Describes advanced configuration of the the access point.

■ **Chapter 5 - Command Line Interface** - Describes the command line interface commands for configuring the access point.

■ **Appendix A - Troubleshooting**

Table of Contents

Chapter 3 - Initial Configuration

Chapter 4 - System Configuration

Chapter 5 - Command Line Interface

1

Chapter 1 - Product Description

In This Chapter:

- "Introduction" on page 2

- "Specifications" on page 4

1.1   Introduction

Alvarion's Wi² suite of converged solutions, including BreezeMAX Wi²and BreezeACCESS Wi²("Wi²"), unites the advantages of the popular WiFi access with the powerful capabilities of BreezeMAX or BreezeACCESS VL/4900 ("BreezeACCESS") systems to provide cost-effective solutions for personal broadband services.

The Wi² system comprises a self-contained combination of an advanced WiFi access point and a BreezeMAX or BreezeACCESSSU-ODU that provides backhaul connectivity. With its advanced roaming software, the Wi² can be deployed almost anywhere to provide broadband mobility to standard WiFi (IEEE 802.11 b/g) end user devices. Used in conjunction with Alvarion's market-leading BreezeMAX or BreezeACCESS base stations, the Wi² can be used to expand the existing capabilities of Alvarion's WiMAX and pre-WiMAX networks. Using the Wi², a BreezeMAX or BreezeACCESS network can be used to provide personal broadband services to high-end business as well as residential users equipped with WiFi enabled devices such as laptops, PDAs, smart-phones, and portable gaming devices. As a converged system, the Wi² also gives operators the ability to seamlessly transition to a fully mobile WiMAX network with managed services for personal broadband users.

Operating in both licensed and licensed-exempt frequencies, the Wi² system leverages the easy availability of WiFi technology - along with the power and robustness of BreezeMAX or BreezeACCESS broadband wireless access system - to answer critical public and private sector needs such as traffic management, video surveillance, public Internet access, homeland security, and various nomadic applications.

The Wi² is a self-contained, robust all-outdoor system that comprises three elements:

- A feature-rich WiFi (IEEE 802.11 b/g) Access Point (AP)

- A BreezeMAX/BreezeACCESS VL/BreezeACCESS 4900 SU-ODU (supplied separately).

- A power supply module that provides power to both the WiFi AP and the SU-ODU.

The Wi² system requires only a single connection to either AC or DC power. With its easy installation and operation, high performance, and rich security and QoS

feature sets, the Wi² is an ideal solution for operators, municipalities and communities looking to build metropolitan broadband networks or to integrate WiFi hot zone capabilities into their existing broadband wireless access networks. The result is personal broadband services ranging from public Internet access to public safety and Intranet applications.

NOTE

This document describes how to install and manage the Wi² system, including the installation and connections of a BreezeMAX or BreezeACCESS SU-ODU when installed on the mounting plate of the Wi² system. For details on other installation options for the SU-ODU and how to manage it, refer to the relevant *BreezeMAX* or *BreezeACCESS VL/4900* documents.

1.2 Specifications

1.2.1 Radio

Table 1-1: Radio Specifications

Item	Description
Radio Type	IEEE 802.11b/g
Radio Mode	802.11b+g, 802.11b only, 802.11g only
Frequency Band	2400-2497 MHz
Operating Channels	ETSI (EUR): 2412 ~ 2472 MHz(CH1-CH13) MKK (Japan) 11b: 2412 ~ 2484 MHz (CH1-CH14) MKK (Japan) 11g: 2412 ~ 2472 MHz(CH1-CH13) France: 2457 ~ 2472 MHz(CH10-CH13) US & Canada: 2400 ~ 2483.5 MHz(CH1~CH11)
Channel Bandwidth	20 MHz
Data Rates	802.11b: 1, 2, 5.5, 11 Mbps 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps
Turbo Mode (802.11g Super G)	Turbo Mode: 12, 18, 24, 36, 48, 54, 96, 108 Mbps per channel
802.11b Radio Technology	Direct Sequence-Spread Spectrum (DSSS)
802.11b Modulation Technique	Differential Binary Phase Shift Keying (DBPSK) @ 1 Mbps Differential Quadrature Phase Shift Keying (DQPSK) @ 2 Mbps Complementary Code Keying (CCK) @ 5.5 and 11 Mbps
802.11b Radio Technology	Orthogonal Frequency Divisional Multiplexing (OFDM)
802.11b Modulation Technique	Binary Phase Shift Keying (BPSK) @ 6 and 9 Mbps Quadrature Phase Shift Keying (QPSK) @ 12 and 18 Mbps 16-Quadrature Amplitude Modulation (QAM) @ 24 & 36 Mbps 64-QAM @ 48 & 54 Mbps
FEC Coding Rates	1/2 2/3, 3/4
Max Tx Power	11b: 20.36dBm 11g: 24.96dBm 11g turbo: 24.53dBm
TPC (Transmit Power Control)	100%, 50%, 25%, 12.5%, Min.
Antenna Ports	2 x N-Type, 50 ohm
Antenna Diversity	Rx antenna switching by energy sensing

1.2.2   Sensitivity

Table 1-2: Sensitivity

Data Rate	Sensitivity (dBm)
802.11b, 1 Mbps	-96
802.11b, 2 Mbps	-93
802.11b, 5.5 Mbps	-93
802.11b, 11 Mbps	-90
802.11g, 6 Mbps	-91
802.11g, 9 Mbps	-90
802.11g, 12 Mbps	-89
802.11g, 18 Mbps	-88
802.11g, 24 Mbps	-84
802.11g, 36 Mbps	-80
802.11g, 48 Mbps	-75
802.11g, 54 Mbps	-73

1.2.3   8 dBi Omni Antenna

Table 1-3: 8 dBi Omni Antenna

Item	Description
Antenna gain	8 dBi
VSWR	2:1 max
Antenna Polarization	Linear Vertical
Horizontal Plane	360°
Vertical Plane	15°
Dimensions	52 cm x 1.9 cm diameter
Weight	340 g

1.2.4 Configuration and Management

Table 1-4: Configuration and Management

Item	Description
Management options	■ Web-based (HTTP/HTTPS) ■ Telnet ■ SSH ■ SNMP
SNMP agent	V1 / V2c, supports 802.11 MIB, RFC-1213 MIB II and private MIB.
Management access	■ Local via Console port ■ From the backhaul network ■ From WiFi clients
Management access protection	■ Access Password ■ Enable/Disable access from wireless clients ■ Enable/Disable access using web/Telnet/SNMP ■ Restrict access to authorized stations (by IP)
WiFi Clients Authentication	■ Local/RADIUS MAC List ■ IEEE 802.1x
Encryption	■ WEP ■ WPA/TKIP over 802.1x or PSK (Pre-shared Key) ■ 802.11i / WPA2 (AES-CCMP) over 802.1x or PSK ■ Mixed WPA and WEP clients support
Allocation of IP parameters	Configurable or automatic (DHCP client)
WiFi Multi-Media Support	Four QoS levels using the WMM standard according to IEEE 802.11e
Software upgrade	HTTP/FTP/TFTP
Configuration Upload/Download	FTP/TFTP

1.2.5   Mechanical

Table 1-5: Mechanical Specifications

Item	Description
Dimensions	278mm (W) X 279mm (H) X 240mm (D)
Weight	5.8Kg (excluding antennas and backhauling CPE)
AC Power Supply	85-260VAC, 47-63Hz, maximum power consumption 2.5A
Mounting Plate Tilt	+/- 15^0
Mounting Plate Rotation	+/- 45^0

1.2.6   Electrical

Table 1-6: Electrical Specifications

Type	Details
AC Power Supply	85-260VAC, 47-63Hz, maximum power consumption 2.5A
DC Power supply	42 VDC to 60 VDC, maximum power consumption 3.5A
AC/DC Power Switching	When both AC and DC power sources are connected, AC power input will be used as long as internal power supplies are working properly. The unit will switch to DC power source if AC power input fails, or the internal power supplies fail, and the DC power input is in the proper range.

1.2.7   Connectors and LEDs

Table 1-7: Connectors and LEDs

Type	Description
AC IN	Connection to AC mains. 3-pin power plug, Bulgin PX0732/S/07
SU	Ethernet and power connection to backhauling CPE. RJ-45, in a weather protected service box
AP	Ethernet and power connection to AP (PoE). RJ-45, in a weather protected service box
DC IN	Connection to DC power source. 2-pin power plug, Bulgin
PoE	Ethernet and power connection, 8-pins DIN jack 10/100Base-T, half/full duplex with auto-negotiation
Console	RS232 DTE, 3-pins DIN jack

Table 1-7: Connectors and LEDs

Type	Description
LEDs	■ Power ■ Link (Ethernet link integrity/activity) ■ 11b/g: 3 LEDs indicating wireless link activity

1.2.8   Environmental

Table 1-8: Environmental Specifications

Item	Details
Operating Temperature	-40^{0}C to 60^{0}C non condensing 5º~55ºC
Storage Temperature	-55^{0}C to 80^{0}C non condensing 5º~70ºC
Humidity	Maximum 95%.
Water Proof	IP-67
Solar Radiation protection	IEC 60068-2-5
Salt	IEC 60068 part 2-52
Transportation	ETS 300 019-2-2 Class 2.3 Pubic Transportation
Storage shock	IEC 68-2-29
Storage drop	IEC 68-2-32
Wind operation	160 Km/hour
Wind survival	220 Km/hour

1.2.9   Standards Compliance

Table 1-9: Standards Compliance

Type	Standard
EMC	■ EN55022 CE Class B ■ FCC Class B Part 15 ■ VCCI Class B
Safety	■ UL / CUL (CSA60950-1, UL60950-1) ■ CE / CB (EN60950/IEC 60950-1)
Lightning	The unit withstand at +4KV of Input surge, 1.2usec rise/fall time, 50µsec duration, every 10 seconds, for all interfaces.
Radio	■ ETSI 300 328 (11b/g) ■ ETSI 301 489 (DC power) ■ FCC Part 15C 15.247/15.207 (11b/g) ■ TELEC

2

Chapter 2 - Hardware Installation

In This Chapter:

2.1   Hardware Description

The Wi² consists of a WiFi access point with an integrated power supply and interface module that connects to either a BreezeMAX or BreezeACCESS outdoor unit (SU-ODU) for backhaul and network management software. Each unit is housed in a weatherproof enclosure for mounting outdoors.
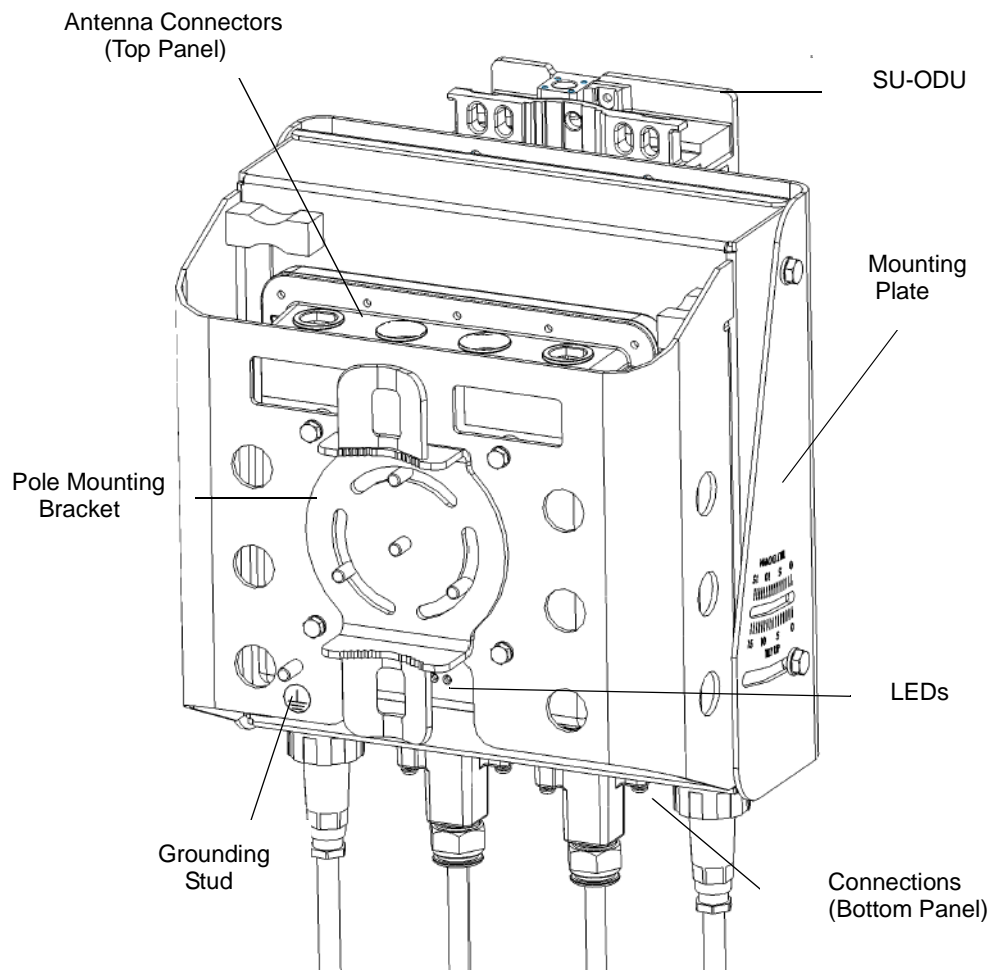
Figure 2-1: Wi² Unit (with SU-ODU attached)

> **NOTE**
>
> The diagram in Figure 2-1 includes a mounting plate and an SU-ODU. The SU-ODU can also be installed separately, in which case there is no need to attach the mounting plate to the Wi² unit.

2.1.1 Bottom Panel

Figure 2-2 shows the bottom panel of the Wi² unit and Table 2-10 lists the components.
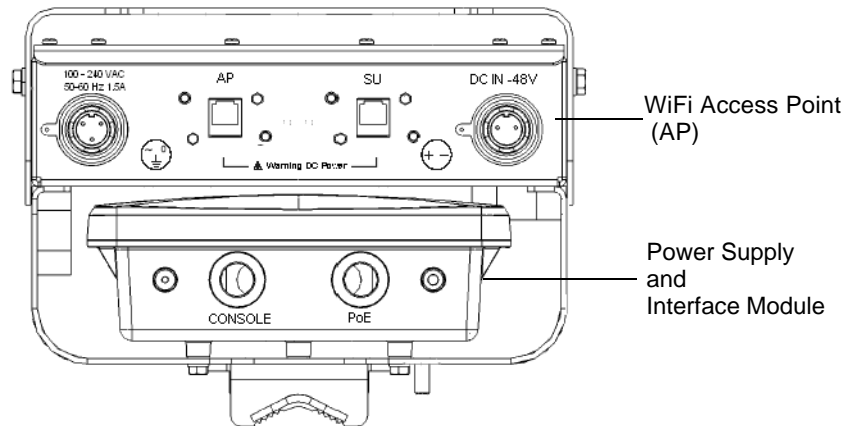
Figure 2-2: Bottom Panel (without the SU-ODU)

Table 2-10: Bottom Panel Components

Element	Item	Description
Power Supply and Interface Module	Console Port Cover Holder	Holder for waterproof protection cover for console port when port is not in use.
	Console Port	Connection to console port for system management.
	PoE Port	An Ethernet cable connects the PoE port to the AP port in the WiFi access point.
	Impermeability Test Screw	Do not remove or loosen this screw. Doing so may impair the sealing of the unit against moisture and humidity.

Table 2-10: Bottom Panel Components

Element	Item	Description
WiFI Access Point (AP)	AC Power Plug	3-pin power plug for connection to AC power source.
	AP Port	An Ethernet cable connects the AP port to the PoE port i n the power supply and interface module.
	SU Port	Connection to BreezeMAX or BreezeACCESS outdoor unit
	DC Power Plug)	2-pin power plug for connection to DC power source.

2.1.2   Top Panel
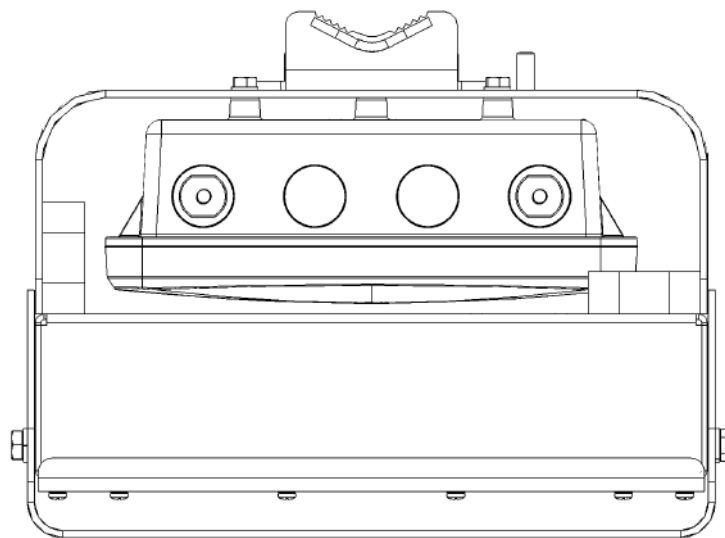
Figure 2-3: Top Panel (without the SU-ODU)

Figure 2-3 shows the top panel of the Wi² unit with two N-type RF connectors for external antennas.

2.1.3   LED Indicators

The Wi² includes eight status LED indicators. Figure 2-4 shows the LEDs and Table 2-11 describes the system status.

Figure 2-4: LED Indicators

Table 2-11: LED Indicators

LED	Status	Description
Power	On Green	Indicates that the system is working normally.
	On Amber	Indicates a power shutdown due to a low temperature condition.
Link	On Green	Indicates a valid 10/100 Mbps Ethernet cable link.
	Flashing Green	Indicates that the Wi² is transmitting or receiving data on a 10/100 Mbps Ethernet LAN. Flashing rate is proportional to network activity.
11b/g (three LEDs)	Off	No signal detected or the 802.11b/g radio is disabled.
	Slow Flashing Green	The 802.11b/g radio is enabled with a low level of network activity.
	Fast Flashing Green	Indicates a medium level of network activity.
	On Green	Indicates a high level of network activity.

2.2 Installation Requirements

This section describes all the supplies required to install the Wi² and the items included in each installation package.

2.2.1 Packing List

The BreezeMAX Wi² and BreezeACCESS Wi² installation kit includes the following components:

- Wi² unit

- SU-ODU mounting plate

- 4 x M8 x 16 hex head screws + flat washers + spring washers

- 4 x 1/4" x 1/2" hex head screws + flat washers + spring washers

- 4 x M6 x 12 hex head screws with integral washers

- 55 cm category 5E Ethernet cable with two RJ-45 connectors, one shielded with a metal service box.

- AC power connector

- 2 x 9/16" (530 mm) metal bands

- 3 m Ethernet data cable for connecting the PoE port to the AP port (2 pairs straight)

2.2.2 Additional/Optional Installation Requirements

- Category 5E cable* for connecting to an SU-ODU if installed separately (maximum length 100m.)

- Rubber sealing cap (supplied with SU-ODU)

- Crimping tool for RJ-45 connectors

- RS232 console cable*

- One or two 8 dBi Omni directional Antenna(s)*

- UL/CSA listed smooth circular power cable, 1.5mm to 2.5mm each. Outer diameter 7mm to 9mm, UV resistant, temperatures range -40^{0}C to +65^{0}C min. Other specifications (such as oil resistance, no of wires) according to specific installation requirements.

- A mains plug (if connecting to AC mains)

- Grounding cable with an appropriate termination.

- Installation tools and materials, including appropriate means for installing the Wi² and antenna .

- A PC with an Ethernet NIC for configuring basic parameters of the WiFi AP and the SU-ODU.

- Wall - Tilt Pole Mounting kit* (page 28)

- DC power connector* (pack of 5)

- Waterproof covers for AC/DC socket* (pack of 5)

- Spirit level

NOTE

Before starting to install the Wi² unit, check that you have all the necessary parts and accessories. Optional accessories marked with an * can be ordered from your supplier.

2.2.3   Guidelines for Positioning Wi²

CAUTION

ONLY experienced installation professionals who are familiar with local building and safety codes and, wherever applicable, are licensed by the appropriate government regulatory authorities should install outdoor units and antennas.

Failure to do so may void the product warranty and may expose the end user or Service Provider to legal and financial liabilities. Alvarion and its resellers or distributors are not liable for injury, damage or regulation violations associated with the installation of Outdoor Units or antennas.

The Wi² should be mounted vertically on a 1"-4" pole. Its location should enable easy access to the unit and its connectors for installation and maintenance and should have a clear or near line of sight to the area to be covered.

The SU-ODU attached to the unit should have a clear or near line of sight to the base stations. For further information about the optimal installation location of the SU-ODU refer to the relevant manual.

2.3   Installation

The following sections describe how to install a Wi² unit, including attaching the SU-ODU to the mounting plate, attaching the mounting plate to the Wi² unit, connecting to the SU-ODU, pole mounting, connecting a grounding cable, and connecting the antenna(s).

2.3.1   Attaching the SU-ODU to the Mounting Plate

IMPORTANT

The angle at which the SU-ODU is mounted on the Wi² can be adapted depending on the location of the Wi² unit in relation to the base station. Once attached, the mounting plate can be tilted either up or down. Before attaching the SU-ODU to the mounting plate, determine the direction of the tilt.

To attach a BreezeMAX PRO-S ODU or BreezeACCESSSU-ODU with HW Revision E to the mounting plate:

NOTE

BreezeACCESS SU-ODU with HW Revision E is the new, smaller size ODU available in the 5.4 and 5.8 GHz bands.

1   Determine the tilt direction of the SU-ODU.

2   Using the M8 x 16 hex head screws and the flat washers and spring washers supplied, attach the SU-ODU to the mounting plate as shown in Figure 2-5 in the direction marked.
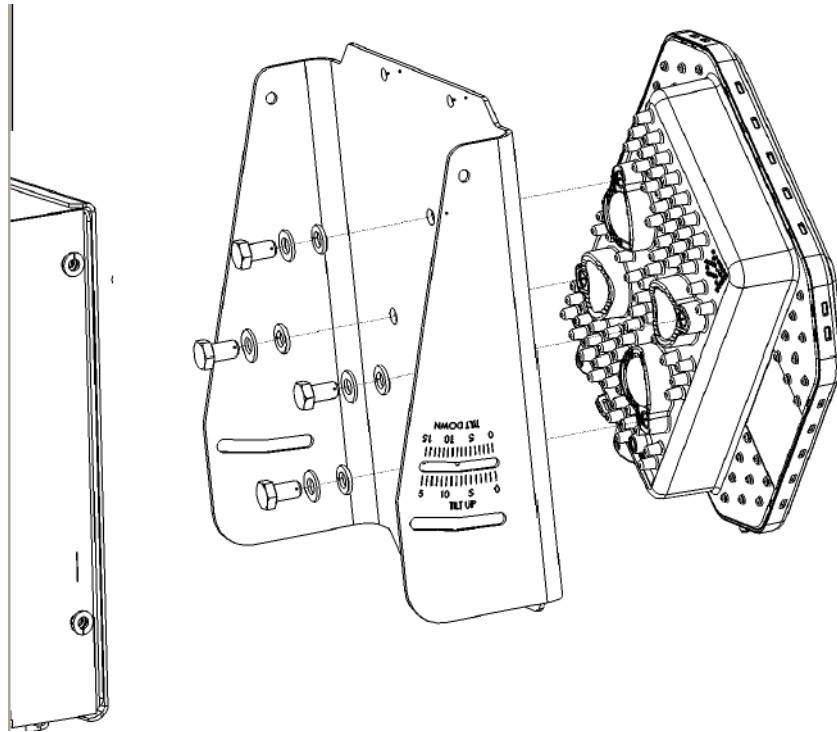
Figure 2-5: Attaching BreezeMAX PRO-S ODU or BreezeACCESSSU-ODU with HW Revision E to Mounting Plate

---

NOTE

For information about polarization refer to the relevant manual.

To attach a BreezeACCESS SU-ODU with HW Revision D or lower to the mounting plate:

1 Determine the tilt direction of the SU-ODU.

2 Using the 1/4" x 1/2" hex head screws and the flat washers and spring washers supplied, attach the SU-ODU to the mounting plate as shown in Figure 2-6 in the direction marked.
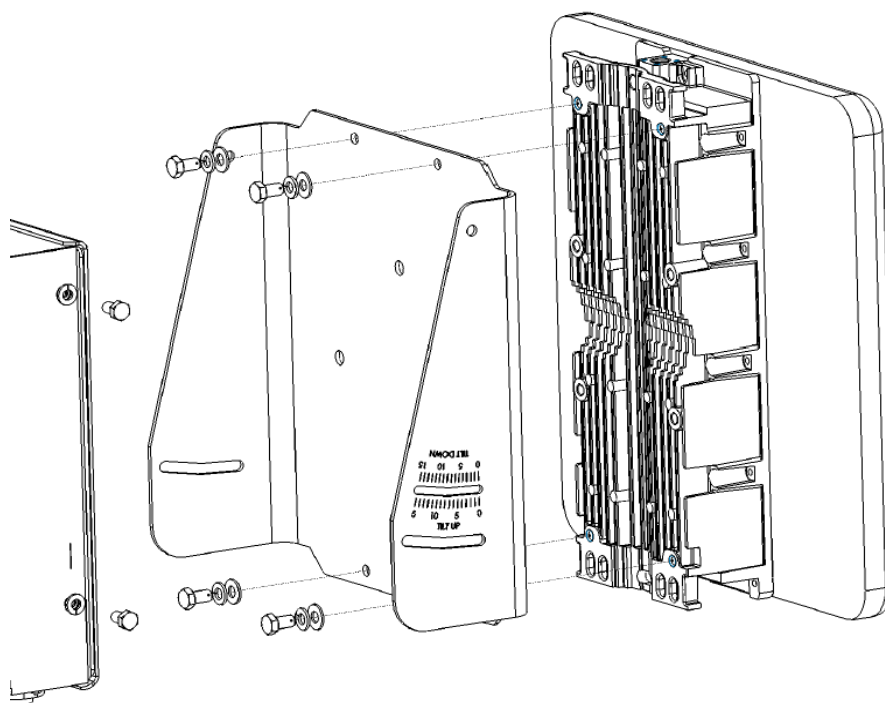
Figure 2-6: Attaching BreezeACCESS SU-ODU with HW Revision D or lower to Mounting Plate

NOTE

Sometimes, physical circumstance require that the SU-ODU be located at a distance from the Wi²
unit and not attached to the mounting plate. For further information see the section on SU-ODU
mounting in the relevant manual.

2.3.2   Attaching the Mounting Plate to the Wi² unit

1 Hold the mounting plate with SU-ODU attached so the tilt label faces in the
tilt direction that you have decided upon (see Section 2.3.1).

2 Using the M6 x 12 hex head screws with integral washers, attach the
mounting plate to the Wi² unit as shown in Figure 2-7.
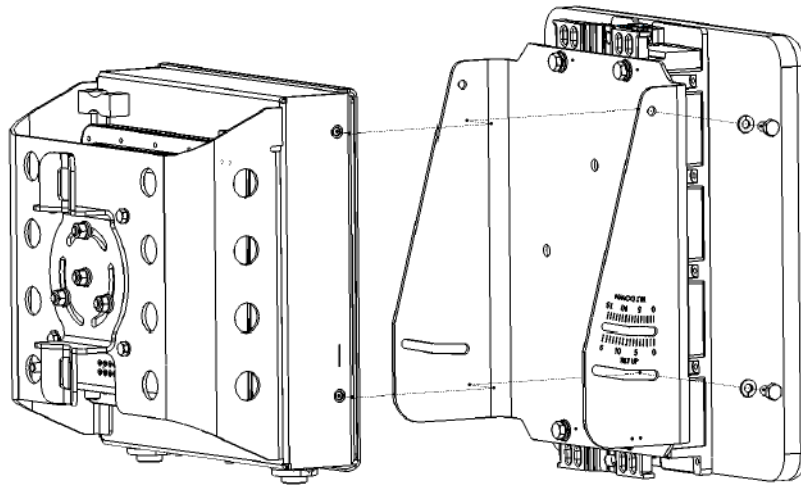
Figure 2-7: Attaching the Mounting Plate to the Wi² Unit

3 Adjust the tilt angle according the scale marked on the mounting plate and tighten the screws.

2.3.3 Connecting the Wi² unit to the SU-ODU

NOTE

The Wi² installation kit includes a Category 5E Ethernet cable, suitable for connecting to BreezeMAX PRO-S and BreezeACCESSHW revision E SU-ODU units. For instructions on how to adapt the Ethernet cable for connecting to a BreezeACCESS SU-ODU with HW revision D or lower refer to Section 2.3.3.1, "Adapting the Ethernet Cable for Connecting to BreezeACCESS SU-ODU with HW Revision D or lower" on page 2-24

To connect the Wi² to BreezeMAX PRO-S and BreezeACCESS HW revision E SU-ODU units:

1 The rubber sealing cap (supplied with the SU-ODU) has a special groove allowing to insert an ethernet cable with an already assembled RJ-45 connector through the cap. To expose the groove, lightly squeeze the cap (see Figure 2-8). Carefully insert the unshielded end of category 5E Ethernet cable supplied through the groove.

groove
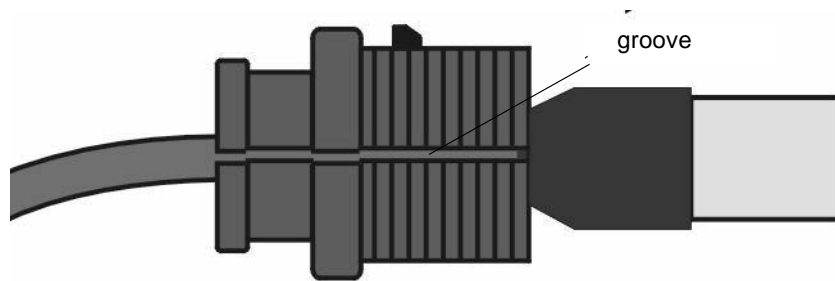
Figure 2-8: Sealing Cap

2 Expose the RJ-45 connector under the sealing cap on the Ethernet cable and connect to the SU-ODU RJ-45 connector (Figure 2-9).
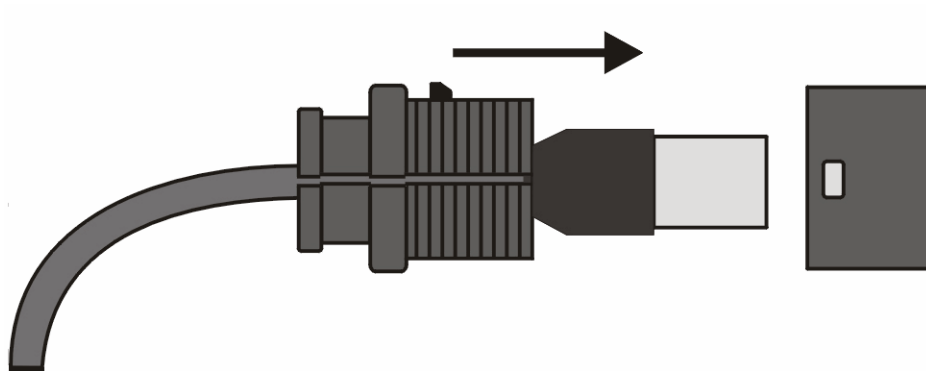
Figure 2-9: Connecting the SU-ODU connector and inserting the Sealing Cap

3 Put the sealing cap back in its place. Make sure that the small protrusion on the side of the cap fits inside the hole on the connector's protective body.

4 Connect the other end of the Ethernet cable to the SU port on the Wi² unit.

5 Verify that the O-ring supplied with the service box kit is in place, attach the service box to the unit and tighten the top nut.

6 Use appropriate sealing material to protect the connection to the SU-ODU against moisture and humidity. Use removable sealing material to enable future access to the connector.

NOTE

Use high quality sealing material such as Scotch® 130C Linerless Rubber Splicing Tape from 3M to ensure IP-67 compliant protection against dust and water.

2.3.3.1   Adapting the Ethernet Cable for Connecting to BreezeACCESS SU-ODU with HW Revision D or lower

The rubber sealing cap on the Category 5E Ethernet cable supplied does not suit all SU-ODU units and sometimes has to be changed.

To adapt the Ethernet cable for connecting to a BreezeACCESS SU-ODU with HW Revision D or lower:

1   Lightly squeeze the groove on the sealing cap on the Ethernet cable and remove the sealing cap (see Figure 2-8).

2   Cut the cable and remove the RJ-45 connector.

3   Route the cable through the service box supplied with the SU-ODU.

4   Use a crimp tool to prepare the wires, insert them into the appropriate pins as outlined on the service box and use the crimp tool to crimp the connector. Make sure to do the following:

    ◇   Remove as small a length as possible of the external jacket of the wires. Verify that the external jacket is well inside the service box to ensure good sealing.

    ◇   Pull back the shield drain wire before inserting the cable into the RJ-45 connector, to ensure a good connection with the connector's shield after crimping.

5   Connect the Ethernet cable to the SU-ODU RJ-45 connector.

6   Make sure that the external jacket of the cable is well inside the service box to guarantee a good seal.

7   Verify that the O-ring of the service box kit is in place , attach the service box to the unit and tighten the top nut.

2.3.4   Preparing the Power Cable

CAUTION

Electric Shock Hazard. Only a licensed electrician should connect the power plug.

All mains used outdoors, in damp or wet conditions, should be supplied from a correctly fused source and protected according to applicable local regulations.

To prepare the power cable:

1   Use a UL/CSA listed smooth circular power cable, 1.5mm to 2.5mm each. Outer diameter 7mm to 9mm, UV resistant, temperature range -40°C to + 65°C (-40°F to +149°F) minimum. Other specifications (such as oil resistance, no of wires) according to specific installation requirements.

2   Use a cap assembly tool to unscrew the locking nut.

3   Thread the cable through component parts as shown in Figure 2-10.

NOTE

Figure 2-10 shows an AC power jack. The DC power jack is similar, but only has two sockets.
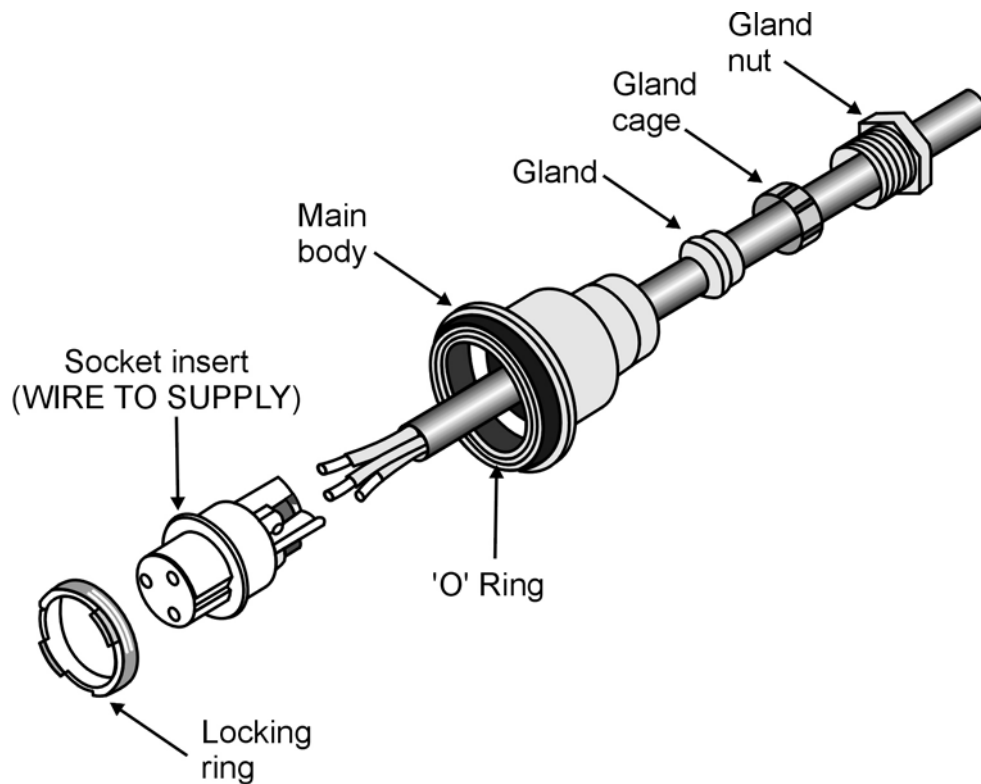
Figure 2-10: Preparing the Power Cable

4   Strip insulation from wires as shown in Figure 2-10.

5   Insert bare wire ends into the terminals and fully tighten the screws. The wires should be connected as shown below:

AC		DC	
Brown	Phase ~	Red	+
Blue	Neutral 0	Black	-
Yellow/green	Grounding ⏚		

6   Draw cable back until socket insert is correctly seated in D-shaped location in the main body. Tighten the Gland nut. Screw back the locking ring using the cap assembly tool.

7   For an AC cable, connect a mains plug to the other end of the cable. For a DC cable, connect the appropriate termination.

2.3.5   Pre-Configuration and Testing

It is highly recommended that you configure the parameters of the Access Point (AP) unit and the SU-ODU and verify proper operation of the system in the laboratory before installing the Wi² unit.

To configure the AP unit:

1   Set up the unit a short distance (4.5m to 7.5m) from an approved test unit, either outdoors or indoors.

2   Connect the power cable to the power socket on the unit. Connect the other end to the mains supply.

3   Check that the LED on the Wi² is green indicating that the system is working normally.

4   Using Telnet, login as outlined in Chapter 3 - "Initial Configuration" and complete the initial configuration.

5   Complete the configuration of the AP, using either Telnet or the web-based interface as outlined in Chapter 4 - "System Configuration".

6   Disconnect the cable connecting the SU-ODU to the SU port of the Wi²unit.

7   Connect an SU-IDU to the SU-ODU.

8   Connect a PC to the Ethernet port of the IDU and configure its parameters. For configuration details refer to the relevant manual.

9   After configuring the parameters of the AP and SU-ODU and verifying proper operation of the system, disconnect the unit from the power source and proceed to mount the unit as outlined in Section 2.3.6.

2.3.6   Mounting the Wi² Unit

To pole mount the Wi² unit:

1   With the bottom panel of the unit facing downwards, thread the two 9/16"
    wide metal bands supplied through the brackets on the sides of the unit.

2   Rotate the mounting bracket, so that the Wi² faces the Base Station.

NOTE

The mounting bracket can be rotated up to 45° in any direction.

3   Secure the Wi² unit to a pole as shown in Figure 2-11.
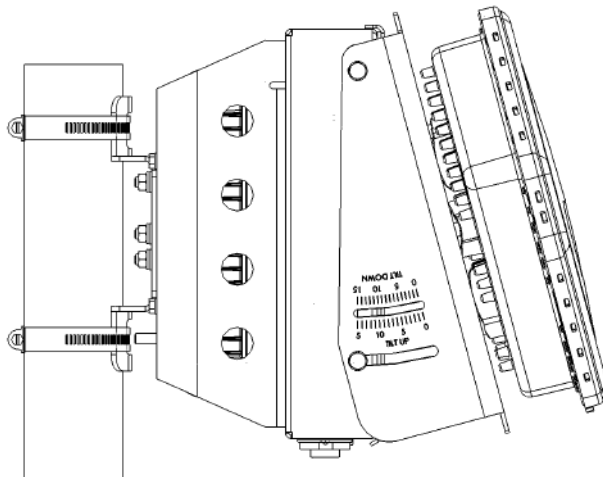
Figure 2-11: Pole Mounting the Wi²

2.3.6.1   Mounting the Wi² using the Tilt Accessory

The Wi² can also be installed on a wall or on a non-vertical pole using an optional
tilt accessory kit. The tilt accessory kit (Figure 2-12) includes:

■   A mounting bracket

■   3 metal bands for attaching the bracket to a pole

■ Screws for attaching the bracket to a wall

■ A 50 cm pole (diameter 6.03 cm)

■ Screws for attaching the pole to mounting bracket
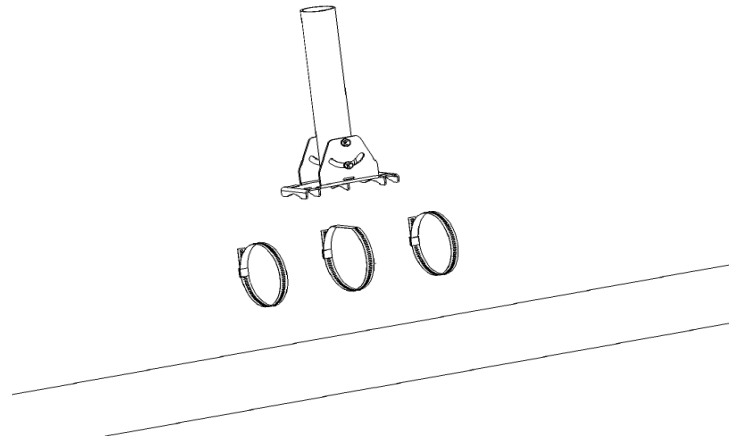
Figure 2-12: Tilt Accessory Kit

➤ **To mount the tilt accessory on a wall:**

1 Place the bracket on the wall and use as a template to mark the position of the holes to be drilled for the screws .

2 Remove the bracket from the wall and drill a hole in each of the locations marked.

3 Insert anchors into the holes.

4 Hold the bracket over the holes and insert a screw into each of the holes in the bracket, and screw into the anchors in the wall. Secure the bracket to the wall, making sure that the screw heads are as level with the bracket as possible.

➤ **To mount the tilt accessory on a non-vertical pole:**

■ Thread the metal bands provides with the tilt accessory through the slits in the bracket and attach to the pole as shown in .
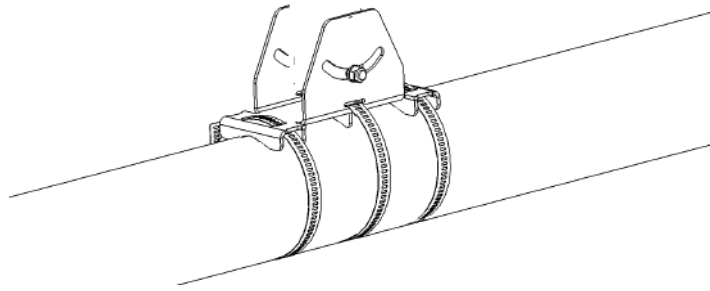
Figure 2-13: Mounting Tilt Accessory on Non-Vertical Pole

➤ **To mount the Wi² using the tilt accessory:**

1 Mount the tilt accessory bracket on the wall or pole as described above.

2 Using the screws provided attach the pole to the tilt accessory bracket.

3 Using a spirit level, adjust the angle of the pole until it is vertical and tighten the screws to hold in place.

4 Secure the Wi² to the pole as described in "Mounting the Wi² Unit" on page 28.
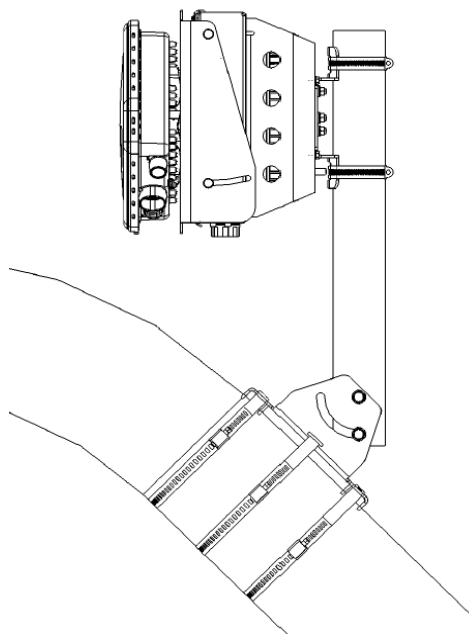
Figure 2-14: Wi² Mounting Using the Tilt Accessory

2.3.7 Connecting the Grounding Cables

To connect the grounding cables:

1 Connect a grounding cable to the grounding stud on theWi² unit and tighten the grounding screw firmly.

2 Connect a grounding cable to the grounding stud on the SU-ODU and tighten the grounding screw firmly.

3 Connect the other ends of the grounding cables to a good ground (earth) connection.

CAUTION

Be sure that grounding is available and that it meets local and national electrical codes. For additional lightning protection, use lightning rods, lightning arrestors, or surge suppressors.

2.3.8 Connecting to Power Source

1 Connect the power cable (see Section 2.3.4) to the power socket on the unit and to the mains supply.

CAUTION

The Wi² can be connected to either an AC or DC power source, or to both. By default the DC plug is covered with a waterproof sealing cap which must be removed before connecting to the power cable. Any socket that is NOT in use must always be protected from moisture and must be covered with a waterproof sealing cap.

2 Check that the LED on the Wi² is green indicating that the system is working normally.

2.4   Post Installation Configuration of the AP/SU-ODU

As mentioned before, it is highly recommended to complete configuration of the AP and SU-ODU in the lab prior to installation. After initial configuration proceed to advanced configuration via the web-based interface, Telnet, SSH, SNM web/SSH or backhaul wireless link. See Chapter 4 - "System Configuration" for further details.

3

Chapter 3 - Initial Configuration

In This Chapter:

3.1　Introduction

The Access Point (AP) unit offers a variety of management options, including a web-based interface, Telnet, SSH, SNMP and a direct connection to the console port.

The initial configuration steps can be made through the web browser interface or CLI.

3.2 Initial Setup through the CLI

For a description of how to use the CLI, see "Using the Command Line Interface" on page 125. For a list of all the CLI commands and detailed information on using the CLI, refer to "Command Groups" on page 132.

3.2.1 Configuration via Telnet

By default, use the Telnet option to configure the unit. The AP uses the default address 192.168.1.1. This address may not be compatible with your network. You will therefore have to use the command line interface (CLI) to assign an IP address that is compatible with your network as described on page 36.

Use the category 5 Ethernet data cable (2 pairs crosswire) provided to connect the SU port on the Wi² unit to your PC and Telnet the unit to start the initial setup.

3.2.2 Configuration via Console

The Wi² has a console port that enables a connection to a PC or terminal for monitoring and configuration. Attach a VT100-compatible terminal, or a PC running a terminal emulation program to the Wi² using an RS232 console cable.

To connect to the console port:

1   Connect the console cable to the serial port on a terminal, or a PC running terminal emulation software.

2   Connect the other end of the cable to the console port on the Wi² unit.

3   Make sure the terminal emulation software is set as follows:-:

  ◇ Select the appropriate serial port (COM port 1 or 2).

  ◇ Set the data rate to 9600 baud.

  ◇ Set the data format to 8 data bits, 1 stop bit, and no parity.

  ◇ Set flow control to none.

  ◇ Set the emulation mode to VT100.

  ◇ When using HyperTerminal, select Terminal keys, not Windows keys.

4   Once you have set up the terminal correctly, press the [Enter] key to initiate the console connection. The console login screen is displayed.

3.2.3   Initial Configuration Steps

Logging In – Enter *admin* for the user name. The default password is null, so just press [Enter] at the password prompt. The CLI prompt appears displaying Enterprise AP#.

```
Username: admin
Password:
Enterprise AP#
```

Setting the Country Code – You must use the CLI to set the country code. Setting the country code restricts operation of the AP to the radio channels and transmit power levels permitted for wireless networks in the specified country.

> **NOTE**
>
> For American and Canadian customers only channels 1~11 are permitted. Setting of other channels is not possible.

Type **exit** to leave configuration mode. Then type **country ?** to display the list of countries. Select the code for your country, and enter the country command again, following by your country code (e.g., tw for Taiwan).

```
Enterprise AP#country tw
Enterprise AP#
```

Setting the IP Address – By default, the AP is configured to obtain IP address settings from a DHCP server. If a DHCP server is not available, the IP address defaults to 192.168.1.1, which may not be compatible with your network. You will therefore have to use the command line interface (CLI) to assign an IP address that is compatible with your network.

Type **configure** to enter configuration mode, then type **interface ethernet** to access the Ethernet interface-configuration mode.

```
Enterprise AP#configure
Enterprise AP(config)#interface ethernet
Enterprise AP(config-if)#
```

First type **no ip dhcp** to disable DHCP client mode. Then type **ip address** and the *ip-address netmask gateway*, where *ip-address* is the AP's IP address, *netmask* is the network mask for the network, and *gateway* is the default gateway router. Check with your system administrator to obtain an IP address that is compatible with your network.

```
Enterprise AP(if-ethernet)#no ip dhcp
Enterprise AP(if-ethernet)#ip address 192.168.2.2 255.255.255.0 192.168.2.254
Enterprise AP(if-ethernet)#
```

After configuring the AP's IP parameters, you can access the management interface from anywhere within the attached network. The command line interface can also be accessed using Telnet from any computer attached to the network.

NOTE

Command examples shown later in this manual use the console prompt to Enterprise AP.

3.3   Logging In
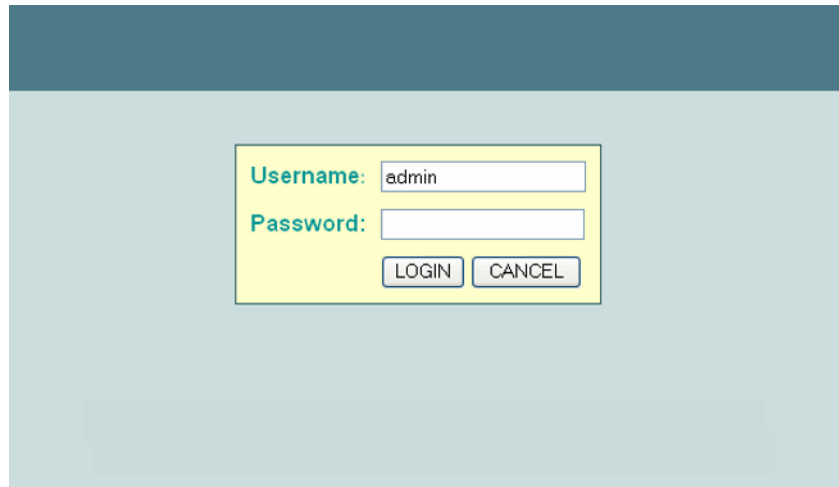
There are a few basic steps you need to complete to connect the AP to your corporate network, and provide network access to wireless clients.

The AP can be managed by any computer using a web browser (Internet Explorer 5.0 or above, or Netscape 6.2 or above).

To Login:

1   Enter the default IP address *http://192.168.1.1*. Figure 3-1 is displayed.

Figure 3-1: Login

2   Enter the username *admin.*

3   The password is null, so leave blank and click **LOGIN.**

4   The home page (Figure 3-2) is displayed.
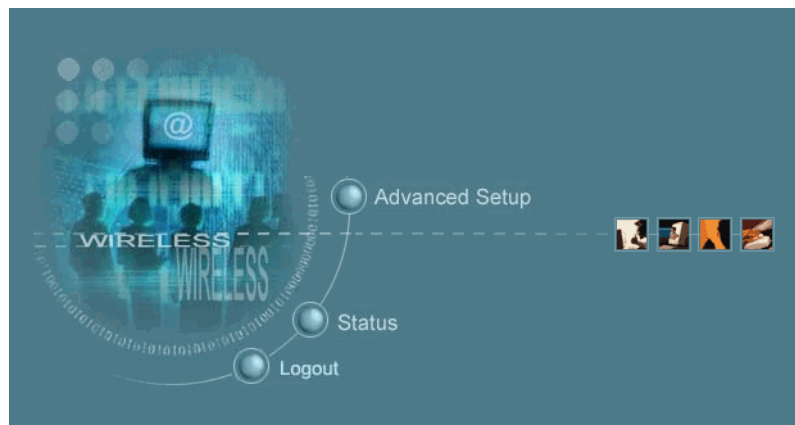
Figure 3-2: Home Page

NOTE

For information on configuring a user name and password, see page 64.

4

Chapter 4 - System Configuration

In This Chapter:

4.1   Introduction

Before continuing with advanced configuration, first complete the initial configuration steps described in Chapter 3 to set up an IP address for the Access Point (AP) unit.

The AP unit can be managed by any computer using a web browser (Internet Explorer 5.0 or above, or Netscape 6.2 or above). Enter the configured IP address of the AP unit, or use the default address: http://192.168.1.1.

Enter the default user name *admin* in the Log In Dialog Box (Figure 3-1) and click **LOGIN**. Select **Advanced Setup** from the menu on the home page. Figure 4-1 is displayed.
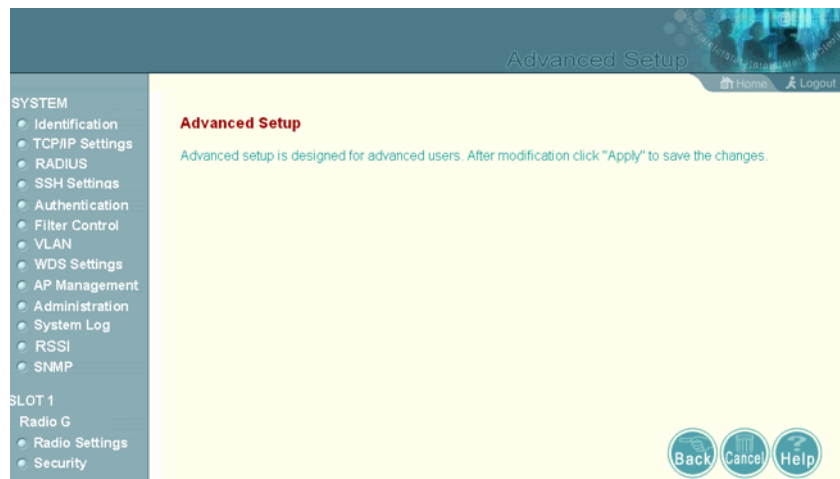
Figure 4-1: Advanced Setup

The information in this chapter is organized to reflect the structure of the web screens for easy reference. However, it is recommended that you configure a user name and password as the first step under Administration to control management access to this device (Section 4.2.10).

4.2   Advanced Configuration

The Advanced Configuration pages include the following options.

Table 4-1: Menu

Menu	Description	Page
System	Configures basic administrative and client access	44
Identification	Specifies the host name	44
TCP / IP Settings	Configures the IP address, subnet mask, gateway, and domain name servers	45
RADIUS	Configures the RADIUS server for wireless client authentication and accounting	48
SSH Settings	Configures Secure Shell management access	51
Authentication	Configures 802.1X client authentication, with an option for MAC address authentication	53
Filter Control	Filters communications between wireless clients, access to the management interface from wireless clients, and traffic matching specific Ethernet protocol types	57
VLAN	Enables VLAN support and sets the management VLAN ID	60
WDS Settings	Not applicable for current release	62
AP Management	Configures access to management interfaces	62
Administration	Configures user name and password for management access; upgrades software from local file, FTP or TFTP server; resets configuration settings to factory defaults; and resets the AP	64
System Log	Controls logging of error messages; sets the system clock via SNTP server or manual configuration	70
RSSI	Not applicable for current release	74
SNMP	Configures SNMP settings	75
Radio Interface G	Configures the IEEE 802.11g interface	81
Radio Settings	Configures common radio signal parameters and other settings for each VAP interface	81
Security	Enables each VAP interface, sets the SSID, and configures wireless security	98
Status	Displays information about the access point and wireless clients	116
AP Status	Displays configuration settings for the basic system and the wireless interface	116
Station Status	Shows the wireless clients currently associated with the access point	118
Event Logs	Shows log messages stored in memory	120

> **NOTE**
>
> This chapter may include references to features that are not applicable to the current release such as Radio A, WDS Settings and RSSI.

4.2.1 System Identification

The system name can be left with the default setting. However, modifying this parameter enables you to easily identify different devices in your network.

Figure 4-2: Identification

System Name – An alias for the AP, enabling the device to be uniquely identified on the network. (Default: BlueSecure BSAP-1600; Range: 1-32 characters)

4.2.1.0.1 CLI Commands for System Identification

Enter the global configuration mode, and use the **system name** command to specify a new system name. Return to the Exec mode, and use the **show system** command to display the changes to the system identification settings.

```
Enterprise AP#config                                            135
Enter configuration commands, one per line.
Enterprise AP(config)#system name R&D                           142
Enterprise AP(config)#end                                       135
Enterprise AP#show system                                       149

System Information
==============================================================
Serial Number          : 0000000000
System Up time         :  2 days, 4 hours, 33 minutes, 38 seconds
System Name            : R&D
System Location        :
System Contact         : Contact
System Country Code
System Country Code
Radio G MAC Address    : 00-12-CF-12-34-95
IP Address             : 192.168.1.2
Subnet Mask            : 255.255.255.0
Default Gateway        : 192.168.1.254
VLAN State             : DISABLED
Management VLAN ID(AP): 1
IAPP State             : ENABLED
DHCP Client            : DISABLED
HTTP Server            : ENABLED
HTTP Server Port       : 80
HTTP Session Timeout   : 300   sec(s)
HTTPS Server           : ENABLED
HTTPS Server Port      : 443
Slot Status            : 802.11g only
Boot Rom Version       : v2.1.6
Software Version       : v4.3.3.8b02
SSH Server             : ENABLED
SSH Server Port        : 22
Telnet Server          : ENABLED
DHCP Relay             : DISABLED
==============================================================

Enterprise AP#
```

4.2.2   TCP / IP Settings

Configuring the AP with an IP address expands your ability to manage the AP. A number of features depend on IP addressing to operate.

NOTE

You can use the web browser interface to access IP addressing only if the AP already has an IP address that is accessible through your network.

By default, the AP is automatically configured with IP settings from a Dynamic Host Configuration Protocol (DHCP) server. However, if you are not using a DHCP server to configure IP addressing, use the CLI to manually configure the initial IP values (see page 36). Once you have network access to the AP, you can use the web browser interface to modify the initial IP configuration, if necessary.

NOTE

If there is no DHCP server on your network, or DHCP fails, the AP will automatically start up with a default IP address of 192.168.1.1.

Figure 4-3: TCP/IP Settings

DHCP Client (Enable) – Select this option to obtain the IP settings for the AP from a DHCP (Dynamic Host Configuration Protocol) server. The IP address, subnet mask, default gateway, and Domain Name Server (DNS) address are dynamically assigned to the AP by the network DHCP server. (Default: Enabled)

DHCP Client (Disable) – Select this option to manually configure a static address for the AP.

- *IP Address*: The IP address of the AP. Valid IP addresses consist of four decimal numbers, 0 to 255, separated by periods.

- *Subnet Mask*: The mask that identifies the host address bits used for routing to specific subnets.

■ *Default Gateway*: The default gateway is the IP address of the router for the AP, which is used if the requested destination address is not on the local subnet.

If you have management stations, DNS, RADIUS, or other network servers located on another subnet, type the IP address of the default gateway router in the text field provided. Otherwise, leave the address as all zeros (0.0.0.0).

■ *Primary and Secondary DNS Address*: The IP address of Domain Name Servers on the network. A DNS maps numerical IP addresses to domain names and can be used to identify network hosts by familiar names instead of the IP addresses.

If you have one or more DNS servers located on the local network, type the IP addresses in the text fields provided. Otherwise, leave the addresses as all zeros (0.0.0.0).

4.2.2.0.1 CLI Commands for TCP/IP Settings

From the global configuration mode, enter the interface configuration mode with the **interface ethernet** command. Use the **ip dhcp** command to enable the DHCP client, or **no ip dhcp** to disable it. To manually configure an address, specify the new IP address, subnet mask, and default gateway using the **ip address** command. To specify DNS server addresses use the **dns server** command and use the **show interface ethernet** command from the Exec mode to display the current IP settings.

```
Enterprise AP(config)#interface ethernet                              204
Enter Ethernet configuration commands, one per line.
Enterprise AP(if-ethernet)#no ip dhcp                                 206
Enterprise AP(if-ethernet)#ip address 192.168.1.2
255.255.255.0 192.168.1.253                                          205
Enterprise AP(if-ethernet)#dns primary-server 192.168.1.55           204
Enterprise AP(if-ethernet)#dns secondary-server 10.1.0.55            204
Enterprise AP(config)#end                                            135
Enterprise AP#show interface ethernet                                207
Ethernet Interface Information
========================================
IP Address          : 192.168.1.2
Subnet Mask         : 255.255.255.0
Default Gateway     : 192.168.1.253
Primary DNS         : 192.168.1.55
Secondary DNS       : 10.1.0.55
Admin status        : Up
Operational status  : Up
========================================
Enterprise AP#
```

4.2.3   RADIUS

Remote Authentication Dial-in User Service (RADIUS) is an authentication protocol that uses software running on a central server to control access to RADIUS-aware devices on the network. An authentication server contains a database of user credentials for each user that requires access to the network.

A primary RADIUS server must be specified for the AP to implement IEEE 802.1X network access control and WiFi Protected Access (WPA) wireless security. A secondary RADIUS server may also be specified as a backup should the primary server fail or become inaccessible.

In addition, the configured RADIUS server can also act as a RADIUS Accounting server and receive user-session accounting information from the AP. RADIUS Accounting can be used to provide valuable information on user activity in the network.

NOTE

This manual assumes that you have already configured RADIUS server(s) to support the AP. Configuration of RADIUS server software is beyond the scope of this manul, refer to the documentation provided with the RADIUS server software.

Figure 4-4: RADIUS

MAC Address Format – MAC addresses can be specified in one of four formats, using no delimiter, with a single dash delimiter, with multiple dash delimiters, and with multiple colon delimiters.

VLAN ID Format – A VLAN ID (a number between 1 and 4094) can be assigned to each client after successful authentication using IEEE 802.1X and a central RADIUS server. The user VLAN IDs must be configured on the RADIUS server for

each user authorized to access the network. VLAN IDs can be entered as hexadecimal numbers or as ASCII strings.

Primary Radius Server Setup – Configure the following settings to use RADIUS authentication on the AP.

- *Radius Status*: Enabling Radius Status allows the settings of RADIUS authentication. (Default: Enable)

- *IP Address*: Specifies the IP address or host name of the RADIUS server.

- *Port*: The UDP port number used by the RADIUS server for authentication messages. (Range: 1024-65535; Default: 1812)

- *Key*: A shared text string used to encrypt messages between the AP and the RADIUS server. Be sure that the same text string is specified on the RADIUS server. Do not use blank spaces in the string. (Maximum length: 255 characters)

- *Timeout*: Number of seconds the AP waits for a reply from the RADIUS server before resending a request. (Range: 1-60 seconds; Default: 5)

- *Retransmit attempts*: The number of times the AP tries to resend a request to the RADIUS server before authentication fails. (Range: 1-30; Default: 3)

- *Accounting Port*: The RADIUS Accounting server UDP port used for accounting messages. (Range: 0 or 1024-65535; Default: 0, disabled)

- *Interim Update Timeout*: The interval between transmitting accounting updates to the RADIUS server. (Range: 60-86400; Default: 3600 seconds)

NOTE

For the *Timeout* and *Retransmit* attempts fields, accept the default values unless you experience problems connecting to the RADIUS server over the network.

Secondary Radius Server Setup – Configure a secondary RADIUS server to provide a backup in case the primary server fails. The AP uses the secondary server if the primary server fails or becomes inaccessible. Once the AP switches over to the secondary server, it periodically attempts to establish communication again with primary server. If communication with the primary server is re-established, the secondary server reverts to a backup role.

4.2.3.0.1 CLI Commands for RADIUS

From the global configuration mode, use the **radius-server address** command to specify the address of the primary or secondary RADIUS servers. (The following example configures the settings for the primary RADIUS server.) Configure the other parameters for the RADIUS server. Then use the **show radius** command from the Exec mode to display the current settings for the primary and secondary RADIUS servers.

```
Enterprise AP(config)#radius-server address 192.168.1.25        185
Enterprise AP(config)#radius-server port 181                    186
Enterprise AP(config)#radius-server key green                   186
Enterprise AP(config)#radius-server timeout 10                  187
Enterprise AP(config)#radius-server retransmit 5                186
Enterprise AP(config)#radius-server port-accounting 1813        187
Enterprise AP(config)#radius-server timeout-interim 500         188
Enterprise AP(config)#exit
Enterprise AP#show radius                                       189

Radius Server Information
======================================
IP                 : 192.168.1.25
Port               : 181
Key                : *****
Retransmit         : 5
Timeout            : 10
Radius MAC format  : no-delimiter
Radius VLAN format : HEX
======================================

Radius Secondary Server Information
======================================
IP                 : 0.0.0.0
Port               : 1812
Key                : *****
Retransmit         : 3
Timeout            : 5
Radius MAC format  : no-delimiter
Radius VLAN format : HEX
======================================
Enterprise AP#
```

4.2.4 SSH Settings

Telnet is a remote management tool that can be used to configure the AP from anywhere in the network. However, Telnet is not secure from hostile attacks. The Secure Shell (SSH) can act as a secure replacement for Telnet. The SSH protocol uses generated public keys to encrypt all data transfers passing between the AP and SSH-enabled management station clients and ensures that data traveling over the network arrives unaltered. Clients can then securely use the local user name and password for access authentication.

SSH client software needs to be installed on the management station to access the AP for management via the SSH protocol.

NOTE

■ The AP supports only SSH version 2.0.

■ After boot up, the SSH server needs about two minutes to generate host encryption keys. The SSH server is disabled while the keys are being generated.
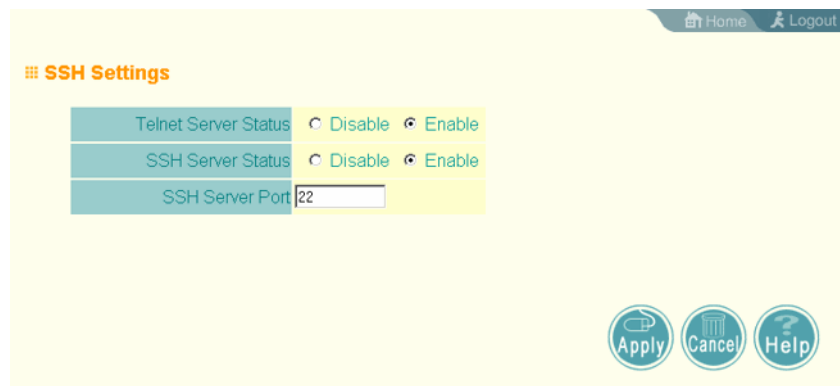
Figure 4-5: SSH Settings

4.2.4.1 SSH Settings

Telnet Server Status – Enables or disables the Telnet server. (Default: Enabled)

SSH Server Status – Enables or disables the SSH server. (Default: Enabled)

SSH Server Port – Sets the UDP port for the SSH server. (Range: 1-65535; Default: 22)

4.2.4.1.1 CLI Commands for SSH

To enable the SSH server, use the **ip ssh-server enable** command from the CLI Ethernet interface configuration mode. To set the SSH server UDP port, use the **ip ssh-server port** command. To view the current settings, use the **show system** command from the CLI Exec mode (not shown in the following example).

```
Enterprise AP(if-ethernet)#no ip telnet-server              144
Enterprise AP(if-ethernet)#ip ssh-server enable            143
Enterprise AP(if-ethernet)#ip ssh-server port 1124         144
Enterprise AP(if-ethernet)#exit
Enterprise AP(config)#
```

4.2.5 Authentication

Wireless clients can be authenticated for network access by checking their MAC address against the local database configured on the AP, or by using a database configured on a central RADIUS server. Alternatively, authentication can be implemented using the IEEE 802.1X network access control protocol.

A client's MAC address provides relatively weak user authentication, since MAC addresses can be easily captured and used by another station to break into the network. Using 802.1X provides more robust user authentication using user names and passwords or digital certificates. You can configure the access point to use both MAC address and 802.1X authentication, with client station MAC authentication occurring prior to IEEE 802.1X authentication. However, it is better to choose one or the other, as appropriate.

Take note of the following points before configuring MAC address or 802.1X authentication:

■ Use MAC address authentication for a small network with a limited number of users. MAC addresses can be manually configured on the AP itself without the need to set up a RADIUS server, but managing a large number of MAC addresses across many APs is very cumbersome. A RADIUS server can be used to centrally manage a larger database of user MAC addresses.

■ Use IEEE 802.1X authentication for networks with a larger number of users and where security is the most important issue. When using 802.1X authentication, a RADIUS server is required in the wired network to centrally manage the credentials of the wireless clients. It also provides a mechanism for enhanced network security using dynamic encryption key rotation or WiFi Protected Access (WPA).

NOTE

If you configure RADIUS MAC authentication together with 802.1X, RADIUS MAC address authentication is performed prior to 802.1X authentication. If RADIUS MAC authentication succeeds, then 802.1X authentication is performed. If RADIUS MAC authentication fails, 802.1X authentication is not performed.

■ The AP can also operate in a 802.1X supplicant mode. This enables the AP itself to be authenticated with a RADIUS server using a configured MD5 user name and password. This prevents rogue APs from gaining access to the network.

Figure 4-6: Authentication

MAC Authentication – You can configure a list of the MAC addresses for wireless clients that are authorized to access the network. This provides a basic level of authentication for wireless clients attempting to gain access to the network. A database of authorized MAC addresses can be stored locally on the AP or remotely on a central RADIUS server. (Default: Disabled)

■ *Disabled*: No checks are performed on an associating station's MAC address.

■ *Local MAC*: The MAC address of the associating station is compared against the local database stored on the AP. Use the Local MAC Authentication section of this web page to set up the local database, and configure all APs in the wireless network service area with the same MAC address database.

■ *Radius MAC:* The MAC address of the associating station is sent to a configured RADIUS server for authentication. When using a RADIUS authentication server for MAC address authentication, the server must first be configured in the Radius window (see "RADIUS" on page 48). The database of MAC addresses and filtering policy must be defined in the RADIUS server.

> **NOTE**
>
> MAC addresses on the RADIUS server can be entered in four different formats (see "RADIUS" on page 48).

802.1X Supplicant – The AP can also operate in a 802.1X supplicant mode. This enables the access point itself to be authenticated with a RADIUS server using a configured MD5 user name and password. This prevents rogue APs from gaining access to the network.

Local MAC Authentication – Configures the local MAC authentication database. The MAC database provides a mechanism to take certain actions based on a wireless client's MAC address. The MAC list can be configured to allow or deny network access to specific clients.

■ *System Default*: Specifies a default action for all unknown MAC addresses (that is, those not listed in the local MAC database).

   ◇ Deny: Blocks access for all MAC addresses except those listed in the local database as "Allow."

   ◇ Allow: Permits access for all MAC addresses except those listed in the local database as "Deny."

■ *MAC Authentication Settings*: Enters specified MAC addresses and permissions into the local MAC database.

   ◇ MAC Address: Physical address of a client. Enter six pairs of hexadecimal digits separated by hyphens; for example, 00-90-D1-12-AB-89.

   ◇ Permission: Select Allow to permit access or Deny to block access. If Delete is selected, the specified MAC address entry is removed from the database.

   ◇ Update: Enters the specified MAC address and permission setting into the local database.

■ *MAC Authentication Table*: Displays current entries in the local MAC database.

4.2.5.0.1   CLI Commands for Local MAC Authentication

Use the **mac-authentication server** command from the global configuration mode to enable local MAC authentication. Use the **mac-authentication session-timeout** command to set the authentication interval to enable web-based authentication for service billing. Set the default action for MAC addresses not in the local table using the **address filter default** command, then enter MAC

addresses in the local table using the **address filter entry** command. To remove an entry from the table, use the **address filter delete** command. To display the current settings, use the **show authentication** command from the Exec mode.

```
Enterprise AP(config)#mac-authentication server local              196
Enterprise AP(config)#mac-authentication session-timeout 5        196
Enterprise AP(config)#address filter default denied               194
Enterprise AP(config)#address filter entry
   00-70-50-cc-99-1a denied                                       195
Enterprise AP(config)#address filter entry
   00-70-50-cc-99-1b allowed
Enterprise AP(config)#address filter entry
   00-70-50-cc-99-1c allowed
Enterprise AP(config)#address filter delete
   00-70-50-cc-99-1c                                              195
Enterprise AP(config)#exit
Enterprise AP#show authentication                                 193


Authentication Information
============================================================
MAC Authentication Server      : LOCAL
MAC Auth Session Timeout Value : 0 min
802.1x supplicant              : DISABLED
802.1x supplicant user         : EMPTY
802.1x supplicant password     : EMPTY
Address Filtering              : DENIED

System Default : ALLOW addresses not found in filter table.
Filter Table

MAC Address             Status
-----------------       ----------
00-70-50-cc-99-1a       DENIED
00-70-50-cc-99-1b       ALLOWED
=========================================================
Enterprise AP#
```

4.2.5.0.2   CLI Commands for RADIUS MAC Authentication

Use the **mac-authentication server** command from the global configuration mode to enable remote MAC authentication. Set the timeout value for re-authentication using the **mac- authentication session-timeout** command. Be sure to also configure connection settings for the RADIUS server (not shown in the

following example). To display the current settings, use the **show authentication** command from the Exec mode.

```
Enterprise AP(config)#mac-authentication server remote              196
Enterprise AP(config)#mac-authentication
   session-timeout 300                                             196
Enterprise AP(config)#exit
Enterprise AP#show authentication                                 193


Authentication Information
==========================================================
MAC Authentication Server      : REMOTE
MAC Auth Session Timeout Value : 300 min
802.1x supplicant              : DISABLED
802.1x supplicant user         : EMPTY
802.1x supplicant password     : EMPTY
Address Filtering              : DENIED

System Default : DENY addresses not found in filter table.
Filter Table

MAC Address              Status
-----------------        ----------
00-70-50-cc-99-1a        DENIED
00-70-50-cc-99-1b        ALLOWED
==========================================================
Enterprise AP#
```

4.2.5.0.3   CLI Command for *802.1x Supplicant*

To configure the AP to operate as a 802.1X supplicant, first use the **802.1X supplicant user** command to set a user name and password for the AP, then use the **802.1X supplicant** command to enable the feature. To display the current settings, use the **show authentication** command from the Exec mode (not shown in the following example)

```
Enterprise AP(config)#802.1X supplicant user secureAP dot1xpass    192
Enterprise AP(config)#802.1X supplicant                            192
Enterprise AP(config)#
```

4.2.6   Filter Control

The AP can employ network traffic frame filtering to control access to network resources and increase security. You can prevent communications between wireless clients and prevent AP management from wireless clients. You can also block specific Ethernet traffic from being forwarded by the AP.

Figure 4-7: Filter Control

Inter Client STAs Communication Filter – Sets the global mode for wireless-to-wireless communications between clients associated to Virtual AP (VAP) interfaces on the AP. (Default: Disabled)

■ *Disabled*: All clients can communicate with each other through the access point.

■ *Prevent Intra VAP client communication*: When enabled, clients associated with a specific VAP interface cannot establish wireless communications with each other. Clients can communicate with clients associated to other VAP interfaces.

■ *Prevent Inter and Intra VAP client communication*: When enabled, clients cannot establish wireless communications with any other client, either those associated to the same VAP interface or any other VAP interface.

AP Management Filter – Controls management access to the AP from wireless clients. Management interfaces include the web, Telnet, or SNMP. (Default: Enabled)

■ *Disabled*: Allows management access from wireless clients.

■ *Enabled*: Blocks management access from wireless clients.

Uplink Port MAC Address Filtering Status – Prevents traffic with specified source MAC addresses from being forwarded to wireless clients through the AP. You can add a maximum of four MAC addresses to the filter table. (Default: Disabled)

■ *MAC Address*: Specifies a MAC address to filter, in the form xx-xx-xx-xx-xx-xx.

■ *Permission*: Adds or deletes a MAC address from the filtering table.

Ethernet Type Filter – Controls checks on the Ethernet type of all incoming and outgoing Ethernet packets against the protocol filtering table. (Default: Disabled)

■ *Disabled*: AP does not filter Ethernet protocol types.

■ *Enabled*: AP filters Ethernet protocol types based on the configuration of protocol types in the filter table. If the status of a protocol is set to **ON**, the protocol is filtered from the AP.

NOTE

Ethernet protocol types not listed in the filtering table are always forwarded by the AP.

Ethernet Type Filter – Enables or disables Ethernet filtering on the port. (Default: Disabled)

4.2.6.0.1   CLI Commands for Filtering

Use the **filter ap-manage** command to restrict management access from wireless clients. To configure Ethernet protocol filtering, use the **filter ethernet-type enable** command to enable filtering and the **filter ethernet-type protocol** command to define the protocols that you want to filter. To remove an entry from

---

the table, use the **address filter delete** command. To display the current settings, use the **show filters** command from the Exec mode.

```
Enterprise AP(config)#filter ap-manage                          198
Enterprise AP(config)#filter uplink enable                      198
Enterprise AP(config)#filter uplink add 00-12-34-56-78-9a       199
Enterprise AP(config)#filter ethernet-type enable               199
Enterprise AP(config)#filter ethernet-type protocol ARP         200
Enterprise AP(config)#exit
Enterprise AP#show filters                                      201

Protocol Filter Information
=========================================================
Local AP             :ENABLED
AP Management         :ENABLED
Ethernet Type Filter :ENABLED

Enabled Protocol Filters
---------------------------------------------------------
Protocol: ARP                              ISO: 0x0806
=========================================================
Enterprise AP#
```

4.2.7   VLAN

The AP can employ VLAN tagging support to control access to network resources and increase security. VLANs separate traffic passing between the AP, associated clients, and the wired network. There can be a VLAN assigned to each associated client, a default VLAN for each VAP (Virtual Access Point) interface, and a management VLAN for the AP.

Note the following points about the AP's VLAN support:

■ The management VLAN is for managing the AP through remote management tools, such as the web interface, SSH, SNMP, or Telnet. The AP only accepts management traffic that is tagged with the specified management VLAN ID.

■ All wireless clients associated to the AP are assigned to a VLAN. If IEEE 802.1X is being used to authenticate wireless clients, specific VLAN IDs can be configured on the RADIUS server to be assigned to each client. If a client is not assigned to a specific VLAN or if 802.1X is not used, the client is assigned to the default VLAN for the VAP interface with which it is associated. The AP only allows traffic tagged with assigned VLAN IDs or default VLAN IDs to access clients associated on each VAP interface.

■ When VLAN support is enabled on the AP, traffic passed to the wired network is tagged with the appropriate VLAN ID, either an assigned client VLAN ID, default VLAN ID, or the management VLAN ID. Traffic received from the wired

network must also be tagged with one of these known VLAN IDs. Received traffic that has an unknown VLAN ID or no VLAN tag is dropped.

■ When VLAN support is disabled, the AP does not tag traffic passed to the wired network and ignores the VLAN tags on any received frames.

NOTE

Before enabling VLAN tagging on the AP, be sure to configure the backhaul system to support tagged VLAN frames from the AP's management VLAN ID, default VLAN IDs, and other client VLAN IDs. Otherwise, connectivity to the AP will be lost when you enable the VLAN feature.

Using IEEE 802.1X and a central RADIUS server, up to 64 VLAN IDs can be mapped to specific wireless clients, allowing users to remain within the same VLAN as they move around a campus site. This feature can also be used to control access to network resources from clients, thereby improving security.

A VLAN ID (1-4094) can be assigned to a client after successful IEEE 802.1X authentication. The client VLAN IDs must be configured on the RADIUS server for each user authorized to access the network. If a client does not have a configured VLAN ID on the RADIUS server, the AP assigns the client to the configured default VLAN ID for the VAP interface.

NOTE

When using IEEE 802.1X to dynamically assign VLAN IDs, the AP must have 802.1X authentication enabled and a RADIUS server configured. Wireless clients must also support 802.1X client software.

When setting up VLAN IDs for each user on the RADIUS server, be sure to use the RADIUS attributes and values as indicated Table 4-2.

Table 4-2: RADIUS Attributes

Number	RADIUS Attribute	Value
64	Tunnel-Type	VLAN (13)
65	Tunnel-Medium-Type	802
81	Tunnel-Private-Group-ID	VLANID (1 to 4094 as hexadecimal or string)

VLAN IDs on the RADIUS server can be entered as hexadecimal digits or a string (see "radius-server vlan-format" on page 189).

Figure 4-8: VLAN Configuration

VLAN Classification – Enables or disables VLAN tagging support on the AP.

Native VLAN ID – The VLAN ID that traffic must have to be able to manage the AP. (Range 1-4094; Default: 1)

4.2.8   WDS Settings

WDS Settings is not applicable for the current release.

4.2.9   AP Management

The Web, Telnet, and SNMP management interfaces are enabled and open to all IP addresses by default. To provide more security for management access to the AP, specific interfaces can be disabled and management restricted to a single IP address or a limited range of IP addresses.

Once you specify an IP address or range of addresses, access to management interfaces is restricted to the specified addresses. If anyone tries to access a management interface from an unauthorized address, the AP will reject the connection.

Figure 4-9: AP Management

UI Management – Enables or disables management access through Telnet, the Web (HTTP), or SNMP interfaces. (Default: Enabled)

> **NOTE**
>
> Secure Web (HTTPS) connections are not affected by the UI Management or IP Management settings.

IP Management – Restricts management access to Telnet, Web, and SNMP interfaces to specified IP addresses. (Default: Any IP)

■ *Any IP*: Indicates that any IP address is allowed management access.

■ *Single IP*: Specifies a single IP address that is allowed management access.

■ *Multiple IP*: Specifies an address range as defined by the entered IP address and subnet mask. For example, IP address 192.168.1.6 and subnet mask 255.255.255.0, defines all IP addresses from 192.168.1.6 to 192.168.1.254.

4.2.9.0.1 CLI Commands for AP Management features.

```
Enterprise AP(config)#apmgmtip multiple 192.168.1.6 255.255.255.0    147
Enterprise AP(config)#apmgmtui SNMP enable                           148
```

4.2.10 Administration

4.2.10.1 Changing the Password

Management access to the web and CLI interface on the AP is controlled through a single user name and password. You can also gain additional access security by using control filters (see "Filter Control" on page 57).

To protect access to the management interface, you need to change the default user name and password as soon as possible. If the user name and password are not changed, anyone having access to the AP can compromise AP and network security. Once a new administrator has been configured, you can delete the default *admin* user name from the system.
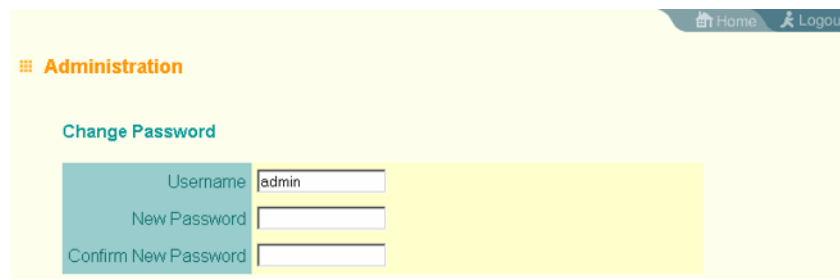
Figure 4-10: Administration

Username – The name of the user. The default name is *admin.* (Length: 3-16 characters, case sensitive)

New Password – The password for management access. (Length: 3-16 characters, case sensitive)

Confirm New Password – Enter the password again for verification.

4.2.10.1.1 CLI Commands for Changing User Name and Password

Use the **username** and **password** commands from the CLI configuration mode.

```
Enterprise AP(config)#username bob      142
Enterprise AP(config)#password admin    143
Enterprise AP#
```

4.2.10.2 Setting the Timeout Interval

You can set the timeout interval for web access to the unit, after which the user will have to re-enter the username and password.

Session Timeout for WEB

Timeout (0-1800) seconds `0`   (value 0 is for disable)
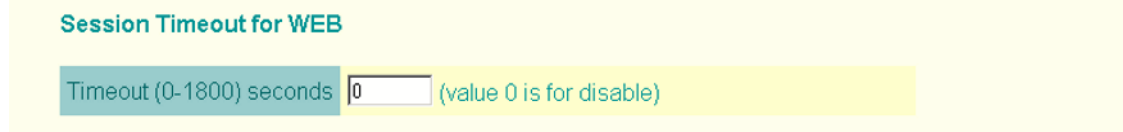
Figure 4-11: Session Timeout for WEB

Session Timeout for WEB: Sets the time limit for an idle web interface session. (Range: 0-1800 seconds; Default: 300 seconds; 0 is disabled)

4.2.10.2.1 CLI Command for the Web Session Timeout

Use the **ip http session-timeout** command from the CLI configuration mode.

```
Enterprise AP(config)#ip http session-timeout 0                    145
Enterprise AP(config)#
```

4.2.10.3 Upgrading Firmware

You can upgrade new AP software from a local file on the management workstation, or from an FTP or TFTP server. New software may be provided periodically from your distributor.

After upgrading new software, you must reboot the AP to implement the new code. Until a reboot occurs, the AP will continue to run the software it was using before the upgrade started. Also note that new software that is incompatible with the current configuration automatically restores the AP to the factory default settings when first activated after a reboot.

Figure 4-12: Firmware Upgrade

Before upgrading new software, verify that the AP is connected to the network and has been configured with a compatible IP address and subnet mask.

If you need to download from an FTP or TFTP server, take the following additional steps:

■ Obtain the IP address of the FTP or TFTP server where the AP software is stored.

■ If upgrading from an FTP server, be sure that you have an account configured on the server with a user name and password.

■ If VLANs are configured on the AP, determine the VLAN ID with which the FTP or TFTP server is associated, and then configure the management station, or the network port to which it is attached, with the same VLAN ID. If you are

managing the AP from a wireless client, the VLAN ID for the wireless client must be configured on a RADIUS server.

Current version – Version number of runtime code.

Firmware Upgrade Local – Downloads an operation code image file from the web management station to the AP using HTTP. Use the Browse button to locate the image file locally on the management station and click Start Upgrade to proceed.

■ *New firmware file*: Specifies the name of the code file on the server. The new firmware file name should not contain slashes (\ or /), the leading letter of the file name should not be a period (.), and the maximum length for file names is 32 characters for files on the access point. (Valid characters: A-Z, a-z, 0-9, ".", "-", "_")

Firmware Upgrade Remote – Downloads an operation code image file from a specified remote FTP or TFTP server. After filling in the following fields, click **Start Upgrade** to proceed.

■ *New firmware file*: Specifies the name of the code file on the server. The new firmware file name should not contain slashes (\ or /), the leading letter of the file name should not be a period (.), and the maximum length for file names on the FTP/TFTP server is 255 characters or 32 characters for files on the access point. (Valid characters: A-Z, a-z, 0-9, ".", "-", "_")

■ *IP Address*: IP address or host name of FTP or TFTP server.

■ *Username*: The user ID used for login on an FTP server.

■ *Password*: The password used for login on an FTP server.

Configuration File Backup/Restore – Uploads the current AP configuration file to a specified remote FTP or TFTP server. A configuration file can also be downloaded to the AP to restore a specific configuration.

■ *Export/Import*: Select Export to upload a file to an FTP/TFTP server. Select Import to download a file from an FTP/TFTP server.

■ *Config file*: Specifies the name of the configuration file, which must always be "syscfg." A path on the server can be specified using "/" in the name, providing the path already exists; for example, "myfolder/syscfg." Other than to indicate a path, the file name must not contain any slashes (\ or /), the leading letter

cannot be a period (.), and the maximum length for file names on the FTP/TFTP server is 255 characters. (Valid characters: A-Z, a-z, 0-9, ".", "-", "_")

- *IP Address*: IP address or host name of FTP or TFTP server.

- *Username*: The user ID used for login on an FTP server.

- *Password*: The password used for login on an FTP server.

Restore Factory Settings – Click the **Restore** button to reset the configuration settings for the AP to the factory defaults and reboot the system. Note that all user configured information will be lost. You will have to re-enter the default user name (admin) to re-gain management access to this device.

Reboot Access Point – Click the **Reset** button to reboot the system.

> **NOTE**
>
> If you have upgraded system software, then you must reboot the AP to implement the new operation code. New software that is incompatible with the current configuration automatically restores the AP to default values when first activated after a reboot.

Upon uploading a new configuration file you will be prompted to either restore factory settings, or reboot the unit.

Figure 4-13: New Configuration Warning

4.2.10.3.1 CLI Commands for Downloading Software from a TFTP Server

Use the **copy tftp file** command from the Exec mode and then specify the file type, name, and IP address of the TFTP server. When the download is complete,

the **dir** command can be used to check that the new file is present in the AP file system. To run the new software, use the **reset board** command to reboot the AP.

```
Enterprise AP#copy tftp file                                         181
1. Application image
2. Config file
3. Boot block image
Select the type of download<1,2,3>:  [1]:1
TFTP Source file name:img.bin
TFTP Server IP:192.168.1.19


Enterprise AP#dir                                                    183
File Name                       Type    File Size
------------------------        ----    -----------
dflt-img.bin                      2      1319939
img.bin                           2      1629577
syscfg                            5        17776
syscfg_bak                        5        17776


      262144 byte(s) available


Enterprise AP#reset board                                            136
Reboot system now? <y/n>: y
```

4.2.11 System Log

The AP can be configured to send event and error messages to a System Log Server. The system clock can also be synchronized with a time server, so that all the messages sent to the Syslog server are stamped with the correct time and date.

Figure 4-14: System Log

4.2.11.1 Enabling System Logging

The AP supports a logging process that can control error messages saved to memory or sent to a Syslog server. The logged messages serve as a valuable tool for isolating AP and network problems.

System Log Setup – Enables the logging of error messages. (Default: Disable)

Server (1-4) – Enables the sending of log messages to a Syslog server host. Up to four Syslog servers are supported on the AP. (Default: Disable)

Server Name/IP – The IP address or name of a Syslog server. (Default: 0.0.0.0)

UDP Port – The UDP port used by a Syslog server. (Range: 514 or 11024-65535; Default: 514)

Logging Console – Enables the logging of error messages to the console. (Default: Disable)

Logging Level – Sets the minimum severity level for event logging. (Default: Informational)

The system allows you to limit the messages that are logged by specifying a minimum severity level. Table 4-3 lists the error message levels from the most severe (Emergency) to least severe (Debug). The message levels that are logged include the specified minimum level up to the Emergency level.

Table 4-3: Error Message Levels

Error Level	Description
Emergency	System unusable
Alerts	Immediate action needed
Critical	Critical conditions (e.g., memory allocation, or free memory error - resource exhausted)
Error	Error conditions (e.g., invalid input, default used)
Warning	Warning conditions (e.g., return false, unexpected return)
Notice	Normal but significant condition, such as cold start
Informational	Informational messages only
Debug	Debugging messages

NOTE

The AP error log can be viewed using the Event Logs window in the Status section (page 120). The Event Logs window displays the last 128 messages logged in chronological order, from the newest to the oldest. Log messages saved in the AP's memory are erased when the device is rebooted.

Logging Facility Type – Sets the facility type for remote logging of syslog messages. The command specifies the facility type tag sent in syslog messages. (See RFC 3164.) This type has no effect on the kind of messages reported by the switch. However, it may be used by the syslog server to sort messages or to store messages in the corresponding database. (Range: 16-23; Default: 16)

4.2.11.1.1 CLI Commands for System Logging

To enable logging on the AP, use the **logging on** command from the global configuration mode. The **logging level** command sets the minimum level of message to log. Use the **logging console** command to enable logging to the console. Use the **logging host** command to specify up to four Syslog servers. The CLI also allows the **logging facility-type** command to set the facility-type number

to use on the Syslog server. To view the current logging settings, use the **show logging** command.

```
Enterprise AP(config)#logging on                              157
Enterprise AP(config)#logging level alert                     158
Enterprise AP(config)#logging console                         158
Enterprise AP(config)#logging host 1 IP 10.1.0.3 514          157
Enterprise AP(config)#logging host 1 Port 514                 157
Enterprise AP(config)#logging facility-type 19                159
Enterprise AP(config)#exit
Enterprise AP#show logging                                    160

Logging Information
============================================
Syslog State             : Enabled
Logging Console State     : Enabled
Logging Level            : Alert
Logging Facility Type    : 19
Servers
   1: 10.1.0.3, UDP Port: 514, State: Enabled
   2: 0.0.0.0, UDP Port: 514, State: Disabled
   3: 0.0.0.0, UDP Port: 514, State: Disabled
   4: 0.0.0.0, UDP Port: 514, State: Disabled
============================================

Enterprise AP#
```

4.2.11.2 Configuring SNTP

Simple Network Time Protocol (SNTP) allows the AP to set its internal clock based on periodic updates from a time server (SNTP or NTP). Maintaining an accurate time on the AP enables the system log to record meaningful dates and times for event entries. If the clock is not set, the AP will only record the time from the factory default set at the last bootup.

The AP acts as an SNTP client, periodically sending time synchronization requests to specific time servers. You can configure up to two time server IP addresses. The AP will attempt to poll each server in the configured sequence.

SNTP Server – Configures the AP to operate as an SNTP client. When enabled, at least one time server IP address must be specified.

■ *Primary Server*: The IP address of an SNTP or NTP time server that the AP attempts to poll for a time update.

■ *Secondary Server*: The IP address of a secondary SNTP or NTP time server. The AP first attempts to update the time from the primary server; if this fails it attempts an update from the secondary server.

> **NOTE**
>
> The AP also allows you to disable SNTP and set the system clock manually.

Set Time Zone – SNTP uses Coordinated Universal Time (or UTC, formerly Greenwich Mean Time, or GMT) based on the time at the Earth's prime meridian, zero degrees longitude. To display a time corresponding to your local time, you must indicate the number of hours your time zone is located before (east) or after (west) UTC.

Enable Daylight Saving – The AP provides a way to automatically adjust the system clock for Daylight Savings Time changes. To use this feature you must define the month and date to begin and to end the change from standard time. During this period the system clock is set back by one hour.

4.2.11.2.1 CLI Commands for SNTP

To enable SNTP support on the AP, from the global configuration mode specify SNTP server IP addresses using the **sntp-server ip** command, then use the **sntp-server enable** command to enable the service. Use the **sntp-server timezone** command to set the time zone for your location, and the **sntp-server daylight-saving** command to set daylight savings. To view the current SNTP settings, use the **show sntp** command.

```
Enterprise AP(config)#sntp-server ip 1 10.1.0.19                162
Enterprise AP(config)#sntp-server enable                        163
Enterprise AP(config)#sntp-server timezone +8                   164
Enterprise AP(config)#sntp-server daylight-saving               164
Enter Daylight saving from which month<1-12>: 3
and which day<1-31>: 31
Enter Daylight saving end to which month<1-12>: 10
and which day<1-31>: 31
Enterprise AP(config)#exit
Enterprise AP#show sntp                                         165

SNTP Information
=========================================================
Service State        : Enabled
SNTP (server 1) IP    : 10.1.0.19
SNTP (server 2) IP    : 192.43.244.18
Current Time         : 19 : 35, Oct 10th, 2003
Time Zone            : +8 (TAIPEI, BEIJING)
Daylight Saving      : Enabled, from Mar, 31st to Oct, 31st
=========================================================

Enterprise AP#
```

4.2.11.2.2 CLI Commands for the System Clock

The following example shows how to manually set the system time when SNTP server support is disabled on the AP.

```
Enterprise AP(config)#no sntp-server enable                          163
Enterprise AP(config)#sntp-server date-time                         163
Enter Year<1970-2100>: 2003
Enter Month<1-12>: 10
Enter Day<1-31>: 10
Enter Hour<0-23>: 18
Enter Min<0-59>: 35
Enterprise AP(config)#
```

4.2.12 RSSI

RSSI is not applicable for the current release.

4.3   SNMP

You can use a network management application such as HP's OpenView to manage the AP via the Simple Network Management Protocol (SNMP) from a network management station. To implement SNMP management, the AP must have an IP address and subnet mask, configured either manually or dynamically. Once an IP address has been configured, appropriate SNMP communities and trap receivers should be configured.

Community names are used to control management access to SNMP stations, as well as to authorize SNMP stations to receive trap messages from the AP. To communicate with the AP, a management station must first submit a valid community name for authentication. You therefore need to assign community names to specified users or user groups and set the access level.

Figure 4-15: SNMP

SNMP – Enables or disables SNMP management access and also enables the AP to send SNMP traps (notifications). (Default: Disable)

Location – A text string that describes the system location. (Maximum length: 255 characters)

Contact – A text string that describes the system contact. (Maximum length: 255 characters)

Community Name (Read Only) – Defines the SNMP community access string that has read-only access. Authorized management stations are only able to retrieve MIB objects. (Maximum length: 23 characters, case sensitive; Default: public)

Community Name (Read/Write) – Defines the SNMP community access string that has read/write access. Authorized management stations are able to both retrieve and modify MIB objects. (Maximum length: 23 characters, case sensitive; Default: private)

Trap Destination (1 to 4) – Enables recipients (up to four) of SNMP notifications.

- *Trap Destination IP Address* – Specifies the recipient of SNMP notifications. Enter the IP address or the host name. (Host Name: 1 to 63 characters, case sensitive)

- *Trap Destination Community Name* – The community string sent with the notification operation. (Maximum length: 23 characters, case sensitive; Default: public)

Engine ID – Sets the engine identifier for the SNMPv3 agent that resides on the AP. This engine protects against message replay, delay, and redirection. The engine ID is also used in combination with user passwords to generate the security keys for authenticating and encrypting SNMPv3 packets. A default engine ID is automatically generated that is unique to the AP. (Range: 10 to 64 hexadecimal characters)

NOTE

If the local engine ID is deleted or changed, all SNMP users will be cleared. All existing users will need to be re-configured.

Figure 4-16: Trap Configuration

Trap Configuration – Allows selection of specific SNMP notifications to send. The following items are available:

- *sysSystemUp* - The AP is up and running.

- *sysSystemDown* - The AP is about to shutdown and reboot.

- *sysRadiusServerChanged* - The AP has changed from the primary RADIUS server to the secondary, or from the secondary to the primary.

- *sysConfigFileVersionChanged* - The AP's configuration file has been changed.

- *dot11StationAssociation* - A client station has successfully associated with the AP.

- *dot11StationReAssociation* - A client station has successfully re-associated with the AP.

- *dot11StationAuthentication* - A client station has been successfully authenticated.

- *dot11StationRequestFail* - A client station has failed association, re-association, or authentication.

- *dot11InterfaceBFail* - The 802.11b interface has failed.

- *dot1xMacAddrAuthSuccess* - A client station has successfully authenticated its MAC address with the RADIUS server.

- *dot1xMacAddrAuthFail* - A client station has failed MAC address authentication with the RADIUS server.

- *dot1xAuthNotInitiated* - A client station did not initiate 802.1X authentication.

- *dot1xAuthSuccess* - A 802.1X client station has been successfully authenticated by the RADIUS server.

- *dot1xAuthFail* - A 802.1X client station has failed RADIUS authentication.

- *dot1xSuppAuthenticated* - A supplicant station has been successfully authenticated by the RADIUS server

- *localMacAddrAuthSuccess* - A client station has successfully authenticated its MAC address with the local database on the AP.

- *localMacAddrAuthFail* - A client station has failed authentication with the local MAC address database on the AP.

- *iappStationRoamedFrom* - A client station has roamed from another AP (identified by its IP address).

- *iappStationRoamedTo* - A client station has roamed to another AP (identified by its IP address).

- *iappContextDataSent* - A client station's Context Data has been sent to another AP with which the station has associated.

- *sntpServerFail* - The AP has failed to set the time from the configured SNTP server.

- *dot11WirelessStationDeauthenticate* - A client station has de-authenticated from the network.

- *dot11StationDisassociate* - A client station no longer associates with the network.

- *dot11StationAuthenticateFail* - A client station has tried and failed to authenticate to the network.

- *Enable All Traps* - Click the button to enable all the available traps.

- *Disable All Traps* - Click the button to disable all the available traps.

4.3.0.0.1   CLI Commands for SNMP and Trap Configuration

Use the **snmp-server enable server** command from the global configuration mode to enable the SNMP agent. Use the **snmp-server location** and **snmp-server contact** commands to indicate the physical location of the wi and define a system contact. To set the read-only and read/write community names, use the **snmp-server community** command. Use the **snmp-server host** command to define a trap receiver host and the **snmp-server trap** command to enable or disable specific traps.

```
Enterprise AP(config)#snmp-server enable server                    170
Enterprise AP(config)#snmp-server community alpha rw               168
Enterprise AP(config)#snmp-server community beta ro
Enterprise AP(config)#snmp-server location WC-19                   169
Enterprise AP(config)#snmp-server contact Paul                     169
Enterprise AP(config)#snmp-server host 192.168.1.9 alpha           170
Enterprise AP(config)#snmp-server trap dot11StationAssociation     171
Enterprise AP(config)#
```

To view the current SNMP settings, use the **show snmp** command.

```
Enterprise AP#show snmp                                              179


SNMP Information
==============================================
Service State             : Enable
Community (ro)            : *****
Community (rw)            : *****
Location                  : WC-19
Contact                   : Paul


EngineId   :80:00:07:e5:80:00:00:2e:62:00:00:00:18
EngineBoots:1


Trap Destinations:
   1:      192.168.1.9, Community: *****, State: Enabled
   2:          0.0.0.0, Community: *****, State: Disabled
   3:          0.0.0.0, Community: *****, State: Disabled
   4:          0.0.0.0, Community: *****, State: Disabled


     dot11InterfaceAGFail  Enabled        dot11InterfaceBFail    Enabled
  dot11StationAssociation  Enabled dot11StationAuthentication    Enabled
dot11StationReAssociation  Enabled    dot11StationRequestFail    Enabled
           dot1xAuthFail  Enabled       dot1xAuthNotInitiated    Enabled
        dot1xAuthSuccess  Enabled        dot1xMacAddrAuthFail    Enabled
 dot1xMacAddrAuthSuccess  Enabled          iappContextDataSent    Enabled
    iappStationRoamedFrom  Enabled          iappStationRoamedTo    Enabled
     localMacAddrAuthFail  Enabled    localMacAddrAuthSuccess    Enabled
 iappContextDataSent       Enabled        dot1XSuppAuthenticated Enabled
    wirelessExternalAntenna Enabled           dot11InterfaceAFail Enabled
       dot11InterfaceGFail Enabled
           pppLogonFail  Enabled                 sntpServerFail    Enabled
 configFileVersionChanged  Enabled        radiusServerChanged    Enabled
             systemDown  Enabled                      systemUp    Enabled


==============================================
Enterprise AP#
```

4.4   Radio Interface

The 802.11g interface includes configuration options for radio signal characteristics and wireless security features. The configuration options are nearly identical, and are therefore both covered in this section of the manual.

> **NOTE**
>
> 802.11g is backward compatible with 802.11b. The 802.11g interface is configured independently under the Radio Interface G: 802.11b/g web pages.

The radio supports up to four virtual AP (VAP) interfaces numbered 0 to 3. Each VAP functions as a separate AP, and can be configured with its own Service Set Identification (SSID) and security settings. However, most radio signal parameters apply to all four VAP interfaces.

The VAPs function similar to a VLAN, with each VAP mapped to its own VLAN ID. Traffic to specific VAPs can be segregated based on user groups or application traffic. Each VAP can have up to 64 wireless clients, whereby the clients associate with these VAPs the same as they would with a physical AP.

> **NOTE**
>
> The radio channel settings for the AP are limited by local regulations, which determine the number of channels that are available. Refer to "Specifications" on page 4 for additional information on the maximum number channels available.

4.4.1   Radio Settings G (802.11g)

The IEEE 802.11g standard operates within the 2.4 GHz band at up to 54 Mbps. Also note that because the IEEE 802.11g standard is an extension of the IEEE 802.11b standard, it allows clients with 802.11b wireless network cards to associate to an 802.11g access point.

First configure the radio settings that apply to the individual VAPs (Virtual Access Point) and the common radio settings that apply to all of the 802.11g interfaces. After you have configured the radio settings, go to the Security page under the 802.g Interface (see "Security" on page 4-98.), enable the radio service for any of the VAP interfaces, and then set an SSID to identify the wireless network service provided by each VAP. Remember that only clients with the same SSID can associate with a VAP.

NOTE

You must first enable VAP interface 0 before the other interfaces can be enabled.

For information on configuring 802.11g settings, refer to the following sections:

- "Configuring VAP Radio Settings" on page 82

- "Configuring Rogue AP Detection" on page 84

- "Configuring WiFi Multimedia" on page 92

4.4.1.1 Configuring VAP Radio Settings

To configure VAP radio settings, select the Radio Settings page.

Figure 4-17: Radio Settings Page

Figure 4-18: Radio Settings

Default VLAN ID – The VLAN ID assigned to wireless clients associated to the VAP interface that are not assigned to a specific VLAN by RADIUS server configuration. (Default: 1)

Closed System – When enabled, the VAP interface does not include its SSID in beacon messages. Nor does it respond to probe requests from clients that do not include a fixed SSID. (Default: Disable)

Authentication Timeout Interval – The time within which the client should finish authentication before authentication times out. (Range: 5-60 minutes; Default: 60 minutes)

Association Timeout Interval – The idle time interval (when no frames are sent) after which a client is disassociated from the VAP interface. (Range: 5-60 minutes; Default: 30 minutes)

WPA2 PMKSA Life Time – WPA2 provides fast roaming for authenticated clients by retaining keys and other security settings in a cache for each VAP. In this way, when clients roam back into a VAP they had previously been using, re-authentication is not required. When a WPA2 client is first authenticated, it receives a Pairwise Master Key (PMK) that is used to generate the other keys used for unicast data encryption. This key and other client information form a client Security Association (SA) that the VAP holds in a cache. When the lifetime expires, the security association and keys are deleted from the cache. If the client returns to an access point after the association has been deleted, it will require full re-authentication. (Range: 1-1440 minutes; Default: 720 minutes)

4.4.1.1.1 CLI Commands for the Configuring the VAPs

From the global configuration mode, enter the **interface wireless g** command to access the 802.11g radio interface. From the 802.11g interface mode, you can access radio settings that apply to all VAP interfaces. To access a specific VAP

---

interface (numbered 0 to 3), use the **vap** command. You can configure a name for each interface using the **description** command. You can also use the **closed-system** command to stop sending the SSID in beacon messages. Set any other VAP parameters and radio setting as required before enabling the VAP interface (with the **no shutdown** command). To view the current 802.11g radio settings for the VAP interface, use the **show interface wireless g [0-3]** command as shown on .

```
Enterprise AP(if-wireless g)#vap 0                                        210
Enterprise AP(if-wireless g: VAP[0])#description RD-AP#3                  219
Enterprise AP(if-wireless g: VAP[0])#vlan-id 1                           243
Enterprise AP(if-wireless g: VAP[0])#closed-system                      220
Enterprise AP(if-wireless g: VAP[0])#authentication-timeout-
  interval 30                                                           221
Enterprise AP(if-wireless g: VAP[0])#association-timeout-
   interval 20                                                          221
Enterprise AP(if-wireless g: VAP[0])#max-association 32                 220
Enterprise AP(if-wireless g: VAP[0])#pmksa-lifetime 900                 236
Enterprise AP(if-wireless g: VAP[0])#
```

4.4.1.2   Configuring Rogue AP Detection

To configure Rouge AP detection, select the **Radio Settings** page, and scroll down to the **Rouge AP** section.

Figure 4-19: Rouge AP Section of Radio Settings page

Rogue AP – A "rogue AP" is either an AP that is not authorized to participate in the wireless network, or an AP that does not have the correct security configuration. Rogue APs can allow unauthorized access to the network, or fool client stations into mistakenly associating with them and thereby blocking access to network resources.

The AP can be configured to periodically scan all radio channels and find other APs within range. A database of nearby APs is maintained where any rogue APs can be identified. During a scan, Syslog messages (see "Enabling System Logging"

) are sent for each AP detected. Rogue APs can be identified by unknown BSSID (MAC address) or SSID configuration.

- *AP Detection* – Enables the periodic scanning for other APs. (Default: Disable)

- *AP Scan Interval* – Sets the time between each rogue AP scan. (Range: 30 -10080 minutes; Default: 720 minutes)

- *AP Scan Duration* – Sets the length of time for each rogue AP scan. A long scan duration time will detect more access points in the area, but causes more disruption to client access. (Range: 100 -1000 milliseconds; Default: 350 milliseconds)

- *Rogue AP Authenticate* – Enables or disables RADIUS authentication. Enabling RADIUS Authentication allows the AP to discover rogue APs. With RADIUS authentication enabled, the access point checks the MAC address/ Basic Service Set Identifier (BSSID) of each access point that it finds against a RADIUS server to determine whether the access point is allowed. With RADIUS authentication disabled, the access point can detect its neighboring APs only; it cannot identify whether the APs are allowed or are rogues. If you enable RADIUS authentication, you must configure a RADIUS server for this AP (see "RADIUS" on page 4-48.).

- Scan AP Now – Starts an immediate rogue AP scan on the radio interface. (Default: Disable)

NOTE

While the AP scans a channel for rogue APs, wireless clients will not be able to connect to the access point. Therefore, avoid frequent scanning or scans of a long duration unless there is a reason to believe that more intensive scanning is required to find a rogue AP.

4.4.1.2.1 CLI Commands for Rogue AP Detection

From the global configuration mode, enter the **interface wireless** command to access the 802.11g radio interface. From the wireless interface mode, use the **rogue-ap enable** command to enable rogue AP detection. Set the duration and interval times with the **rogue-ap duration** and **rogue-ap interval** commands. If required, start an immediate scan using the **rogue-ap scan** command. To view the

database of detected access points, use the **show rogue-ap** command from the Exec level.

```
Enterprise AP(config)#interface wireless g                              210
Enter Wireless configuration commands, one per line.
Enterprise AP(if-wireless g)#rogue-ap enable                           226
configure either syslog or trap or both to receive the rogue APs detected.
Enterprise AP(if-wireless g)#rogue-ap duration 200                     227
Enterprise AP(if-wireless g)#rogue-ap interval 120                     228
Enterprise AP(if-wireless g)#rogue-ap scan                            228
Enterprise AP(if-wireless g)#rogueApDetect Completed (Radio G) : 5 APs detected
rogueAPDetect (Radio G): refreshing ap database now

Enterprise AP(if-wireless g)#exit
Enterprise AP#show rogue-ap                                            229

802.11g Channel : Rogue AP Status
AP Address(BSSID)           SSID    Channel(MHz) RSSI
=====================================================
00-04-e2-2a-37-23        WLAN1AP   11(2462 MHz)   17
00-04-e2-2a-37-3d            ANY    7(2442 MHz)   42
00-04-e2-2a-37-49        WLAN1AP    9(2452 MHz)   42
00-90-d1-08-9d-a7        WLAN1AP    1(2412 MHz)   12
00-30-f1-fb-31-f4           WLAN    6(2437 MHz)   16
Enterprise AP#
```

To configure the remaining 802.11g radio settings, select the **Radio Settings** page.

Figure 4-20: Radio Setting Configuration

Radio Channel – The radio channel that the AP uses to communicate with wireless clients. When multiple APs are deployed in the same area, set the channel on neighboring access points at least four channels apart to avoid interference with each other. This means that you can deploy up to three APs in the same area. (In the United States you should use channels 1, 6 and 11. In most of Europe you can also use channels 2, 7 and 12, or 3, 8 and 13).

 Also note that the channel for wireless clients is automatically set to the same as that used by the access point to which it is linked. In Turbo Mode (Super G enabled) only channel 6 should be used. (Default: Channel 6))

Table 4-4: Channels Assignment

Channel NumberV	Frequency (GHz)
1	2.412
2	2.417
3	2.422
4	2.427
5	2.432

Table 4-4: Channels Assignment

Channel NumberV	Frequency (GHz)
6	2.437
7	2.442
8	2.447
9	2.452
10	2.457
11	2.462
12	2.467
13	2.472
14	2.482

Auto Channel Select – Enables the AP to automatically select an unoccupied radio channel. (Default: Enabled)

NOTE

Check your country's regulations to see if Auto Channel can be disabled.

Transmit Power – Adjusts the power of the radio signals transmitted from the access point. The higher the transmission power, the farther the transmission range. Power selection is not just a trade off between coverage area and maximum supported clients. You also have to ensure that high-power signals do not interfere with the operation of other radio devices in the service area. (Options: 100%, 50%, 25%, 12%, minimum; Default: 100%)

Maximum Station Data Rate – The maximum data rate at which the access point transmits unicast packets on the wireless interface. The maximum transmission distance is affected by the data rate. The lower the data rate, the longer the transmission distance. (Default: 54 Mbps)
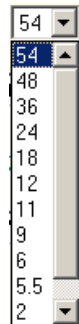
Antenna ID – Selects the antenna to be used by the AP. The optional external antennas that are certified for use with the access point are listed in the drop-down menu. Selecting the correct antenna ID ensures that the AP's radio transmissions are within regulatory power limits for the country of operation. In the current release, select *id-0x0108,*

module-ACC04-05427A Omni-Directional Ant from the list for the 8dBi omni antenna(s). The unit will not transmit until an antenna is selected. (Default:id=0x0000, module=NA)

NOTE

The Antenna ID must be selected in conjunction with the Antenna Control Method to configure proper use of any of the antenna options.

Antenna Control Method - Selects the use of two antennas operating in diversity mode or a single antenna. (Default: Diversity)

- *Diversity*: The radio uses two identical antennas in a diversity system.

- *Right*: The radio uses a single antenna on the right side.

- *Left*: The radio uses a single antenna on the left side.

Antenna Location – Selects the mounting location of the antenna in use. Selecting the correct location ensures that the access point only uses radio channels that are permitted in the country of operation. (Default: Outdoor)

MIC Mode – The Michael Integrity Check (MIC) is part of the Temporal Key Integrity Protocol (TKIP) encryption used in WiFi Protected Access (WPA) security. The MIC calculation is performed in the access point for each transmitted packet and this can impact throughput and performance. The AP supports a choice of software or hardware MIC calculation. The performance of the AP can be improved by selecting the best method for the specific deployment. (Default: Software)

- *Hardware*: Provides best performance when the number of supported clients is less than 27.

- *Software*: Provides the best performance for a large number of clients on one radio interface. Throughput may be reduced when the 802.11g interface supports a high number of clients simultaneously.

Super G – The Atheros proprietary Super G performance enhancements are supported by the access point. These enhancements include bursting, compression, and fast frames. Maximum throughput ranges between 40 to 60 Mbps for connections to Atheros-compatible clients. (Default: Disabled)

Radio Mode – Selects the operating mode for the 802.11g wireless interface. (Default: 802.11b+g)

- 802.11b+g: Both 802.11b and 802.11g clients can communicate with the access point (up to 54 Mbps).

- 802.11b only: Both 802.11b and 802.11g clients can communicate with the access point, but 802.11g clients can only transfer data at 802.11b standard rates (up to 11 Mbps).

- 802.11g only: Only 802.11g clients can communicate with the access point (up to 54 Mbps).

Auto Channel Select – Enables the access point to automatically select an unoccupied radio channel. (Default: Enabled)

Preamble – Sets the length of the signal preamble that is used at the start of a data transmission. (Default: Long)

- *Long*: Sets the preamble to long (192 microseconds). Using a long preamble ensures the access point can support all 802.11b and 802.11g clients.

- *Short or Long*: Sets the preamble according to the capability of clients that are currently associated. Uses a short preamble (96 microseconds) if all associated clients can support it, otherwise a long preamble is used. The access point can increase data throughput when using a short preamble, but will only use a short preamble if it determines that all associated clients support it.

Beacon Interval – The rate at which beacon signals are transmitted from the access point. The beacon signals allow wireless clients to maintain contact with the access point. They may also carry power-management information.
(Range: 20-1000 TUs; Default: 100 TUs)

Data Beacon Rate – The rate at which stations in sleep mode must wake up to receive broadcast/multicast transmissions.

Known also as the Delivery Traffic Indication Map (DTIM) interval, it indicates how often the MAC layer forwards broadcast/multicast traffic, which is necessary to wake up stations that are using Power Save mode. The default value of 2 indicates that the access point will save all broadcast/multicast frames for the Basic Service Set (BSS) and forward them after every second beacon. Using smaller DTIM intervals delivers broadcast/multicast frames in a more timely manner, causing stations in Power Save mode to wake up more often and drain power faster. Using higher DTIM values reduces the power used by stations in Power Save mode, but delays the transmission of broadcast/multicast frames.
(Range: 1-255 beacons; Default: 1 beacon)

Multicast Data Rate – The maximum data rate at which the access point transmits multicast and broadcast packets on the wireless interface. (Options: 24, 12, 6 Mbps; Default: 6 Mbps)

Fragmentation Length – Configures the minimum packet size that can be fragmented when passing through the access point. Fragmentation of the PDUs (Package Data Unit) can increase the reliability of transmissions because it increases the probability of a successful transmission due to smaller frame size. If there is significant interference present, or collisions due to high network utilization, try setting the fragment size to send smaller fragments. This will speed up the retransmission of smaller frames. However, it is more efficient to set the fragment size larger if very little or no interference is present because it requires overhead to send multiple frames. (Range: 256-2346 bytes; Default: 2346 bytes)

RTS Threshold – Sets the packet size threshold at which a Request to Send (RTS) signal must be sent to a receiving station prior to the sending station starting communications. The access point sends RTS frames to a receiving station to negotiate the sending of a data frame. After receiving an RTS frame, the station sends a CTS (clear to send) frame to notify the sending station that it can start sending data.

If the RTS threshold is set to 0, the access point always sends RTS signals. If set to 2347, the access point never sends RTS signals. If set to any other value, and the packet size equals or exceeds the RTS threshold, the RTS/CTS (Request to Send / Clear to Send) mechanism will be enabled.

The APs contending for the medium may not be aware of each other. The RTS/CTS mechanism can solve this "Hidden Node Problem." (Range: 0-2347 bytes: Default: 2347 bytes)

4.4.1.2.2 CLI Commands for the 802.11g Wireless Interface

From the global configuration mode, enter the **interface wireless g** command to access the 802.11g radio interface. The 802.11g radio can be forced to an 802.11g-only, 802.11b-only, or mixed 802.11b/g operating mode using the **radio-mode** command. You should set the desired operating mode before configuring channel settings (the default is mixed 802.11b/g operation). Select a radio channel or set selection to Auto using the **channel** command. Set any other radio settings as required before enabling the VAP interface (with the **no shutdown** command). To view the current 802.11g radio settings for the VAP

interface, use the **show interface wireless g [0~3]** command as shown on

```
Enterprise AP(config)#interface wireless g                        210
Enter Wireless configuration commands, one per line.
Enterprise AP(if-wireless g)#radio-mode g                         214
Enterprise AP(if-wireless g)#channel auto                         213
Enterprise AP(if-wireless g)#transmit-power full                  213
Enterprise AP(if-wireless g)#super-g                              218
Enterprise AP(if-wireless g)#preamble short                       214
Enterprise AP(if-wireless g)#
```

4.4.1.2.3   CLI Commands for the Radio Settings

From the global configuration mode, enter the **interface wireless g** command to access the 802.11g radio interface. From the 802.11g interface mode, you can access radio settings that apply to all VAP interfaces. Use the **turbo** command to enable this feature before setting the radio channel with the **channel** command. Set any other radio setting as required before enabling the VAP interface (with the **no shutdown** command). To view the current 802.11g radio settings for the VAP interface, use the **show interface wireless g [0~3]** command as shown on

```
Enterprise AP(config)#interface wireless g                        210
Enter Wireless configuration commands, one per line.
Enterprise AP(if-wireless g)#channel 42                           213
Enterprise AP(if-wireless g)#transmit-power full                  213
Enterprise AP(if-wireless g)#speed 9                              211
Enterprise AP(if-wireless g)#antenna id 0000                      215
Enterprise AP(if-wireless g)#antenna control right                215
Enterprise AP(if-wireless g)#antenna location outdoor             216
Enterprise AP(if-wireless g)#mic_mode hardware                    235
Enterprise AP(if-wireless g)#super-g                              218
Enterprise AP(if-wireless g)#beacon-interval 150                  216
Enterprise AP(if-wireless g)#beacon-interval 150
Enterprise AP(if-wireless g)#dtim-period 5                        216
Enterprise AP(if-wireless g)#multicast-data-rate 6                211
Enterprise AP(if-wireless g)#fragmentation-length 512             217
Enterprise AP(if-wireless g)#rts-threshold 256                    218
Enterprise AP(if-wireless g)#
```

4.4.1.3   Configuring WiFi Multimedia

Wireless networks offer an equal opportunity for all devices to transmit data from any type of application. Although this is acceptable for most applications, multimedia applications (with audio and video) are particularly sensitive to the delay and throughput variations that result from this "equal opportunity" wireless access method. For multimedia applications to run well over a wireless network, a

Quality of Service (QoS) mechanism is required to prioritize traffic types and provide an "enhanced opportunity" wireless access method.

The access point implements QoS using the WiFi Multimedia (WMM) standard. Using WMM, the access point is able to prioritize traffic and optimize performance when multiple applications compete for wireless network bandwidth at the same time. WMM employs techniques that are a subset of the developing IEEE 802.11e QoS standard and it enables the access point to inter operate with both WMM-enabled clients and other devices that may lack any WMM functionality.

Access Categories — WMM defines four access categories (ACs): voice, video, best effort, and background. These categories correspond to traffic priority levels and are mapped to IEEE 802.1D priority tags (see Table 4-5). The direct mapping of the four ACs to 802.1D priorities is specifically intended to facilitate inter operability with other wired network QoS policies. While the four ACs are specified for specific types of traffic, WMM allows the priority levels to be configured to match any network-wide QoS policy. WMM also specifies a protocol that access points can use to communicate the configured traffic priority levels to QoS-enabled wireless clients.

Table 4-5: WMM Access Categories

Access Category	WMM Designation	Description	802.1D Tags
AC_VO (AC3)	Voice	Highest priority, minimum delay. Time-sensitive data such as VoIP (Voice over IP) calls.	7, 6
AC_VI (AC2)	Video	High priority, minimum delay. Time-sensitive data such as streaming video.	5, 4
AC_BE (AC0)	Best Effort	Normal priority, medium delay and throughput. Data only affected by long delays. Data from applications or devices that lack QoS capabilities.	0, 3
AC_BK (AC1)	Background	Lowest priority. Data with no delay or throughput requirements, such as bulk data transfers.	2, 1

WMM Operation — WMM uses traffic priority based on the four ACs; Voice, Video, Best Effort, and Background. The higher the AC priority, the higher the probability that data is transmitted.

When the access point forwards traffic, WMM adds data packets to four independent transmit queues, one for each AC, depending on the 802.1D priority tag of the packet. Data packets without a priority tag are always added to the Best Effort AC queue. From the four queues, an internal "virtual" collision resolution mechanism first selects data with the highest priority to be granted a transmit

opportunity. Then the same collision resolution mechanism is used externally to determine which device has access to the wireless medium.

For each AC queue, the collision resolution mechanism is dependent on two timing parameters:

■ AIFSN (Arbitration Inter-Frame Space Number), a number used to calculate the minimum time between data frames

■ CW (Contention Window), a number used to calculate a random backoff time

After a collision detection, a backoff wait time is calculated. The total wait time is the sum of a minimum wait time (Arbitration Inter-Frame Space, or AIFS) determined from the AIFSN, and a random backoff time calculated from a value selected from zero to the CW. The CW value varies within a configurable range. It starts at CWMin and doubles after every collision up to a maximum value, CWMax. After a successful transmission, the CW value is reset to its CWMin value.
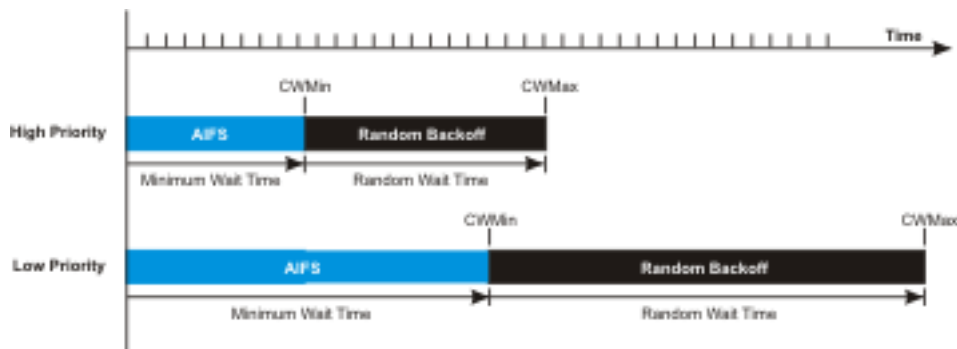
Figure 4-21: WMM Backoff Wait Times

For high-priority traffic, the AIFSN and CW values are smaller. The smaller values equate to less backoff and wait time, and therefore more transmit opportunities.

To configure WMM, select the Radio Settings page, and scroll down to the WMM configuration settings.

Figure 4-22: WMM Configuration Settings

WMM – Sets the WMM operational mode on the AP. When enabled, the parameters for each AC queue will be employed on the access point and QoS capabilities are advertised to WMM-enabled clients. (Default: Support)

■ *Disable*: WMM is disabled.

■ *Support*: WMM will be used for any associated device that supports this feature. Devices that do not support this feature may still associate with the access point.

■ *Required*: WMM must be supported on any device trying to associated with the access point. Devices that do not support this feature will not be allowed to associate with the access point.

WMM Acknowledge Policy – By default, all wireless data transmissions require the sender to wait for an acknowledgement from the receiver. WMM allows the acknowledgement wait time to be turned off for each Access Category (AC). Although this increases data throughput, it can also result in a high number of errors when traffic levels are heavy. (Default: Acknowledge)

WMM BSS Parameters – These parameters apply to the wireless clients.

WMM AP Parameters – These parameters apply to the access point.

- **logCWMin** (Minimum Contention Window) – The initial upper limit of the random backoff wait time before wireless medium access can be attempted. The initial wait time is a random value between zero and the CWMin value. Specify the CWMin value in the range 0-15 microseconds. Note that the CWMin value must be equal or less than the CWMax value.

- **logCWMax** (Maximum Contention Window) – The maximum upper limit of the random backoff wait time before wireless medium access can be attempted. The contention window is doubled after each detected collision up to the CWMax value. Specify the CWMax value in the range 0-15 microseconds. Note that the CWMax value must be greater or equal to the CWMin value.

- **AIFS** (Arbitration Inter-Frame Space) – The minimum amount of wait time before the next data transmission attempt. Specify the AIFS value in the range 0-15 microseconds.

- **TXOP Limit** (Transmit Opportunity Limit) – The maximum time an AC transmit queue has access to the wireless medium. When an AC queue is granted a transmit opportunity, it can transmit data for a time up to the TxOpLimit. This data bursting greatly improves the efficiency for high data-rate traffic. Specify a value in the range 0-65535 microseconds.

- **Admission Control** – The admission control mode for the access category. When enabled, clients are blocked from using the access category. (Default: Disabled)

Key Type – See "Wired Equivalent Privacy (WEP)" on page 104.

4.4.1.3.1   CLI Commands for WMM

Enter interface wireless mode and type **wmm required** for clients that want to associate with the access point. The **wmm-acknowledge-policy** command is used to enable or disable a policy for each access category. The **wmmparms** command defines detailed WMM parameters.

```
Enterprise AP(if-wireless g)#wmm required                              245
Enterprise AP(if-wireless g)#wmm-acknowledge-policy 0 noack            245
Enterprise AP(if-wireless g)#wmmparams ap 0 4 6 3 1 1                  246
```

To view the current 802.11g radio settings for the VAP interface, use the **show interface wireless g [0-3]** command.

```
Enterprise AP#show interface wireless g 0                              222


Wireless Interface Information
==============================================================
-------------------Identification--------------------------
Description                     : Enterprise 802.11g Access Point
SSID                            : VAP_TEST_11G 0
Turbo Mode                      : DISABLED
Channel                         : 36 (AUTO)
Status                          : DISABLED
MAC Address                     : 00:12:cf:05:95:0c
----------------802.11 Parameters--------------------------
Transmit Power                  : FULL (16 dBm)
Max Station Data Rate           : 54Mbps
Multicast Data Rate             : 6Mbps
Fragmentation Threshold         : 2346 bytes
RTS Threshold                   : 2347 bytes
Beacon Interval                 : 100 TUs
Authentication Timeout Interval : 60 Mins
Association Timeout Interval     : 30 Mins
DTIM Interval                   : 1 beacon
Maximum Association             : 64 stations
MIC Mode                        : Software
Super G                         : Disabled
VLAN ID                         : 1
----------------Security-----------------------------------
Closed System                   : Disabled
Multicast cipher                : WEP
WPA clients                     : TKIP and AES
WPA Key Mgmt Mode               : PRE SHARED KEY
WPA PSK Key Type                : PASSPHRASE
Encryption                      : DISABLED
Default Transmit Key            : 1
Common Static Keys              : Key 1: EMPTY     Key 2: EMPTY
                                  Key 3: EMPTY     Key 4: EMPTY
Authentication Type             : OPEN
----------------802.1x-------------------------------------
802.1x                          :
Broadcast Key Refresh Rate      : 30 min
Session Key Refresh Rate        : 30 min
802.1x Session Timeout Value    : 0 min
---------------Antenna-------------------------------------
Antenna Control method          : Diversity
Antenna ID                      : 0x0000(Default Antenna)
Antenna Location                : Outdoor
```

```
----------------Quality of Service---------------------------
WMM Mode                        : SUPPORTED
WMM Acknowledge Policy
AC0(Best Effort)                : Ack
AC1(Background)                 : Acknowledge
AC2(Video)                      : Acknowledge
AC3(Voice)                      : Acknowledge
WMM BSS Parameters
AC0(Best Effort)                : logCwMin:  4  logCwMax: 10  AIFSN:  3
                                  Admission Control: No
                                  TXOP Limit: 0.000 ms
AC1(Background)                 : logCwMin:  4  logCwMax: 10  AIFSN:  7
                                  Admission Control: No
                                  TXOP Limit: 0.000 ms
AC2(Video)                      : logCwMin:  3  logCwMax:  4  AIFSN:  2
                                  Admission Control: No
                                  TXOP Limit: 3.008 ms
AC3(Voice)                      : logCwMin:  2  logCwMax:  3  AIFSN:  2
                                  Admission Control: No
                                  TXOP Limit: 1.504 ms
WMM AP Parameters
AC0(Best Effort)                : logCwMin:  4  logCwMax:  6  AIFSN:  3
                                  Admission Control: No
                                  TXOP Limit: 0.000 ms
AC1(Background)                 : logCwMin:  4  logCwMax: 10  AIFSN:  7
                                  Admission Control: No
                                  TXOP Limit: 0.000 ms
AC2(Video)                      : logCwMin:  3  logCwMax:  4  AIFSN:  1
                                  Admission Control: No
                                  TXOP Limit: 3.008 ms
AC3(Voice)                      : logCwMin:  2  logCwMax:  3  AIFSN:  1
                                  Admission Control: No
                                  TXOP Limit: 1.504 ms

=============================================================
Enterprise AP#
```

4.4.2   Security

The access point is configured by default as an "open system," which broadcasts a beacon signal including the configured SSID. Wireless clients with an SSID setting of "any" can read the SSID from the beacon and automatically set their SSID to allow immediate connection to the nearest access point.

To improve wireless network security, you have to implement two main functions:

■ *Authentication*: It must be verified that clients attempting to connect to the network are authorized users.

■ *Traffic Encryption*: Data passing between the access point and clients must be protected from interception and eavesdropping.

For a more secure network, the AP can implement one or a combination of the following security mechanisms:

- Wired Equivalent Privacy (WEP) page 99

- IEEE 802.1X page 114

- Wireless MAC address filtering page 54

- WiFi Protected Access (WPA or WPA2) page 108

Both WEP and WPA security settings are configurable separately for each virtual access point (VAP) interface. MAC address filtering, and RADIUS server settings are global and apply to all VAP interfaces.

The security mechanisms that may be employed depend on the level of security required, the network and management resources available, and the software support provided on wireless clients.

A summary of wireless security considerations is listed in Table 4-6.

Table 4-6: Wireless Security Considerations

Security Mechanism	Client Support	Implementation Considerations
WEP	Built-in support on all 802.11g devices	■ Provides only weak security ■ Requires manual key management
WEP over 802.1X	Requires 802.1X client support in system or by add-in software (support provided in Windows 2000 SP3 or later and Windows XP)	■ Provides dynamic key rotation for improved WEP security ■ Requires configured RADIUS server ■ 802.1X EAP type may require management of digital certificates for clients and server
MAC Address Filtering	Uses the MAC address of client network card	■ Provides only weak user authentication ■ Management of authorized MAC addresses ■ Can be combined with other methods for improved security ■ Optionally configured RADIUS server

Table 4-6: Wireless Security Considerations

Security Mechanism	Client Support	Implementation Considerations
WPA over 802.1X Mode	Requires WPA-enabled system and network card driver (native support provided in Windows XP)	■ Provides robust security in WPA-only mode (i.e., WPA clients only) ■ Offers support for legacy WEP clients, but with increased security risk (i.e., WEP authentication keys disabled) ■ Requires configured RADIUS server ■ 802.1X EAP type may require management of digital certificates for clients and server
WPA PSK Mode	Requires WPA-enabled system and network card driver (native support provided in Windows XP)	■ Provides good security in small networks ■ Requires manual management of pre-shared key
WPA2 with 802.1X	Requires WPA-enabled system and network card driver (native support provided in Windows XP)	■ Provides the strongest security in WPA2-only mode ■ Provides robust security in mixed mode for WPA and WPA2 clients ■ Offers fast roaming for time-sensitive client applications ■ Requires configured RADIUS server ■ 802.1X EAP type may require management of digital certificates for clients and server ■ Clients may require hardware upgrade to be WPA2 compliant
WPA2 PSK Mode	Requires WPA-enabled system and network card driver (native support provided in Windows XP)	■ Provides robust security in small networks ■ Requires manual management of pre-shared key ■ Clients may require hardware upgrade to be WPA2 compliant

NOTE

You must enable data encryption through the web or CLI in order to enable all types of encryption (WEP, TKIP, or AES) in the access point.

The AP can simultaneously support clients using various different security mechanisms. The configuration for these security combinations are outlined in the following table. Note that MAC address authentication can be configured

independently to work with all security mechanisms and is indicated separately in the table. Required RADIUS server support is also listed.

Table 4-7: Security Combinations

Client Security Combination	Configuration Summary[a]	MAC Authentication[b]	RADIUS Server
No encryption and no authentication	Interface Detail Settings: Authentication: Open System Encryption: Disable 802.1x: Disable	Local, RADIUS, or Disabled	Yes[3]
Static WEP only (with or without shared key authentication)	Enter 1 to 4 WEP keys Select a WEP transmit key for the interface Interface Detail Settings: Authentication: Shared Key or Open System Encryption: Enable 802.1x: Disable	Local, RADIUS, or Disabled	Yes[c]
Dynamic WEP (802.1x) only	Interface Detail Settings: Authentication: Open System Encryption: Enable 802.1x: Required Set 802.1x key refresh and reauthentication rates	Local, RADIUS, or Disabled	Yes[d]
802.1x WPA only	Interface Detail Settings: Authentication: WPA Encryption: Enable WPA Configuration: Required Cipher Suite: TKIP 802.1x: Required Set 802.1x key refresh and reauthentication rates	Local only	Yes
WPA Pre-Shared Key only	Interface Detail Settings: Authentication: WPA-PSK Encryption: Enable WPA Configuration: Required Cipher Configuration: TKIP 802.1x: Disable WPA Pre-shared Key Type: Hexadicmal or Alphanumeric Enter a WPA Pre-shared key	Local only	No

Table 4-7: Security Combinations

Client Security Combination	Configuration Summary[a]	MAC Authentication[b]	RADIUS Server
Static and dynamic (802.1x) WEP keys	Enter 1 to 4 WEP keys Select a WEP transmit key Interface Detail Settings: Authentication: Open System Encryption: Enable 802.1x: Supported Set 802.1x key refresh and reauthentication rates	Local, RADIUS, or Disabled	Yes
Dynamic WEP and 802.1x WPA	Interface Detail Settings: Authentication: WPA Encryption: Enable WPA Configuration: Supported Cipher Suite: WEP 802.1x: Required Set 802.1x key refresh and reauthentication rates	Local or Disabled	Yes
Static and dynamic (802.1x) WEP keys and 802.1x WPA	Enter 1 to 4 WEP keys Select a WEP transmit key Interface Detail Settings: Authentication: WPA Encryption: Enable WPA Configuration: Supported Cipher Suite: WEP 802.1x: Supported Set 802.1x key refresh and reauthentication rates	Local or Disabled	Yes
802.1x WPA2 only	Interface Detail Settings: Authentication: WPA2 Encryption: Enable WPA Configuration: Required Cipher Suite: AES-CCMP 802.1x: Required Set 802.1x key refresh and reauthentication rates	Local or Disabled	Yes

Table 4-7: Security Combinations

Client Security Combination	Configuration Summary[a]	MAC Authentication[b]	RADIUS Server
WPA2 Pre-Shared Key only	Interface Detail Settings: Authentication: WPA2-PSK Encryption: Enable WPA Configuraton: Required Cipher Suite: AES-CCMP 802.1x: Disable WPA Pre-shared Key Type: Hexadicmal or Alphanumeric Enter a WPA Pre-shared key	Local or Disabled	No
802.1x WPA-WPA2 Mixed Mode	Interface Detail Settings: Authentication: WPA-WPA2-mixed Encryption: Enable WPA Configuration: Required Cipher Suite: TKIP 802.1x: Required Set 802.1x key refresh and reauthentication rates	Local or Disabled	Yes
WPA-WPA2 Mixed Mode Pre-Shared Key	Interface Detail Settings: Authentication: WPA-WPA2-PSK-mixed Encryption: Enable WPA Configuration: Required Cipher Suite: TKIP 802.1x: Disable WPA Pre-shared Key Type: Hexadicmal or Alphanumeric Enter a WPA Pre-shared key	Local or Disabled	No

a. The configuration summary does not include the set up for MAC authentication or RADIUS server .
b. The configuration of RADIUS MAC authentication together with 802.1x WPA or WPA Pre-shared Key is not supported.
c. RADIUS server required only when RADIUS MAC authentication is configured.
d. RADIUS server required only when RADIUS MAC authentication is configured.

NOTE

If you choose to configure RADIUS MAC authentication together with 802.1X, the RADIUS MAC address authentication occurs prior to 802.1X authentication. Only when RADIUS MAC authentication succeeds is 802.1X authentication performed. When RADIUS MAC authentication fails, 802.1X authentication is not performed.

4.4.2.1 Enabling the VAPs

Before enabling the Virtual Access Point (VAP) radio interfaces, first configure all of the relevant radio settings (see "Radio Settings G (802.11g)" on page 81.)

After you have configured the radio settings, select Security under Radio G, set an SSID to identify the wireless network service provided by each VAP you want to use, and then click Apply to save your settings.

Before enabling the radio service for any VAP, first configure the WEP, WPA, and 802.1X security settings described in the following sections. After you have finished configuring the security settings, return to the main Security page shown below, start the required VAP interfaces by clicking the **Enable** checkbox, and then click **Apply**.
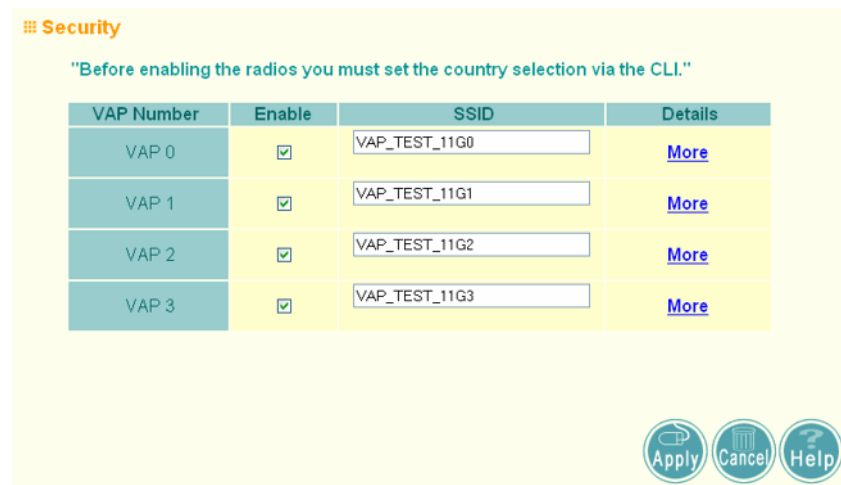
Figure 4-23: Security

Enable – Enables radio communications on the VAP interface. (Default: Disabled)

NOTE

You must first enable VAP interface 0 before you can enable other VAP interfaces.

SSID – The name of the basic service set provided by a VAP interface. Clients that want to connect to the network through the access point must set their SSID to the same as that of an access point VAP interface. (Default: VAP_TEST_11A # (0-3); Range: 1-32 characters)

4.4.2.2 Wired Equivalent Privacy (WEP)

WEP provides a basic level of security, preventing unauthorized access to the network, and encrypting data transmitted between wireless clients and the access

point. WEP uses static shared keys (fixed-length hexadecimal or alphanumeric strings) that are manually distributed to all clients that want to use the network.

WEP is the security protocol initially specified in the IEEE 802.11 standard for wireless communications. Unfortunately, WEP has been found to be seriously flawed and cannot be recommended for a high level of network security. For more robust wireless security, the access point provides WiFi Protected Access (WPA) for improved data encryption and user authentication.

Setting up shared keys enables the basic IEEE 802.11 Wired Equivalent Privacy (WEP) on the access point to prevent unauthorized access to the network.

If you choose to use WEP shared keys instead of an open system, be sure to define at least one static WEP key for user authentication and data encryption. Also, be sure that the WEP shared keys are the same for each client in the wireless network.

NOTE

All clients share the same keys, which are used for user authentication and data encryption. Up to four keys can be specified. These four keys are used for all VAP interfaces on the same radio.

To set up WEP shared keys, click **Radio Settings**.

Figure 4-24: WEP Shared Keys

Key Type – Select the preferred method of entering WEP encryption keys on the access point and enter up to four keys:

■ *Hexadecimal*: Enter keys as 10 hexadecimal digits (0-9 and A-F) for 64 bit keys, 26 hexadecimal digits for 128 bit keys, or 32 hexadecimal digits for 152 bit keys (802.11g radio only). This is the default setting.

- *Alphanumeric*: Enter keys as 5 alphanumeric characters for 64 bit keys, 13 alphanumeric characters for 128 bit keys, or 16 alphanumeric characters for 152 bit keys.

Key Number – Selects the key number to use for encryption for each VAP interface. If the clients have all four keys configured to the same values, you can change the encryption key to any of the four settings without having to update the client keys. (Default: Key 1)

Shared Key Setup – Select 64 Bit, 128 Bit, or 152 Bit key length. Note that the same size of encryption key must be supported on all wireless clients. (Default: None)

> **NOTE**
>
> - Key index and type must match that configured on the clients.
>
> - In a mixed-mode environment with clients using static WEP keys and WPA, select WEP transmit key index 2, 3, or 4. The access point uses transmit key index 1 for the generation of dynamic keys.

To enable WEP shared keys for a VAP interface, click **Security**. Then, select the VAP interface that will use WEP keys by clicking **More**, and configure the *Authentication Type Setup* and *Encryption* fields.
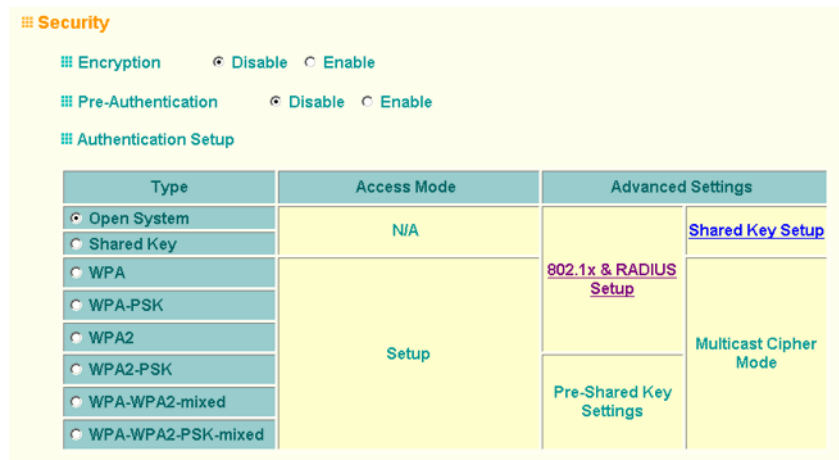
Figure 4-25: Security - Shared Keys

Authentication Type Setup – Sets the access point to communicate as an open system that accepts network access attempts from any client, or with clients using pre-configured static shared keys. (Default: Open System)

■ Open System: If you don't set up any other security mechanism on the access point, the network has no protection and is open to all users. This is the default setting.

■ Shared Key: Sets the access point to use WEP shared keys. If this option is selected, you must configure at least one key on the access point and all clients.

NOTE

To use 802.1X on wireless clients requires a network card driver and 802.1X client software that supports the EAP authentication type that you want to use. Windows 2000 SP3 or later and Windows XP provide 802.1X client support. Windows XP also provides native WPA support. Other systems require additional client software to support 802.1X and WPA.

Encryption – Enable or disable the access point to use data encryption (WEP, TKIP, or AES). If this option is selected when using static WEP keys, you must configure at least one key on the access point and all clients. (Default: Disabled)

NOTE

You must enable data encryption through the web or CLI in order to enable all types of encryption (WEP, TKIP, or AES) in the AP.

4.4.2.2.1 CLI Commands for WEP Shared Key Security

To enable WEP shared key security for the 802.11g interface, use the **interface wireless g** command from the CLI configuration mode to access the interface mode for the 802.11g radio. First use the **key** command to define up to four WEP keys that can be used for all VAP interfaces on the radio. Then use the **vap** command to access each VAP interface to configure other security settings.

From the VAP interface configuration mode, use the **auth** command to enable WEP shared-key authentication, which enables encryption automatically. Then set one key as the transmit key for the VAP interface using the **transmit-key** command. To view the current security settings, use the **show interface wireless g [0-3]** command from the Exec mode.

4.4.2.2.2 CLI Commands for WEP over 802.1X Security

Use the **vap** command to access each VAP interface to configure the security settings. First set 802.1X to required using the 802.1x command and set the **802.1X** key refresh rates. Then, use the **auth** command to select open system authentication and the **encryption** command to enable data encryption. To view

the current security settings, use the **show interface wireless g [0-3]** command (not shown in example).

```
Enterprise AP(if-wireless g)#vap 0
Enterprise AP(if-wireless g: VAP[0])#802.1X required                    191
Enterprise AP(if-wireless g: VAP[0])#802.1X session-timeout 300
Enterprise AP(if-wireless g: VAP[0])#auth open-system                   230
Enterprise AP(if-wireless g: VAP[0])#encryption                         232
Enterprise AP(if-wireless g: VAP[0])#
```

4.4.2.3   WiFi Protected Access (WPA)

WPA employs a combination of several technologies to provide an enhanced security solution for 802.11 wireless networks.

The access point supports the following WPA components and features:

IEEE 802.1X and the Extensible Authentication Protocol (EAP): WPA employs 802.1X as its basic framework for user authentication and dynamic key management. The 802.1X client and RADIUS server should use an appropriate EAP type—such as EAP-TLS (Transport Layer Security), EAP-TTLS (Tunneled TLS), or PEAP (Protected EAP)—for strongest authentication. Working together, these protocols provide "mutual authentication" between a client, the access point, and a RADIUS server that prevents users from accidentally joining a rogue network. Only when a RADIUS server has authenticated a user's credentials will encryption keys be sent to the access point and client.

NOTE

To implement WPA on wireless clients requires a WPA-enabled network card driver and 802.1X client software that supports the EAP authentication type that you want to use. Windows XP provides native WPA support, other systems require additional software.

Temporal Key Integrity Protocol (TKIP): WPA specifies TKIP as the data encryption method to replace WEP. TKIP avoids the problems of WEP static keys by dynamically changing data encryption keys. Basically, TKIP starts with a master (temporal) key for each user session and then mathematically generates other keys to encrypt each data packet. TKIP provides further data encryption enhancements by including a message integrity check for each packet and a re-keying mechanism, which periodically changes the master key.

WPA Pre-Shared Key Mode (WPA-PSK, WPA2-PSK): For enterprise deployment, WPA requires a RADIUS authentication server to be configured on the wired network. However, for small office networks that may not have the resources to configure and maintain a RADIUS server, WPA provides a simple operating mode that uses just a pre-shared password for network access. The Pre-Shared Key mode uses a common password for user authentication that is manually entered on the access point and all wireless clients. The PSK mode uses the same TKIP

packet encryption and key management as WPA in the enterprise, providing a robust and manageable alternative for small networks.

Mixed WPA and WEP Client Support: WPA enables the access point to indicate its supported encryption and authentication mechanisms to clients using its beacon signal. WPA-compatible clients can likewise respond to indicate their WPA support. This enables the access point to determine which clients are using WPA security and which are using legacy WEP. The access point uses TKIP unicast data encryption keys for WPA clients and WEP unicast keys for WEP clients. The global encryption key for multicast and broadcast traffic must be the same for all clients, therefore it restricts encryption to a WEP key.

When access is opened to both WPA and WEP clients, no authentication is provided for the WEP clients through shared keys. To support authentication for WEP clients in this mixed mode configuration, you can use either MAC authentication or 802.1X authentication.

WPA2 – WPA was introduced as an interim solution for the vulnerability of WEP pending the ratification of the IEEE 802.11i wireless security standard. In effect, the WPA security features are a subset of the 802.11i standard. WPA2 includes the now ratified 802.11i standard, but also offers backward compatibility with WPA. Therefore, WPA2 includes the same 802.1X and PSK modes of operation and support for TKIP encryption. The main differences and enhancements in WPA2 can be summarized as follows:

- **Advanced Encryption Standard (AES)**: WPA2 uses AES Counter-Mode encryption with Cipher Block Chaining Message Authentication Code (CBC-MAC) for message integrity. The AES Counter-Mode/CBCMAC Protocol (AES-CCMP) provides extremely robust data confidentiality using a 128-bit key. The AES-CCMP encryption cipher is specified as a standard requirement for WPA2. However, the computational intensive operations of AES-CCMP requires hardware support on client devices. Therefore to implement WPA2 in the network, wireless clients must be upgraded to WPA2-compliant hardware.

- **WPA2 Mixed-Mode**: WPA2 defines a transitional mode of operation for networks moving from WPA security to WPA2. WPA2 Mixed Mode allows both WPA and WPA2 clients to associate to a common SSID interface. In mixed mode, the unicast encryption cipher (TKIP or AES-CCMP) is negotiated for each client. The access point advertises its supported encryption ciphers in beacon frames and probe responses. WPA and WPA2 clients select the cipher they support and return the choice in the association request to the access point. For mixed-mode operation, the cipher used for broadcast frames is always TKIP. WEP encryption is not allowed.

- ■ **Key Caching**: WPA2 provides fast roaming for authenticated clients by retaining keys and other security information in a cache, so that if a client roams away from an access point and then returns, re-authentication is not required. When a WPA2 client is first authenticated, it receives a Pairwise Master Key (PMK) that is used to generate other keys for unicast data encryption. This key and other client information form a Security Association that the access point names and holds in a cache.

- ■ **Preauthentication**: Each time a client roams to another access point it has to be fully re-authenticated. This authentication process is time consuming and can disrupt applications running over the network. WPA2 includes a mechanism, known as pre-authentication, that allows clients to roam to a new access point and be quickly associated. The first time a client is authenticated to a wireless network it has to be fully authenticated. When the client is about to roam to another access point in the network, the access point sends pre-authentication messages to the new access point that include the client's security association information. Then when the client sends an association request to the new access point, the client is known to be already authenticated, so it proceeds directly to key exchange and association.

To configure WPA, click **Security,** select one of the VAP interfaces by clicking **More**. Select one of the WPA options in the Authentication Setup table, and then configure the parameters displayed beneath the table.

Figure 4-26: Security - WPA Configuration

The WPA configuration parameters are described below:

Encryption – You must enable data encryption in order to enable all types of encryption (WEP, TKIP, or AES) in the access point.

Pre-Authentication – When using WPA2 over 802.1X, pre-authentication can be enabled, which allows clients to roam to a new access point and be quickly associated without performing full 802.1X authentication. (Default: Disabled)

Authentication Setup – To use WPA or WPA2, set the access point to one of the following options. If a WPA/WPA2 mode that operates over 802.1X is selected (WPA, WPA2, or WPA-WPA2-mixed), the 802.1X settings and RADIUS server details need to be configured. Be sure you have also configured a RADIUS server on the network before enabling authentication. If a WPA/WPA2 Pre-shared Key mode is selected (WPA-PSK, WPA2-PSK, or WPA-WPA2 PSK-Mixed), be sure to specify the key string.

■ *WPA*: Clients using WPA over 802.1X are accepted for authentication.

- *WPA-PSK*: Clients using WPA with a Pre-shared Key are accepted for authentication.

- *WPA2*: Clients using WPA2 over 802.1X are accepted for authentication.

- *WPA2-PSK*: Clients using WPA2 with a Pre-shared Key are accepted for authentication.

- *WPA-WPA2-mixe*d: Clients using WPA or WPA2 over 802.1X are accepted for authentication.

- *WPA-WPA2-PSK-mixed*: Clients using WPA or WPA2 with a Pre-shared Key are accepted for authentication.

WPA Configuration – Each VAP interface can be configured to allow only WPA-enabled clients to access the network (Required), or to allow access to both WPA and WEP clients (Supported). (Default: Required)

Cipher Suite – Selects an encryption method for the global key used for multicast and broadcast traffic, which is supported by all wireless clients.

- *WEP*: WEP is used as the multicast encryption cipher. You should select WEP only when both WPA and WEP clients are supported.

- *TKIP*: TKIP is used as the multicast encryption cipher.

- *AES-CCMP*: AES-CCMP is used as the multicast encryption cipher. AES-CCMP is the standard encryption cipher required for WPA2.

WPA Pre-Shared Key Type – If the WPA or WPA2 pre-shared-key mode is used, all wireless clients must be configured with the same key to communicate with the AP.

- *Hexadecimal* – Enter a key as a string of 64 hexadecimal numbers.

- *Alphanumeric* – Enter a key as an easy-to-remember form of letters and numbers. The string must be from 8 to 63 characters, which can include spaces.

The configuration settings for WPA are summarized in Table 4-8:

Table 4-8: WPA Configuration Settings

WPA and WPA2 pre-shared key only	WPA and WPA2 over 802.1X
Encryption: Enabled	Encryption: Enabled
Authentication Setup: WPA-PSK, WPA2-PSK, or WPA-WPA2-mixed	Authentication Setup: WPA, WPA2, WPA-WPA2-mixed
Cipher Suite: WEP/TKIP/AES-CCMP	Cipher Suite: WEP/TKIP/AES-CCMP
WPA Pre-shared Key Type: Hex/ASCII	(requires RADIUS server to be specified)

1:You must enable data encryption in order to enable all types of encryption in the access point.

2:Select TKIP when any WPA clients do not support AES. Select AES only if all clients support AES.

4.4.2.3.1 CLI Commands for *WPA* Using Pre-shared Key Security

From the VAP interface configuration mode, use the **auth wpa-psk required** command to enable WPA Pre-shared Key security. To enter a key value, use the **wpa-pre-shared-key** command to specify a hexadecimal or alphanumeric key. To view the current security settings, use the **show interface wireless a [0-3]** or **show interface wireless g [0-3]** command (not shown in example).

```
Enterprise AP(config)#interface wireless g                        210
Enter Wireless configuration commands, one per line.
Enterprise AP(if-wireless g)#vap 0
Enterprise AP(if-wireless g: VAP[0])#wpa-pre-shared-key
   passphrase-key agoodsecret                                     235
Enterprise AP(if-wireless g: VAP[0])#auth wpa-psk required
Data Encryption is set to Enabled.
WPA2 Clients Mode is set to Disabled.
WPA Clients Mode is set to Required.
WPA Multicast Cipher is set to TKIP.
WPA Unicast Cipher can accept TKIP only.
WPA Authentication is set to Pre-Shared Key.
Enterprise AP(if-wireless g: VAP[0])#
```

4.4.2.3.2 CLI Commands for *WPA Over 802.1X Security*

From the VAP interface configuration mode, use the **auth wpa required** command to select WPA over 802.1X security. Then set the 802.1X key refresh rates. To view

the current security settings, use the **show interface wireless a [0-3]** or **show interface wireless g [0-3]** command (not shown in example).

```
Enterprise AP(config)#interface wireless g                          210
Enter Wireless configuration commands, one per line.
Enterprise AP(if-wireless g)#vap 0
Enterprise AP(if-wireless g: VAP[0])#auth wpa required
Data Encryption is set to Enabled.
WPA2 Clients mode is set to Disabled.
WPA Clients Mode is set to Required.
WPA Multicast Cipher is set to TKIP.
WPA Unicast Cipher can accept TKIP only.
WPA Authentication is set to 802.1X Required.
Enterprise AP(if-wireless g: VAP[0])#802.1X broadcast-key-refresh-rate 5
Enterprise AP(if-wireless g: VAP[0])#802.1X
session-key-refresh-rate 5
Enterprise AP(if-wireless g: VAP[0])#802.1X session-timeout 300
Enterprise AP(if-wireless g: VAP[0])#
```

4.4.2.4   Configuring 802.1X

IEEE 802.1X is a standard framework for network access control that uses a central RADIUS server for user authentication. This control feature prevents unauthorized access to the network by requiring an 802.1X client application to submit user credentials for authentication. The 802.1X standard uses the Extensible Authentication Protocol (EAP) to pass user credentials (either digital certificates, user names and passwords, or other) from the client to the RADIUS server. Client authentication is then verified on the RADIUS server before the access point grants client access to the network.

The 802.1X EAP packets are also used to pass dynamic unicast session keys and static broadcast keys to wireless clients. Session keys are unique to each client and are used to encrypt and correlate traffic passing between a specific client and the access point. You can also enable broadcast key rotation, so the access point provides a dynamic broadcast key and changes it at a specified interval.

Open the **Security** page, and click **More** for one of the VAP interfaces.
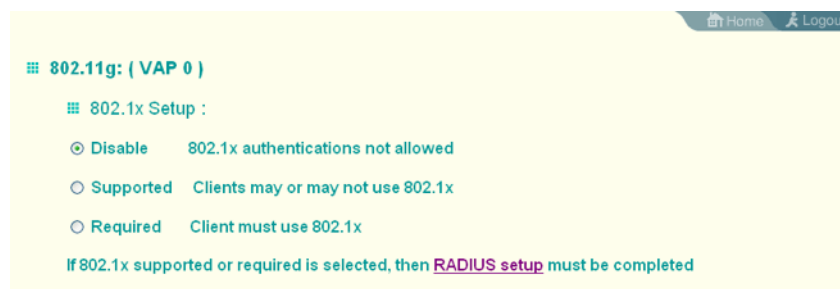
Figure 4-27: 802.1X Configuration

You can enable 802.1X as optionally supported or as required to enhance the security of the wireless network. (Default: Disable)

■ *Disable*: The AP does not support 802.1X authentication for any wireless client. After successful wireless association with the access point, each client is allowed to access the network.

■ *Supported*: The access point supports 802.1X authentication only for clients initiating the 802.1X authentication process (i.e., the access point does not initiate 802.1X authentication). For clients initiating 802.1X, only those successfully authenticated are allowed to access the network. For those clients not initiating 802.1X, access to the network is allowed after successful wireless association with the access point. The 802.1X supported mode allows access for clients not using WPA or WPA2 security.

■ *Required*: The access point enforces 802.1X authentication for all associated wireless clients. If 802.1X authentication is not initiated by a client, the AP will initiate authentication. Only those clients successfully authenticated with 802.1X are allowed to access the network.

NOTE

If 802.1X is enabled on the access point, then RADIUS setup must be completed (see "RADIUS" on page 4-48.).

4.4.2.4.1 CLI Commands for 802.1X Authentication

Use the **802.1X supported** command from the VAP interface mode to enable 802.1X authentication. Set the session and broadcast key refresh rate, and the re-authentication timeout. To display the current settings, use the **show interface wireless** command from the Exec mode (not shown in the example).

```
Enterprise AP(if-wireless g: VAP[0])#802.1X supported                        191
Enterprise AP(if-wireless g: VAP[0])#802.1X broadcast-key-refresh-rate 5
Enterprise AP(if-wireless g: VAP[0])#802.1X session-key-refresh-rate 5
Enterprise AP(if-wireless g: VAP[0])#802.1X session-timeout 300
Enterprise AP#
```

4.5   Status Information
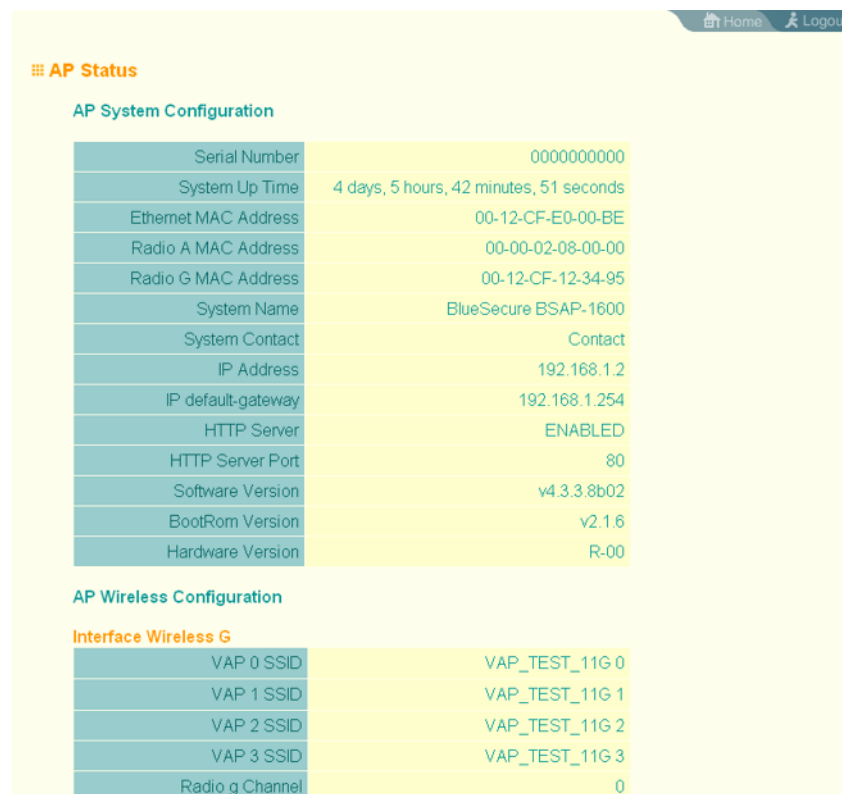
The Status page includes information on the following items:

Table 4-9: Status Page Information

Menu	Description	Page
AP Status	Displays configuration settings for the basic system and the wireless interface	116
Station Status	Shows the wireless clients currently associated with the access point	118
Event Logs	Shows log messages stored in memory	120

4.5.1   Access Point Status

The AP Status window displays basic system configuration settings, as well as the settings for the wireless interface.

Figure 4-28: AP Status

AP System Configuration – The AP System Configuration table displays the basic system configuration settings:

■ *System Up Time*: Length of time the management agent has been up.

■ *Ethernet MAC*: The physical layer address for the Ethernet port.

■ *Radio G MAC*: The physical layer address for the 802.11b/g interface. *System Name*: Name assigned to this system.

■ *System Contact*: Administrator responsible for the system.

■ *IP Address*: IP address of the management interface for this device.

■ *IP Default Gateway*: IP address of the gateway router between this device and management stations that exist on other network segments.

■ *HTTP Server*: Shows if management access via HTTP is enabled.

■ *HTTP Server Port*: Shows the TCP port used by the HTTP interface.

■ *Software Version*: Shows the software version number.

■ *Bootrom Version*: Show the bootrom version number.

■ *Hardware Version*: Shows the hardware version number.

AP Wireless Configuration – The AP Wireless Configuration tables display the radio and VAP interface settings listed below.

■ *SSID*: The service set identifier for the VAP interface.

■ *Radio Channel*: The radio channel through which the access point communicates with wireless clients.

■ *Encryption*: The key size used for data encryption.

■ *Authentication Type*: Shows the type of authentication used.

■ *802.1X*: Shows if IEEE 802.1X access control for wireless clients is enabled.

4.5.1.0.1 CLI Commands for Displaying System Settings

To view the current access point system settings, use the **show system** command from the Exec mode. To view the current radio interface settings, use the **show interface wireless a** or **show interface wireless g** command (see).

```
Enterprise AP#show system                                         149
System Information
============================================================
Serial Number         : A123456789
System Up time         : 0 days, 4 hours, 33 minutes, 29 seconds
System Name            : Enterprise wireless gP
System Location        :
System Contact         :
System Country Code    : US - UNITED STATES
MAC Address            : 00-30-F1-F0-9A-9C
IP Address             : 192.168.1.1
Subnet Mask            : 255.255.255.0
Default Gateway        : 0.0.0.0
VLAN State             : DISABLED
Management VLAN ID(AP): 1
IAPP State             : ENABLED
DHCP Client            : ENABLED
HTTP Server            : ENABLED
HTTP Server Port       : 80
HTTPS Server           : ENABLED
HTTPS Server Port      : 443
Slot Status            : 802.11g only
Boot Rom Version       : v2.1.6
Software Version       : v4.3.3.8b02
SSH Server             : ENABLED
SSH Server Port        : 22
Telnet Server          : ENABLED
WEB Redirect           : DISABLED
DHCP Relay             : DISABLED
============================================================
Enterprise AP
```

4.5.2 Station Status

The Station Status window shows the wireless clients currently associated with the access point.

Figure 4-29: Station Status

The Station Configuration page displays basic connection information for all associated stations as described below. This page is automatically refreshed every five seconds.

■ *Station Address*: The MAC address of the wireless client.

■ *Authenticated*: Shows if the station has been authenticated. The two basic methods of authentication supported for 802.11 wireless networks are "open system" and "shared key." Open-system authentication accepts any client attempting to connect to the access point without verifying its identity. The shared-key approach uses Wired Equivalent Privacy (WEP) to verify client identity by distributing a shared key to stations before attempting authentication.

■ *Associated*: Shows if the station has been successfully associated with the access point. Once authentication is completed, stations can associate with the current access point, or reassociate with a new access point. The association procedure allows the wireless system to track the location of each mobile client, and ensure that frames destined for each client are forwarded to the appropriate access point.

■ *Forwarding Allowed*: Shows if the station has passed 802.1X authentication and is now allowed to forward traffic to the access point.

■ *Key Type* – Displays one of the following:

◇ *WEP Disabled* – The client is not using Wired Equivalent Privacy (WEP) encryption keys.

◇ *Dynamic* – The client is using WiFi Protected Access (802.1X or pre-shared key mode) or using 802.1X authentication with dynamic keying.

◇ *Static* – The client is using static WEP keys for encryption.

4.5.2.0.1 CLI Commands for Displaying Station Status

To view status of clients currently associated with the access point, use the **show station** command from the Exec mode.

```
Enterprise AP#show station                                     224

Station Table Information
===========================================================
if-wireless G VAP [0]   :
802.11g Channel : Auto

No 802.11g Channel Stations.

if-wireless G VAP [1]   :
802.11g Channel : Auto

No 802.11g Channel Stations.

....

No 802.11g Channel Stations.

if-wireless G VAP [3]   :
802.11g Channel : Auto

No 802.11g Channel Stations.
===========================================================
Enterprise AP#
```

4.5.3 Event Logs

The Event Logs window shows the log messages generated by the AP and stored in memory.

Figure 4-30: Event Log

The Event Logs table displays the following information:

- *Log Time*: The time the log message was generated.

- *Event Level*: The logging level associated with this message. For a description of the various levels, see "logging level" on page 70.

- *Event Message*: The content of the log message.

Error Messages : An example of a logged error message is: "Station Failed to authenticate (unsupported algorithm)."

This message may be caused by any of the following conditions:

- AP was set to *Open Authentication*, but a client sent an authentication request frame with a *Shared key*.

- AP was set to *Shared Key Authentication*, but a client sent an authentication frame for *Open System*.

- WEP keys do not match: When the AP uses *Shared Key Authentication*, but the key used by client and access point are not the same, the frame will be decrypted incorrectly, using the wrong algorithm and sequence number.

4.5.3.0.1 CLI Commands for Displaying the Logging Status

From the global configuration mode, use the **show logging** command.

```
Enterprise AP#show logging                                      160

Logging Information
============================================
Syslog State              : Enabled
Logging Console State      : Enabled
Logging Level             : Alert
Logging Facility Type      : 16
Servers
   1: 192.168.1.19, UDP Port: 514, State: Enabled
   2: 0.0.0.0, UDP Port: 514, State: Disabled
   3: 0.0.0.0, UDP Port: 514, State: Disabled
   4: 0.0.0.0, UDP Port: 514, State: Disabled
============================================
Enterprise AP#
```

4.5.3.0.2 CLI Commands for Displaying Event Logs

To view the access point log entries, use the **show event-log** command from the Exec mode. To clear all log entries from the access point, use the **logging clear** command from the Global Configuration mode.

```
Enterprise AP#show event-log                                    161
Mar 09 11:57:55  Information: 802.11g:11g Radio Interface Enabled
Mar 09 11:57:55  Information: 802.11g:Radio channel updated to 8
Mar 09 11:57:34  Information: 802.11g:11g Radio Interface Enabled
Mar 09 11:57:18  Information: 802.11g:11g Radio Interface Enabled
Mar 09 11:55:52  Information: SSH task: Set SSH server port to 22
Mar 09 11:55:52  Information: SSH task: Enable SSH server.
Mar 09 11:55:52  Information: Enable Telnet.
Press <n> next. <p> previous. <a> abort. <y> continue to end :
Enterprise AP#configure
Enter configuration commands, one per line. End with CTRL/Z
Enterprise AP(config)#logging clear                             160
Enterprise AP#
```

5

Chapter 5 - Command Line Interface

In This Chapter:

5.1 Using the Command Line Interface

5.1.1 Accessing the CLI

When accessing the management interface over a direct connection to the console port, or via a Telnet connection, the Access Point (AP) unit can be managed by entering command keywords and parameters at the prompt. Using AP's command-line interface (CLI) is very similar to entering commands on a UNIX system.

5.1.2 Console Connection

To access the Wi² through the console port:

1   At the console prompt, enter the user name and password. (The default user name is *admin* and the default password is *smcadmin.*) When the user name is entered, the CLI displays the `Enterprise AP#` prompt.

2   Enter the necessary commands to complete your desired tasks.

3   When finished, exit the session with the "exit" command.

After connecting to the system through the console port, the login screen is displayed:

```
Username: admin
Password:
Enterprise AP#
```

CAUTION

Command examples shown later in this chapter abbreviate the console prompt to "AP" for simplicity.

5.1.3 Telnet Connection

Telnet operates over the IP transport protocol. In this environment, your management station and any network device you want to manage over the network must have a valid IP address. Valid IP addresses consist of four numbers, 0 to 255, separated by periods. Each address consists of a network portion and host portion. For example, if the AP cannot acquire an IP address from a DHCP server, the default IP address used by the AP, 192.168.1.1, consists of a network portion (192.168.1) and a host portion (1).

To access the AP through a Telnet session, you must first set the IP address for the AP, and set the default gateway if you are managing the AP from a different IP subnet. For example:

```
Enterprise AP#configure
Enterprise AP(config)#interface ethernet
Enterprise AP(if-ethernet)#ip address 10.1.0.1 255.255.255.0 10.1.0.254
Enterprise AP(if-ethernet)#
```

If your corporate network is connected to another network outside your office or to the Internet, you need to apply for a registered IP address. However, if you are attached to an isolated network, then you can use any IP address that matches the network segment to which you are attached.

After you have configured the AP with an IP address, you can open a Telnet session.

To open an Telnet session:

1 From the remote host, enter the Telnet command and the IP address of the device you want to access.

2 At the prompt, enter the user name and system password. The CLI will display the `Enterprise AP#` prompt to show that you are using executive access mode (i.e., Exec).

3 Enter the necessary commands to complete your desired tasks.

4 When finished, exit the session with the "quit" or "exit" command.

After entering the Telnet command, the login screen is displayed:

```
Username: admin
Password:
Enterprise AP#
```

CAUTION

You can open up to four sessions to the device via Telnet.

5.2   Entering Commands

This section describes how to enter CLI commands.

5.2.1   Keywords and Arguments

A CLI command is a series of keywords and arguments. Keywords identify a command, and arguments specify configuration parameters. For example, in the command "show interfaces ethernet," **show** and **interfaces** are keywords, and **ethernet** is an argument that specifies the interface type.

You can enter commands as follows:

■   To enter a simple command, enter the command keyword.

■   To enter commands that require parameters, enter the required parameters after the command keyword. For example, to set a password for the administrator, enter:

```
Enterprise AP(config)#username smith
```

5.2.2   Minimum Abbreviation

The CLI accepts a minimum number of characters that uniquely identify a command. For example, the command "configure" can be entered as **con**. If an entry is ambiguous, the system will prompt for further input.

5.2.3   Command Completion

If you terminate input with a Tab key, the CLI will print the remaining characters of a partial keyword up to the point of ambiguity. In the "configure" example, typing **con** followed by a tab will result in printing the command up to "**configure**."

5.2.4   Getting Help on Commands

You can display a brief description of the help system by entering the **help** command. You can also display command syntax by following a command with the "?" character to list keywords or parameters.

5.2.4.1   Showing Commands

If you enter a "?" at the command prompt, the system will display the first level of keywords for the current configuration mode (Exec, Global Configuration, or

Interface). You can also display a list of valid keywords for a specific command. For example, the command "**show ?**" displays a list of possible show commands:

```
Enterprise AP#show ?
  APmanagement    Show management AP information.
  authentication  Show Authentication parameters
  bootfile        Show bootfile name
  config          System snapshot for tech support
  dhcp-relay      Show DHCP Relay Configuration
  event-log       Show event log on console
  filters         Show filters
  hardware        Show hardware version
  history         Display the session history
  interface       Show interface information
  line            TTY line information
  link-integrity  Show link integrity information
  logging         Show the logging buffers
  radius          Show radius server
  rogue-ap        Show Rogue ap Stations
  snmp            Show snmp configuration
  sntp            Show sntp configuration
  station         Show 802.11 station table
  system          Show system information
  version         Show system version
Enterprise AP#show
```

The command "**show interface ?**" will display the following information:

```
Enterprise AP#show interface ?
  ethernet  Show Ethernet interface
  wireless  Show wireless interface
  <cr>
Enterprise AP#show interface
```

5.2.5   Partial Keyword Lookup

If you terminate a partial keyword with a question mark, alternatives that match the initial letters are provided. (Remember not to leave a space between the command and question mark.) For example "**s?**" shows all the keywords starting with "s."

```
Enterprise AP#show s?
snmp     sntp      station  system
Enterprise AP#show s
```

5.2.6   Negating the Effect of Commands

For many configuration commands you can enter the prefix keyword "**no**" to cancel the effect of a command or reset the configuration to the default value. For example, the **logging** command will log system messages to a host server. To disable logging, specify the **no logging** command. This guide describes the negation effect for all applicable commands.

5.2.7 Using Command History

The CLI maintains a history of commands that have been entered. You can scroll back through the history of commands by pressing the up arrow key. Any command displayed in the history list can be executed again, or first modified and then executed.

Using the **show history** command displays a longer list of recently executed commands.

5.2.8 Understanding Command Modes

The command set is divided into Exec and Configuration classes. Exec commands generally display information on system status or clear statistical counters. Configuration commands, on the other hand, modify interface parameters or enable certain functions. These classes are further divided into different modes. Available commands depend on the selected mode. You can always enter a question mark "**?**" at the prompt to display a list of the commands available for the current mode. The command classes and associated modes are displayed in Table 5-1:

Table 5-1: Command Classes and Associated Modes

Class	Mode
Exec	Privileged
Configuration	Global
	Interface-ethernet
	Interface-wireless
	Interface-wireless-vap

5.2.9 Exec Commands

When you open a new console session on an AP, the system enters Exec command mode. Only a limited number of the commands are available in this mode. You can access all other commands only from the configuration mode. To access Exec mode, open a new console session with the user name *admin*. The command prompt displays as `Enterprise AP#` for Exec mode.

```
Username: admin
Password: [system login password]
Enterprise AP#
```

5.2.10   Configuration Commands

Configuration commands are used to modify AP settings. These commands modify the running configuration and are saved in memory.

The configuration commands are organized into four different modes:

■ Global Configuration (GC) - These commands modify the system level configuration, and include commands such as **username** and **password**.

■ Interface-Ethernet Configuration (IC-E) - These commands modify the Ethernet port configuration, and include command such as **dns** and **ip**.

■ Interface-Wireless Configuration (IC-W) - These commands modify the wireless port configuration of global parameters for the radio, and include commands such as **channel** and **transmit-power**.

■ Interface-Wireless Virtual Access Point Configuration (IC-W-VAP) - These commands modify the wireless port configuration for each VAP, and include commands such as **ssid** and **authentication**.

To enter the Global Configuration mode, enter the command **configure** in Exec mode. The system prompt will change to "Enterprise AP(config)#" which gives you access privilege to all Global Configuration commands.

```
Enterprise AP#configure
Enterprise AP(config)#
```

To enter Interface mode, you must enter the "**interface ethernet**," or "**interface wireless a**," or "**interface wireless g**" command while in Global Configuration mode. The system prompt will change to "Enterprise AP(if-ethernet)#," or Enterprise AP(if-wireless)" indicating that you have access privileges to the associated commands. You can use the **end** command to return to the Exec mode.

```
Enterprise AP(config)#interface ethernet
Enterprise AP(if-ethernet)#
```

5.2.11   Command Line Processing

Commands are not case sensitive. You can abbreviate commands and parameters as long as they contain enough letters to differentiate them from any other currently available commands or parameters. You can use the Tab key to complete partial commands, or enter a partial command followed by the "?"

character to display a list of possible matches. You can also use the following editing keystrokes for command-line processing:

Table 5-2: Keystroke Commands

Keystroke	Function
Ctrl-A	Shifts cursor to start of command line.
Ctrl-B	Shifts cursor to the left one character.
Ctrl-C	Terminates a task and displays the command prompt.
Ctrl-E	Shifts cursor to end of command line.
Ctrl-F	Shifts cursor to the right one character.
Ctrl-K	Deletes from cursor to the end of the command line.
Ctrl-L	Repeats current command line on a new line.
Ctrl-N	Enters the next command line in the history buffer.
Ctrl-P	Shows the last command.
Ctrl-R	Repeats current command line on a new line.
Ctrl-U	Deletes the entire line.
Ctrl-W	Deletes the last word typed.
Esc-B	Moves the cursor backward one word.
Esc-D	Deletes from the cursor to the end of the word.
Esc-F	Moves the cursor forward one word.
Delete key or backspace key	Erases a mistake when entering a command.

5.3   Command Groups

The system commands can be broken down into the functional groups shown below.

Table 5-3: Command Group

Command Group	Description	Page
General	Basic commands for entering configuration mode, restarting the system, or quitting the CLI	134
System Management	Controls user name, password, web browser management options, and a variety of other system information	139
System Logging	Configures system logging parameters	157
System Clock	Configures SNTP and system clock settings	162
DHCP Relay	Configures the AP to send DHCP requests from clients to specified servers	166
SNMP	Configures community access strings and trap managers	168
Flash/File	Manages code image or AP configuration files	181
RADIUS	Configures the RADIUS client used with 802.1X authentication	184
802.1X Authentication	Configures 802.1X authentication	191
MAC Address Authentication	Configures MAC address authentication	194
Filtering	Filters communications between wireless clients, controls access to the management interface from wireless clients, and filters traffic using specific Ethernet protocol types	198
WDS Bridge	Not applicable for the current release	202
Spanning Tree	Not applicable for the current release	203
Ethernet Interface	Configures connection parameters for the Ethernet interface	204
Wireless Interface	Configures radio interface settings	209
Wireless Security	Configures radio interface security and encryption settings	226
Rogue AP Detection	Configures settings for the detection of rogue APs in the network	226
Link Integrity	Configures a link check to a host device on the wired network	238
IAPP	Enables roaming between multi-vendor APs	241
VLANs	Configures VLAN membership	242
WMM	Configures WMM quality of service parameters	245

The access mode shown in the following tables is indicated by these abbreviations: **Exec** (Executive Mode), **GC** (Global Configuration), **IC-E** (Interface-Ethernet

Configuration), **IC-W** (Interface-Wireless Configuration), and **IC-W-VAP** (Interface-Wireless VAP Configuration).

5.4 General Commands

Table 5-4: General Commands

Command	Function	Mode	Page
configure	Activates global configuration mode	Exec	135
end	Returns to previous configuration mode	GC, IC	135
exit	Returns to the previous configuration mode, or exits the CLI	any	135
ping	Sends ICMP echo request packets to another node on the network	Exec	136
reset	Restarts the system	Exec	136
show history	Shows the command history buffer	Exec	137
show line	Shows the configuration settings for the console port	Exec	137

5.4.1 configure

This command activates Global Configuration mode. You must enter this mode to modify most of the settings on the AP. You must also enter Global Configuration mode prior to enabling the context modes for Interface Configuration. see "Using the Command Line Interface" on page 5-125.

Default Setting

None

Command Mode

Exec

Example

```
Enterprise AP#configure
Enterprise AP(config)#
```

Related Commands

end (page 135)

5.4.2 end

This command returns to the previous configuration mode.

Default Setting

None

Command Mode

Global Configuration, Interface Configuration

Example

This example shows how to return to the Configuration mode from the Interface Configuration mode:

```
Enterprise AP(if-ethernet)#end
Enterprise AP(config)#
```

5.4.3 exit

This command returns to the Exec mode or exits the configuration program.

Default Setting

None

Command Mode

Any

Example

This example shows how to return to the Exec mode from the Interface Configuration mode, and then quit the CLI session:

```
Enterprise AP(if-ethernet)#exit
Enterprise AP#exit
CLI session with the Access Point is now closed

Username:
```

5.4.4 ping

This command sends ICMP echo request packets to another node on the network.

Syntax

ping <*host_name | ip_address*>

- *host_name* - Alias of the host.
- *ip_address* - IP address of the host.

Default Setting

None

Command Mode

Exec

Command Usage

- Use the ping command to see if another site on the network can be reached.
- The following are some results of the **ping** command:
  - *Normal response* - The normal response occurs in one to ten seconds, depending on network traffic.
  - *Destination does not respond* - If the host does not respond, a "timeout" appears in ten seconds.
  - *Destination unreachable* - The gateway for this destination indicates that the destination is unreachable.
  - *Network or host unreachable* - The gateway found no corresponding entry in the route table.
- Press <Esc> to stop pinging.

Example

```
Enterprise AP#ping 10.1.0.19
192.168.1.19 is alive
Enterprise AP#
```

5.4.5 reset

This command restarts the system or restores the factory default settings.

Syntax

reset <**board** | **configuration**>

- **board** - Reboots the system.
- **configuration** - Resets the configuration settings to the factory defaults, and then reboots the system.

Default Setting

None

Command Mode

Exec

Command Usage

When the system is restarted, it will always run the Power-On Self-Test.

Example

This example shows how to reset the system:

```
Enterprise AP#reset board
Reboot system now? <y/n>: y
```

5.4.6   show history

This command shows the contents of the command history buffer.

Default Setting

None

Command Mode

Exec

Command Usage

- The history buffer size is fixed at 10 commands.
- Use the up or down arrow keys to scroll through the commands in the history buffer.

Example

In this example, the show history command lists the contents of the command history buffer:

```
Enterprise AP#show history
 config
 exit
 show history
Enterprise AP#
```

5.4.7   show line

This command displays the console port's configuration settings.

Command Mode

Exec

Example

The console port settings are fixed at the values shown below.

```
Enterprise AP#show line
Console Line Information
======================================================
  databits   : 8
  parity     : none
  speed      : 9600
  stop bits  : 1
======================================================
Enterprise AP#
```

5.5   System Management Commands

These commands are used to configure the user name, password, system logs, browser management options, clock settings, and a variety of other system information.

Table 5-5: System Management Commands

Command	Function	Mode	Page
Country Setting			
country	Sets the AP country code	Exec	140
Device Designation			
prompt	Customizes the command line prompt	GC	141
system name	Specifies the host name for the AP	GC	142
snmp-server contact	Sets the system contact string	GC	169
snmp-server location	Sets the system location string	GC	169
Management Access			
username	Configures the user name for management access	GC	142
password	Specifies the password for management access	GC	143
ip ssh-server enable	Enables the Secure Shell server	IC-E	143
ip ssh-server port	Sets the Secure Shell port	IC-E	144
ip telnet-server enable	Enables the Telnet server	IC-E	144
APmgmtIP	Specifies an IP address or range of addresses allowed access to the management interface	GC	147
APmgmtUI	Enables or disables SNMP, Telnet or web management access	GC	148
show APmanagement	Shows the AP management configuration	Exec	148
Web Server			
ip http port	Specifies the port to be used by the web browser interface	GC	144
ip http server	Allows the AP to be monitored or configured from a browser	GC	145
ip http session-timeout	Sets the timeout for the web browser interface	GC	145
ip https port	Specifies the UDP port number used for a secure HTTP connection to the AP's Web interface	GC	146
ip https server	Enables the secure HTTP server on the AP	GC	146
System Status			
show system	Displays system information	Exec	149
show version	Displays version information for the system	Exec	150

Table 5-5: System Management Commands

Command	Function	Mode	Page
show config	Displays detailed configuration information for the system	Exec	151
show hardware	Displays the AP's hardware version	Exec	156

5.5.1 country

This command configures the AP's country code, which identifies the country of operation and sets the authorized radio channels.

Syntax

country *<country_code>*

country_code - A two character code that identifies the country of operation. See the following table for a full list of codes.

Table 5-6: Country Codes

Country	Code	Country	Code	Country	Code	Country	Code
Albania	AL	Dominican Republic	DO	Kuwait	KW	Romania	RO
Algeria	DZ	Ecuador	EC	Latvia	LV	Russia	RU
Argentina	AR	Egypt	EG	Lebanon	LB	Saudi Arabia	SA
Armenia	AM	Estonia	EE	Liechtenstein	LI	Singapore	SG
Australia	AU	Finland	FI	Lithuania	LT	Slovak Republic	SK
Austria	AT	France	FR	Macao	MO	Spain	ES
Azerbaijan	AZ	Georgia	GE	Macedonia	MK	Sweden	SE
Bahrain	BH	Germany	DE	Malaysia	MY	Switzerland	CH
Belarus	BY	Greece	GR	Malta	MT	Syria	SY
Belgium	BE	Guatemala	GT	Mexico	MX	Taiwan	TW
		Honduras	HN	Monaco	MC	Thailand	TH
Belize	BZ	Hong Kong	HK	Morocco	MA	Trinidad & Tobago	TT
Bolivia	BO	Hungary	HU	Netherlands	NL	Tunisia	TN
Brazil	BR	Iceland	IS	New Zealand	NZ	Turkey	TR
Brunei Darussalam	BN	India	IN	Norway	NO	Ukraine	UA
Bulgaria	BG	Indonesia	ID	Qatar	QA	United Arab Emirates	AE
Canada	CA	Iran	IR	Oman	OM	United Kingdom	GB

Table 5-6: Country Codes

Chile	CL	Ireland	IE	Pakistan	PK	United States	US
China	CN	Israel	IL	Panama	PA	Uruguay	UY
Colombia	CO	Italy	IT	Peru	PE	Uzbekistan	UZ
Costa Rica	CR	Japan	JP	Philippines	PH	Yemen	YE
Croatia	HR	Jordan	JO	Poland	PL	Venezuela	VE
Cyprus	CY	Kazakhstan	KZ	Portugal	PT	Vietnam	VN
Czech Republic	CZ	North Korea	KP	Puerto Rico	PR	Zimbabwe	ZW
Denmark	DK	Korea Republic	KR	Slovenia	SI		
Elsalvador	SV	Luxembourg	LU	South Africa	ZA		

Default Setting

US - for units sold in the United States
99 (no country set) - for units sold in other countries

Command Mode

Exec

Command Usage

- If you purchased an AP outside of the United States, the country code must be set before radio functions are enabled.
- The available Country Code settings can be displayed by using the **country ?** command.

Example

```
Enterprise AP#country tw
Enterprise AP#
```

5.5.2   prompt

This command customizes the CLI prompt. Use the **no** form to restore the default prompt.

Syntax

prompt *<string>*
no prompt

string - Any alphanumeric string to use for the CLI prompt. (Maximum length: 32 characters)

Default Setting

Enterprise AP

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#prompt RD2
RD2(config)#
```

5.5.3   system name

This command specifies or modifies the system name for this device. Use the **no** form to restore the default system name.

Syntax

system name *<name>*
no system name

name - The name of this host.
(Maximum length: 32 characters)

Default Setting

Enterprise AP

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#system name AP
Enterprise AP(config)#
```

5.5.4   username

This command configures the user name for management access.

Syntax

username *<name>*

name - The name of the user.
(Length: 3-16 characters, case sensitive)

Default Setting

admin

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#username bob
Enterprise AP(config)#
```

5.5.5   password

After initially logging onto the system, you should set the password. Remember to record it in a safe place. Use the **no** form to reset the default password.

Syntax

password <*password***>**
no password

password - Password for management access.
(Length: 3-16 characters, case sensitive)

Default Setting

smcadmin

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#password
Enterprise AP(config)#
```

5.5.6   ip ssh-server enable

This command enables the Secure Shell server. Use the **no** form to disable the server.

Syntax

ip ssh-server enable
no ip ssh-server

Default Setting

Interface enabled

Command Mode

Interface Configuration (Ethernet)

Command Usage

■   The AP supports Secure Shell version 2.0 only.

■ After boot up, the SSH server needs about two minutes to generate host encryption keys. The SSH server is disabled while the keys are being generated. The **show system** command displays the status of the SSH server.

Example

```
Enterprise AP(if-ethernet)#ip ssh-server enable
Enterprise AP(if-ethernet)#
```

5.5.7   ip ssh-server port

This command sets the Secure Shell server port. Use the **no** form to disable the server.

Syntax

ip ssh-server port *<port-number>*

- *port-number* - The UDP port used by the SSH server. (Range: 1-65535)

Default Setting

22

Command Mode

Interface Configuration (Ethernet)

Example

```
Enterprise AP(if-ethernet)#ip ssh-server port 1124
Enterprise AP(if-ethernet)#
```

5.5.8   ip telnet-server enable

This command enables the Telnet server. Use the **no** form to disable the server.

Syntax

ip telnet-server enable
no ip telnet-server

Default Setting

Interface enabled

Command Mode

Interface Configuration (Ethernet)

Example

```
Enterprise AP(if-ethernet)#ip telnet-server enable
Enterprise AP(if-ethernet)#
```

5.5.9   ip http port

This command specifies the TCP port number used by the web browser interface. Use the **no** form to use the default port.

Syntax

ip http port *<port-number>*
no ip http port

    port-number - The TCP port to be used by the browser interface. (Range: 1024-65535)

Default Setting

80

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#ip http port 769
Enterprise AP(config)#
```

Related Commands

ip http server (page 145)

5.5.10 ip http server

This command allows this device to be monitored or configured from a browser. Use the **no** form to disable this function.

Syntax

ip http server
no ip http server

Default Setting

Enabled

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#ip http server
Enterprise AP(config)#
```

Related Commands

ip http port (page 144)

5.5.11 ip http session-timeout

This command sets the time limit for an idle web interface session.

Syntax

ip http session-timeout *<time>*

    time - Sets the web interface session timeout.
    (Range: 0 - 1800 seconds, 0 means disabled)

Default Setting

300 seconds

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#ip http session-timeout 0
Enterprise AP(config)#
```

Related Commands

ip http port

5.5.12 ip https port

Use this command to specify the UDP port number used for HTTPS/SSL connection to the AP's Web interface. Use the **no** form to restore the default port.

Syntax

ip https port *<port_number>*
no ip https port

port_number – The UDP port used for HTTPS/SSL.
(Range: 80, 1024-65535)

Default Setting

443

Command Mode

Global Configuration

Command Usage

- You cannot configure the HTTP and HTTPS servers to use the same port.
- To avoid using common reserved TCP port numbers below 1024, the configurable range is restricted to 443 and between 1024 and 65535.
- If you change the HTTPS port number, clients attempting to connect to the HTTPS server must specify the port number in the URL, in this format:
  https://*device***:***port_number*

Example

```
Enterprise AP(config)#ip https port 1234
Enterprise AP(config)#
```

5.5.13 ip https server

Use this command to enable the secure hypertext transfer protocol (HTTPS) over the Secure Socket Layer (SSL), providing secure access (i.e., an encrypted connection) to the AP's Web interface. Use the **no** form to disable this function.

Syntax

ip https server
no ip https server

Default Setting

Enabled

Command Mode

Global Configuration

Command Usage

- Both HTTP and HTTPS service can be enabled independently.
- If you enable HTTPS, you must indicate this in the URL:
  https://_device_:_port_number_]
- When you start HTTPS, the connection is established in this way:
  - The client authenticates the server using the server's digital certificate.
  - The client and server negotiate a set of security protocols to use for the connection.
  - The client and server generate session keys for encrypting and decrypting data.
- The client and server establish a secure encrypted connection.
  A padlock icon should appear in the status bar for Internet Explorer 5.x.

Example

```
Enterprise AP(config)#ip https server
Enterprise AP(config)#
```

5.5.14 APmgmtIP

This command specifies the client IP addresses that are allowed management access to the AP through various protocols.

> **CAUTION**
>
> Secure Web (HTTPS) connections are not affected by the UI Management or IP Management settings.

Syntax

APmgmtIP <**multiple** _IP_address subnet_mask_ | **single** _IP_address_ | **any>**

- **multiple** - Adds IP addresses within a specifiable range to the SNMP, web and Telnet groups.
- **single** - Adds an IP address to the SNMP, web and Telnet groups.
- **any** - Allows any IP address access through SNMP, web and Telnet groups.
- _IP_address_ - Adds IP addresses to the SNMP, web and Telnet groups.
- _subnet_mask_ - Specifies a range of IP addresses allowed management access.

Default Setting

All addresses

Command Mode

Global Configuration

Command Usage

- If anyone tries to access a management interface on the AP from an invalid address, the unit will reject the connection, enter an event message in the system log, and send a trap message to the trap manager.

- IP address can be configured for SNMP, web and Telnet access respectively. Each of these groups can include up to five different sets of addresses, either individual addresses or address ranges.
- When entering addresses for the same group (i.e., SNMP, web or Telnet), the AP will not accept overlapping address ranges. When entering addresses for different groups, the AP will accept overlapping address ranges.
- You cannot delete an individual address from a specified range. You must delete the entire range, and reenter the addresses.
- You can delete an address range just by specifying the start address, or by specifying both the start address and end address.

Example

This example restricts management access to the indicated addresses.

```
Enterprise AP(config)#apmgmtip multiple 192.168.1.50 255.255.255.0
Enterprise AP(config)#
```

5.5.15 APmgmtUI

This command enables and disables management access to the AP through SNMP, Telnet and web interfaces.

> ⚠️ **CAUTION**
>
> Secure Web (HTTPS) connections are not affected by the UI Management or IP Management settings.

Syntax

APmgmtUI <[**SNMP** | **Telnet** | **Web**] **enable** | **disable**>

- **SNMP** - Specifies SNMP management access.
- **Telnet** - Specifies Telnet management access.
- **Web** - Specifies web based management access.
  - **enable**/**disable** - Enables or disables the selected management access method.

Default Setting

All enabled

Command Mode

Global Configuration

Example

This example restricts management access to the indicated addresses.

```
Enterprise AP(config)#apmgmtui SNMP enable
Enterprise AP(config)#
```

5.5.16 show apmanagement

This command shows the AP management configuration, including the IP addresses of management stations allowed to access the AP, as well as the interface protocols which are open to management access.

Command Mode

Exec

Example

```
Enterprise AP#show apmanagement
Management AP Information
=================================
AP Management IP Mode: Any IP
Telnet UI: Enable
WEB UI   : Enable
SNMP UI  : Enable
=================================
Enterprise AP#
```

5.5.17 show system

This command displays basic system configuration settings.

Default Setting

None

Command Mode

Exec

Example

```
Enterprise AP#show system
System Information
=========================================================
Serial Number        : A123456789
System Up time       : 0 days, 4 hours, 33 minutes, 29 seconds
System Name          : Enterprise wireless gP
System Location      :
System Contact       :
System Country Code  : US - UNITED STATES
MAC Address          : 00-30-F1-F0-9A-9C
IP Address           : 192.168.1.1
Subnet Mask          : 255.255.255.0
Default Gateway      : 0.0.0.0
VLAN State           : DISABLED
Management VLAN ID(AP): 1
IAPP State           : ENABLED
DHCP Client          : ENABLED
HTTP Server          : ENABLED
HTTP Server Port     : 80
HTTPS Server         : ENABLED
HTTPS Server Port    : 443

Slot Status          : 802.11g only
Boot Rom Version     : v2.1.6
Software Version     : v4.3.3.8b02
SSH Server           : ENABLED
SSH Server Port      : 22
Telnet Server        : ENABLED
WEB Redirect         : DISABLED
DHCP Relay           : DISABLED
Proxy ARP            : DISABLED
=========================================================
Enterprise AP#
```

5.5.18 show version

This command displays the software version for the system.

Command Mode

Exec

Example

```
Enterprise AP#show version

Version Information
=======================================
Version: v4.3.3.8b02
Date   : Dec 20 2005, 18:38:12
=======================================
Enterprise AP#
```

5.5.19   show config

This command displays detailed configuration information for the system.

Command Mode

Exec

Example

```
Enterprise AP#show config

Authentication Information
=============================================================
MAC Authentication Server      : DISABLED
MAC Auth Session Timeout Value : 0 min
802.1x supplicant              : DISABLED
802.1x supplicant user         : EMPTY
802.1x supplicant password     : EMPTY
Address Filtering              : ALLOWED

System Default : ALLOW addresses not found in filter table.
Filter Table
-------------------------------------------------------------
No Filter Entries.

Bootfile Information
==================================
Bootfile : ec-img.bin
==================================

Protocol Filter Information
=============================================================
Local AP             :DISABLED
AP Management        :ENABLED
Ethernet Type Filter :DISABLED

Enabled Protocol Filters
-------------------------------------------------------------
No protocol filters are enabled
=============================================================
```

```
Hardware Version Information
==========================================
Hardware version R01A
==========================================


Ethernet Interface Information
======================================
IP Address         : 192.168.0.151
Subnet Mask        : 255.255.255.0
Default Gateway    : 192.168.0.1
Primary DNS        : 210.200.211.225
Secondary DNS      : 210.200.211.193
Speed-duplex       : 100Base-TX Full Duplex
Admin status       : Up
Operational status : Up
======================================


Wireless Interface 802.11g Information
============================================================
----------------Identification-----------------------------
Description              : Enterprise 802.11g Access Point
SSID                     : VAP_TEST_11G 0
Channel                  : 0 (AUTO)
Status                   : Disable
----------------802.11 Parameters--------------------------
Transmit Power           : 100% (5 dBm)
Data Rate                : 54Mbps
Fragmentation Threshold  : 2346 bytes
RTS Threshold            : 2347 bytes
Beacon Interval          : 100 TUs
DTIM Interval            : 1 beacon
Maximum Association      : 64 stations
Native VLAN ID           : 1
----------------Security-----------------------------------
Closed System            : DISABLED
Multicast cipher             : WEP
Unicast cipher               : TKIP and AES
WPA clients              : REQUIRED
WPA Key Mgmt Mode        : PRE SHARED KEY
WPA PSK Key Type         : ALPHANUMERIC
Encryption               : DISABLED
Default Transmit Key     : 1
Static Keys :
   Key 1: EMPTY    Key 2: EMPTY    Key 3: EMPTY    Key 4: EMPTY
Key Length :
   Key 1: ZERO     Key 2: ZERO     Key 3: ZERO     Key 4: ZERO
Authentication Type      : OPEN
Rogue AP Detection       : Disabled
Rogue AP Scan Interval   : 720 minutes
Rogue AP Scan Duration   : 350 milliseconds
============================================================


Console Line Information
============================================================
  databits   : 8
  parity     : none
  speed      : 9600
  stop bits  : 1
============================================================
```

```
Logging Information
======================================================
Syslog State            : Disabled
Logging Console State    : Disabled
Logging Level            : Informational
Logging Facility Type    : 16
Servers
   1: 0.0.0.0          , UDP Port:  514, State: Disabled
   2: 0.0.0.0          , UDP Port:  514, State: Disabled
   3: 0.0.0.0          , UDP Port:  514, State: Disabled
   4: 0.0.0.0          , UDP Port:  514, State: Disabled
======================================================


   Radius Server Information
========================================
IP                : 0.0.0.0
Port              : 1812
Key               : *****
Retransmit        : 3
Timeout           : 5
Radius MAC format  : no-delimiter
Radius VLAN format : HEX
========================================

Radius Secondary Server Information
========================================
IP                : 0.0.0.0
Port              : 1812
Key               : *****
Retransmit        : 3
Timeout           : 5
Radius MAC format  : no-delimiter
Radius VLAN format : HEX
========================================

SNMP Information
=============================================
Service State             : Disable
Community (ro)            : ********
Community (rw)            : ********
Location                  :
Contact                   : Contact


EngineId   :80:00:07:e5:80:00:00:29:f6:00:00:00:0c
EngineBoots:2

Trap Destinations:
   1:         0.0.0.0, Community: *****, State: Disabled
   2:         0.0.0.0, Community: *****, State: Disabled
   3:         0.0.0.0, Community: *****, State: Disabled
   4:         0.0.0.0, Community: *****, State: Disabled
```

```
       dot11InterfaceGFail   Enabled         dot11InterfaceBFail   Enabled
   dot11StationAssociation   Enabled   dot11StationAuthentication  Enabled
 dot11StationReAssociation   Enabled       dot11StationRequestFail  Enabled
            dot1xAuthFail   Enabled        dot1xAuthNotInitiated  Enabled
         dot1xAuthSuccess   Enabled         dot1xMacAddrAuthFail  Enabled
   dot1xMacAddrAuthSuccess   Enabled           iappContextDataSent  Enabled
     iappStationRoamedFrom   Enabled           iappStationRoamedTo  Enabled
      localMacAddrAuthFail   Enabled     localMacAddrAuthSuccess  Enabled
             pppLogonFail   Enabled              sntpServerFail  Enabled
  configFileVersionChanged   Enabled          radiusServerChanged  Enabled
               systemDown   Enabled                    systemUp  Enabled


=============================================

SNTP Information
============================================================
Service State        : Disabled
SNTP (server 1) IP   : 137.92.140.80
SNTP (server 2) IP   : 192.43.244.18
Current Time         : 00 : 14, Jan 1st, 1970
Time Zone            : -5 (BOGOTA, EASTERN, INDIANA)
Daylight Saving      : Disabled
============================================================


Station Table Information
============================================================

if-wireless G VAP [0]   :
802.11g Channel : Auto

No 802.11g Channel Stations.
.
.
.
System Information
============================================================
Serial Number        :
System Up time       : 0 days, 0 hours, 16 minutes, 51 seconds
System Name          : Enterprise wireless gP
System Location      :
System Contact       : Contact
System Country Code  : 99 - NO_COUNTRY_SET
MAC Address          : 00-12-CF-05-B7-84
IP Address           : 192.168.0.151
Subnet Mask          : 255.255.255.0
Default Gateway      : 192.168.0.1
VLAN State           : DISABLED
Management VLAN ID(AP): 1
IAPP State           : ENABLED
DHCP Client          : ENABLED
HTTP Server          : ENABLED
HTTP Server Port     : 80
HTTPS Server         : ENABLED
HTTPS Server Port    : 443
Slot Status          : Single band
Boot Rom Version     : v2.1.6
Software Version     : v4.3.3.8b02
```

```
SSH Server          : ENABLED
SSH Server Port     : 22
Telnet Server       : ENABLED
WEB Redirect        : DISABLED
DHCP Relay          : DISABLED
============================================================

Version Information
========================================
Software Version   : v4.3.3.8b02
Date               : Nov 8 2006, 09:50:03
BootRom Version    : v2.1.6
Hardware version   : R-00
========================================
Enterprise AP#
```

5.5.20 show hardware

This command displays the hardware version of the system.

Command Mode

Exec

Example

```
Enterprise AP#show hardware

Hardware Version Information
==========================================
Hardware version R01
==========================================
Enterprise AP#
```

5.6   System Logging Commands

These commands are used to configure system logging on the AP.

Table 5-7: System Logging Commands

Command	Function	Mode	Page
logging on	Controls logging of error messages	GC	157
logging host	Adds a syslog server host IP address that will receive logging messages	GC	157
logging console	Initiates logging of error messages to the console	GC	158
logging level	Defines the minimum severity level for event logging	GC	158
logging facility-type	Sets the facility type for remote logging of syslog messages	GC	159
logging clear	Clears all log entries in AP memory	GC	160
show logging	Displays the state of logging	Exec	160
show event-log	Displays all log entries in AP memory	Exec	161

5.6.1   logging on

This command controls logging of error messages; i.e., sending debug or error messages to memory. The **no** form disables the logging process.

Syntax

[no] logging on

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

The logging process controls error messages saved to memory. You can use the **logging level** command to control the type of error messages that are stored in memory.

Example

```
Enterprise AP(config)#logging on
Enterprise AP(config)#
```

5.6.2   logging host

This command specifies syslog servers host that will receive logging messages. Use the **no** form to remove syslog server host.

Syntax

logging host <**1** | **2** | **3** | **4**> <*host_name* | *host_ip_address*> [*udp_port*]
no logging host <**1** | **2** | **3** | **4**>

- **1** - First syslog server.
- **2** - Second syslog server.
- **3** - Third syslog server.
- **4** - Fourth syslog server.
- *host_name* - The name of a syslog server. (Range: 1-20 characters)
- *host_ip_address* - The IP address of a syslog server.
- *udp_port* - The UDP port used by the syslog server.

Default Setting

None

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#logging host 1 10.1.0.3
Enterprise AP(config)#
```

5.6.3   logging console

This command initiates logging of error messages to the console. Use the **no** form to disable logging to the console.

Syntax

logging console
no logging console

Default Setting

Disabled

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#logging console
Enterprise AP(config)#
```

5.6.4   logging level

This command sets the minimum severity level for event logging.

Syntax

logging level <**Emergency** | **Alert** | **Critical** | **Error** | **Warning** | **Notice** | **Informational** | **Debug**>

Default Setting

Informational

Command Mode

Global Configuration

Command Usage

Messages sent include the selected level down to Emergency level.

Level Argument	Description
Emergency	System unusable
Alert	Immediate action needed
Critical	Critical conditions (e.g., memory allocation, or free memory error - resource exhausted)
Error	Error conditions (e.g., invalid input, default used)
Warning	Warning conditions (e.g., return false, unexpected return)
Notice	Normal but significant condition, such as cold start
Informational	Informational messages only
Debug	Debugging messages

Example

```
Enterprise AP(config)#logging level alert
Enterprise AP(config)#
```

5.6.5   logging facility-type

This command sets the facility type for remote logging of syslog messages.

Syntax

logging facility-type <*type*>

type - A number that indicates the facility used by the syslog server to dispatch log messages to an appropriate service. (Range: 16-23)

Default Setting

16

Command Mode

Global Configuration

Command Usage

The command specifies the facility type tag sent in syslog messages. (See RFC 3164.) This type has no effect on the kind of messages reported by the AP. However, it may be used by the syslog server to sort messages or to store messages in the corresponding database.

Example

```
Enterprise AP(config)#logging facility 19
Enterprise AP(config)#
```

5.6.6   logging clear

This command clears all log messages stored in the AP's memory.

Syntax

logging clear

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#logging clear
Enterprise AP(config)#
```

5.6.7   show logging

This command displays the logging configuration.

Syntax

show logging

Command Mode

Exec

Example

```
Enterprise AP#show logging
Logging Information
=========================================
Syslog State             : Enabled
Logging Console State    : Enabled
Logging Level            : Alert
Logging Facility Type    : 16
Servers
   1: 192.168.1.19, UDP Port: 514, State: Enabled
   2: 0.0.0.0, UDP Port: 514, State: Disabled
   3: 0.0.0.0, UDP Port: 514, State: Disabled
   4: 0.0.0.0, UDP Port: 514, State: Disabled
=========================================
Enterprise AP#
```

5.6.8   show event-log

This command displays log messages stored in the AP's memory.

Syntax

show event-log

Command Mode

Exec

Example

```
Enterprise AP#show event-log
Mar 09 11:57:55  Information: 802.11g:11g Radio Interface Enabled
Mar 09 11:57:55  Information: 802.11g:Radio channel updated to 8
Mar 09 11:57:34  Information: 802.11g:11g Radio Interface Enabled
Mar 09 11:57:18  Information: 802.11g:11g Radio Interface Enabled
Mar 09 11:55:52  Information: SSH task: Set SSH server port to 22
Mar 09 11:55:52  Information: SSH task: Enable SSH server.
Mar 09 11:55:52  Information: Enable Telnet.
Press <n> next. <p> previous. <a> abort. <y> continue to end :
Enterprise AP#configure
Enter configuration commands, one per line. End with CTRL/Z
Enterprise AP(config)#logging clear
```

5.7 System Clock Commands

These commands are used to configure SNTP and system clock settings on the AP.

Table 5-8: System Clock Commands

Command	Function	Mode	Page
sntp-server ip	Specifies one or more time servers	GC	162
sntp-server enable	Accepts time from the specified time servers	GC	163
sntp-server date-time	Manually sets the system date and time	GC	163
sntp-server daylight-saving	Sets the start and end dates for daylight savings time	GC	164
sntp-server timezone	Sets the time zone for the AP's internal clock	GC	164
show sntp	Shows current SNTP configuration settings	Exec	165

5.7.1 sntp-server ip

This command sets the IP address of the servers to which SNTP time requests are issued. Use the this command with no arguments to clear all time servers from the current list.

Syntax

sntp-server ip <1 | 2> <*ip*>

- **1** - First time server.
- **2** - Second time server.
- *ip* - IP address of an time server (NTP or SNTP).

Default Setting

137.92.140.80
192.43.244.18

Command Mode

Global Configuration

Command Usage

When SNTP client mode is enabled using the **sntp-server enable** command, the **sntp-server ip** command specifies the time servers from which the AP polls for time updates. The AP will poll the time servers in the order specified until a response is received.

Example

```
Enterprise AP(config)#sntp-server ip 10.1.0.19
Enterprise AP#
```

Related Commands

sntp-server enable (page 163)
show sntp (page 165)

5.7.2   sntp-server enable

This command enables SNTP client requests for time synchronization with NTP or SNTP time servers specified by the **sntp-server ip** command. Use the **no** form to disable SNTP client requests.

Syntax

sntp-server enable
no sntp-server enable

Default Setting

Enabled

Command Mode

Global Configuration

Command Usage

The time acquired from time servers is used to record accurate dates and times for log events. Without SNTP, the AP only records the time starting from the factory default set at the last bootup (i.e., 00:14:00, January 1, 1970).

Example

```
Enterprise AP(config)#sntp-server enable
Enterprise AP(config)#
```

Related Commands

sntp-server ip (page 162)
show sntp (page 165)

5.7.3   sntp-server date-time

This command sets the system clock.

Default Setting

00:14:00, January 1, 1970

Command Mode

Global Configuration

Example

This example sets the system clock to 17:37 June 19, 2003.

```
Enterprise AP#sntp-server date-time
Enter Year<1970-2100>: 2003
Enter Month<1-12>: 6
Enter Day<1-31>: 19
Enter Hour<0-23>: 17
Enter Min<0-59>: 37
Enterprise AP#
```

Related Commands

sntp-server enable (page 163)

5.7.4 sntp-server daylight-saving

This command sets the start and end dates for daylight savings time. Use the **no** form to disable daylight savings time.

Syntax

sntp-server daylight-saving
no sntp-server daylight-saving

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

The command sets the system clock back one hour during the specified period.

Example

This sets daylight savings time to be used from July 1st to September 1st.

```
Enterprise AP(config)#sntp-server daylight-saving
Enter Daylight saving from which month<1-12>: 6
and which day<1-31>: 1
Enter Daylight saving end to which month<1-12>: 9
and which day<1-31>: 1
Enterprise AP(config)#
```

5.7.5 sntp-server timezone

This command sets the time zone for the AP's internal clock.

Syntax

sntp-server timezone *<hours>*

hours - Number of hours before/after UTC.
(Range: -12 to +12 hours)

Default Setting

-5 (BOGOTA, EASTERN, INDIANA)

Command Mode

Global Configuration

Command Usage

This command sets the local time zone relative to the Coordinated Universal Time (UTC, formerly Greenwich Mean Time or GMT), based on the earth's prime meridian, zero degrees longitude. To display a time corresponding to your local time, you must indicate the number of hours and minutes your time zone is east (before) or west (after) of UTC.

Example

```
Enterprise AP(config)#sntp-server timezone +8
Enterprise AP(config)#
```

5.7.6   show sntp

This command displays the current time and configuration settings for the SNTP client.

Command Mode

Exec

Example

```
Enterprise AP#show sntp

SNTP Information
=========================================================
Service State       : Enabled
SNTP (server 1) IP  : 137.92.140.80
SNTP (server 2) IP  : 192.43.244.18
Current Time        : 08 : 04, Jun 20th, 2003
Time Zone           : +8 (TAIPEI, BEIJING)
Daylight Saving     : Enabled, from Jun, 1st to Sep, 1st
=========================================================

Enterprise AP#
```

5.8 DHCP Relay Commands

Dynamic Host Configuration Protocol (DHCP) can dynamically allocate an IP address and other configuration information to network clients that broadcast a request. To receive the broadcast request, the DHCP server would normally have to be on the same subnet as the client. However, when the AP's DHCP relay agent is enabled, received client requests can be forwarded directly by the AP to a known DHCP server on another subnet. Responses from the DHCP server are returned to the AP, which then broadcasts them back to clients.

Table 5-9: DHCP Relay Commands

Command	Function	Mode	Page
dhcp-relay enable	Enables the DHCP relay agent	GC	166
dhcp-relay	Sets the primary and secondary DHCP server address	GC	166
show dhcp-relay	Shows current DHCP relay configuration settings	Exec	167

5.8.1 dhcp-relay enable

This command enables the AP's DHCP relay agent. Use the **no** form to disable the agent.

Syntax

[**no**] **dhcp-relay enable**

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

- For the DHCP relay agent to function, the primary DHCP server must be configured using the **dhcp-relay primary** command. A secondary DHCP server does not need to be configured, but it is recommended.
- If there is no response from the primary DHCP server, and a secondary server has been configured, the agent will then attempt to send DHCP requests to the secondary server.

Example

```
Enterprise AP(config)#dhcp-relay enable
Enterprise AP(config)#
```

5.8.2 dhcp-relay

This command configures the primary and secondary DHCP server addresses.

Syntax

dhcp-relay <**primary** | **secondary**> <*ip_address*>

- **primary** - The primary DHCP server.
- **secondary** - The secondary DHCP server.
- *ip_address* - IP address of the server.

Default Setting

Primary and secondary: 0.0.0.0

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#dhcp-relay primary 192.168.1.10
Enterprise AP(config)#
```

5.8.3 show dhcp-relay

This command displays the current DHCP relay configuration.

Command Mode

Exec

Example

```
Enterprise AP#show dhcp-relay
DHCP Relay          : ENABLED
Primary DHCP Server   : 192.168.1.10
Secondary DHCP Server : 0.0.0.0
Enterprise AP#
```

5.9 SNMP Commands

Controls access to this AP from management stations using the Simple Network
Management Protocol (SNMP), as well as the hosts that will receive trap messages.

Table 5-10: SNMP Commands

Command	Function	Mode	Page
snmp-server community	Sets up the community access string to permit access to SNMP commands	GC	168
snmp-server contact	Sets the system contact string	GC	169
snmp-server location	Sets the system location string	GC	169
snmp-server enable server	Enables SNMP service and traps	GC	170
snmp-server host	Specifies the recipient of an SNMP notification operation	GC	170
snmp-server trap	Enables specific SNMP notifications	GC	171
snmp-server engine id	Sets the engine ID for SNMP v3	GC	172
snmp-server user	Sets the name of the SNMP v3 user	GC	173
snmp-server targets	Configures SNMP v3 notification targets	GC	174
snmp-server filter	Configures SNMP v3 notification filters	GC	174
snmp-server filter-assignments	Assigns SNMP v3 notification filters to targets	GC	175
show snmp groups	Displays the pre-defined SNMP v3 groups	Exec	176
show snmp users	Displays SNMP v3 user settings	Exec	176
show snmp group-assignments	Displays the assignment of users to SNMP v3 groups	Exec	177
show snmp target	Displays the SNMP v3 notification targets	Exec	177
show snmp filter	Displays the SNMP v3 notification filters	Exec	178
show snmp filter-assignments	Displays the SNMP v3 notification filter assignments	Exec	178
show snmp	Displays the status of SNMP communications	Exec	179

5.9.1 snmp-server community

This command defines the community access string for the Simple Network
Management Protocol. Use the **no** form to remove the specified community string.

Syntax

snmp-server community *string* [**ro** | **rw**]
no snmp-server community *string*

- *string* - Community string that acts like a password and permits access to the SNMP protocol.

(Maximum length: 23 characters, case sensitive)

- **ro** - Specifies read-only access. Authorized management stations are only able to retrieve MIB objects.
- **rw** - Specifies read/write access. Authorized management stations are able to both retrieve and modify MIB objects.

Default Setting

- public - Read-only access. Authorized management stations are only able to retrieve MIB objects.
- private - Read/write access. Authorized management stations are able to both retrieve and modify MIB objects.

Command Mode

Global Configuration

Command Usage

If you enter a community string without the **ro** or **rw** option, the default is read only.

Example

```
Enterprise AP(config)#snmp-server community alpha rw
Enterprise AP(config)#
```

5.9.2 snmp-server contact

This command sets the system contact string. Use the **no** form to remove the system contact information.

Syntax

snmp-server contact *string*
no snmp-server contact

string - String that describes the system contact. (Maximum length: 255 characters)

Default Setting

None

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#snmp-server contact Paul
Enterprise AP(config)#
```

Related Commands

snmp-server location

5.9.3 snmp-server location

This command sets the system location string. Use the **no** form to remove the location string.

Syntax

snmp-server location *<text>*
no snmp-server location

text - String that describes the system location. (Maximum length: 255 characters)

Default Setting

None

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#snmp-server location WC-19
Enterprise AP(config)#
```

Related Commands

snmp-server contact (page 169)

5.9.4   snmp-server enable server

This command enables SNMP management access and also enables this device to send SNMP traps (i.e., notifications). Use the **no** form to disable SNMP service and trap messages.

Syntax

snmp-server enable server
no snmp-server enable server

Default Setting

Enabled

Command Mode

Global Configuration

Command Usage

- This command enables both authentication failure notifications and link-up-down notifications.
- The **snmp-server host** command specifies the host device that will receive SNMP notifications.

Example

```
Enterprise AP(config)#snmp-server enable server
Enterprise AP(config)#
```

Related Commands

snmp-server host (page 170)

5.9.5   snmp-server host

This command specifies the recipient of an SNMP notification. Use the **no** form to remove the specified host.

Syntax

snmp-server host <1 | 2 | 3 | 4> <*host_ip_address | host_name*> <*community-string*>

no snmp-server host

- **1** - First SNMP host.
- **2** - Second SNMP host.
- **3** - Third SNMP host.
- **4** - Fourth SNMP host.

- *host_ip_address* - IP of the host (the targeted recipient).
- *host_name* - Name of the host. (Range: 1-63 characters)
- *community-string* - Password-like community string sent with the notification operation. Although you can set this string using the **snmp-server host** command by itself, we recommend that you define this string using the **snmp-server community** command prior to using the **snmp-server host** command. (Maximum length: 23 characters)

Default Setting

Host Address: None
Community String: public

Command Mode

Global Configuration

Command Usage

The **snmp-server host** command is used in conjunction with the **snmp-server enable server** command to enable SNMP notifications.

Example

```
Enterprise AP(config)#snmp-server host 1 10.1.19.23 batman
Enterprise AP(config)#
```

Related Commands

snmp-server enable server

5.9.6   snmp-server trap

This command enables the AP to send specific SNMP traps (i.e., notifications). Use the **no** form to disable specific trap messages.

Syntax

snmp-server trap *<trap>*
no snmp-server trap *<trap>*

- *trap* - One of the following SNMP trap messages:
  - **dot11InterfaceGFail** - The 802.11g interface has failed.
  - **dot11InterfaceBFail** - The 802.11b interface has failed.
  - **dot11StationAssociation** - A client station has successfully associated with the AP.
  - **dot11StationAuthentication** - A client station has been successfully authenticated.
  - **dot11StationReAssociation** - A client station has successfully re-associated with the AP.
  - **dot11StationRequestFail** - A client station has failed association, re-association, or authentication.
  - **dot1xAuthFail** - A 802.1X client station has failed RADIUS authentication.
  - **dot1xAuthNotInitiated** - A client station did not initiate 802.1X authentication.
  - **dot1xAuthSuccess** - A 802.1X client station has been successfully authenticated by the RADIUS server.
  - **dot1xMacAddrAuthFail** - A client station has failed MAC address authentication with the RADIUS server.
  - **dot1xMacAddrAuthSuccess** - A client station has successfully authenticated its MAC address with the RADIUS server.
  - **iappContextDataSent** - A client station's Context Data has been sent to another AP with which the station has associated.
  - **iappStationRoamedFrom** - A client station has roamed from another AP (identified by its IP address).
  - **iappStationRoamedTo** - A client station has roamed to another AP (identified by its IP

address).

- **localMacAddrAuthFail** - A client station has failed authentication with the local MAC address database on the AP.
- **localMacAddrAuthSuccess** - A client station has successfully authenticated its MAC address with the local database on the AP.
- **pppLogonFail** - The AP has failed to log onto the PPPoE server using the configured user name and password.
- **sntpServerFail** - The AP has failed to set the time from the configured SNTP server.
- **sysConfigFileVersionChanged** - The AP's configuration file has been changed.
- **sysRadiusServerChanged** - The AP has changed from the primary RADIUS server to the secondary, or from the secondary to the primary.
- **sysSystemDown** - The AP is about to shutdown and reboot.
- **sysSystemUp** - The AP is up and running.

Default Setting

All traps enabled

Command Mode

Global Configuration

Command Usage

This command is used in conjunction with the **snmp-server host** and **snmp-server enable server** commands to enable SNMP notifications.

Example

```
Enterprise AP(config)#no snmp-server trap dot11StationAssociation
Enterprise AP(config)#
```

5.9.7   snmp-server engine-id

This command is used for SNMP v3. It is used to uniquely identify the AP among all APs in the network. Use the **no** form to delete the engine ID.

Syntax

snmp-server engine-id *<engine-id>*
no snmp-server engine-id

engine-id - Enter engine-id in hexadecimal (5-32 characters).

Default Setting

Enabled

Command Mode

Global Configuration

Command Usage

- This command is used in conjunction with the **snmp-server user** command.
- Entering this command invalidates all engine IDs that have been previously configured.
- If the engine ID is deleted or changed, all SNMP users will be cleared. You will need to reconfigure all existing users

Example

```
Enterprise AP(config)#snmp-server engine-id 1a:2b:3c:4d:00:ff
Enterprise AP(config)#
```

5.9.8   snmp-server user

This command configures the SNMP v3 users that are allowed to manage the AP. Use the **no** form to delete an SNMP v3 user.

Syntax

snmp-server user <user-name>

user-name - A user-defined string for the SNMP user. (32 characters maximum)

Default Setting

None

Command Mode

Global Configuration

Command Usage

- Up to 10 SNMPv3 users can be configured on the AP.
- The SNMP engine ID is used to compute the authentication/privacy digests from the pass phrase. You should therefore configure the engine ID with the **snmp-server engine-id** command before using this configuration command.
- The AP enables SNMP v3 users to be assigned to three pre-defined groups. Other groups cannot be defined. The available groups are:
  - RO - A read-only group using no authentication and no data encryption. Users in this group use no security, either authentication or encryption, in SNMP messages they send to the agent. This is the same as SNMP v1 or SNMP v2c.
  - RWAuth - A read/write group using authentication, but no data encryption. Users in this group send SNMP messages that use an MD5 key/password for authentication, but not a DES key/password for encryption.
  - RWPriv - A read/write group using authentication and data encryption. Users in this group send SNMP messages that use an MD5 key/password for authentication and a DES key/password for encryption. Both the MD5 and DES key/passwords must be defined.
- The command prompts for the following information to configure an SNMP v3 user:
  - *user-name* - A user-defined string for the SNMP user. (32 characters maximum)
  - *group-name* - The name of the SNMP group to which the user is assigned (32 characters maximum). There are three pre-defined groups: RO, RWAuth, or RWPriv.
  - *auth-proto* - The authentication type used for user authentication: md5 or none.
  - a*uth-passphrase* - The user password required when authentication is used (8 – 32 characters).
  - *priv-proto* - The encryption type used for SNMP data encryption: des or none.
  - *priv-passphrase* - The user password required when data encryption is used (8 – 32 characters).
- Users must be assigned to groups that have the same security levels. If a user who has "AuthPriv" security (uses authentication and encryption) is assigned to a read-only (RO) group, the user will not be able to access the database. An AuthPriv user must be assigned to the RWPriv group with the AuthPriv security level.
- To configure a user for the RWAuth group, you must include the *auth-proto* and *auth-passphrase* keywords.
- To configure a user for the RWPriv group, you must include the *auth-proto, auth-passphrase, priv-proto,* and *priv-passphrase* keywords.

Example

```
Enterprise AP(config)#snmp-server user
User Name<1-32> :chris
Group Name<1-32> :RWPriv
Authtype(md5,<cr>none):md5
Passphrase<8-32>:a good secret
Privacy(des,<cr>none) :des
Passphrase<8-32>:a very good secret
Enterprise AP(config)#
```

5.9.9 snmp-server targets

This command configures SNMP v3 notification targets. Use the **no** form to delete
an SNMP v3 target.

Syntax

snmp-server targets *<target-id>* *<ip-addr>* *<sec-name>*
  [**version** {**3**}] [**udp-port** {*port-number*}] [**notification-type**
  {**TRAP**}]
no snmp-server targets *<target-id>*

- *target-id* - A user-defined name that identifies a receiver of SNMP notifications. (Maximum length: 32 characters)
- *ip-addr* - Specifies the IP address of the management station to receive notifications.
- *sec-name* - The defined SNMP v3 user name that is to receive notifications.
- **version** - The SNMP version of notifications. Currently only version **3** is supported in this command.
- **udp-port** - The UDP port that is used on the receiving management station for notifications.
- **notification-type** - The type of notification that is sent. Currently only **TRAP** is supported.

Default Setting

None

Command Mode

Global Configuration

Command Usage

- The AP supports up to 10 SNMP v3 target IDs.
- The SNMP v3 user name that is specified in the target must first be configured using the **snmp-server user** command.

Example

```
Enterprise AP(config)#snmp-server targets mytraps 192.168.1.33 chris
Enterprise AP(config)#
```

5.9.10 snmp-server filter

This command configures SNMP v3 notification filters. Use the **no** form to delete
an SNMP v3 filter or remove a subtree from a filter.

Syntax

snmp-server filter *<filter-id>* **<include | exclude>** *<subtree>*
  [**mask** {*mask*}]
no snmp-server filter *<filter-id>* [*subtree*]

- *filter-id* - A user-defined name that identifies an SNMP v3 notification filter. (Maximum length: 32 characters)
- **include** - Defines a filter type that includes objects in the MIB subtree.
- **exclude** - Defines a filter type that excludes objects in the MIB subtree.
- *subtree* - The part of the MIB subtree that is to be filtered.
- *mask* - An optional hexadecimal value bit mask to define objects in the MIB subtree.

Default Setting

None

Command Mode

Global Configuration

Command Usage

- The AP allows up to 10 notification filters to be created. Each filter can be defined by up to 20 MIB subtree ID entries.
- Use the command more than once with the same filter ID to build a filter that includes or excludes multiple MIB objects. Note that the filter entries are applied in the sequence that they are defined.
- The MIB subtree must be defined in the form ".1.3.6.1" and always start with a ".".
- The mask is a hexadecimal value with each bit masking the corresponding ID in the MIB subtree. A "1" in the mask indicates an exact match and a "0" indicates a "wild card." For example, a mask value of 0xFFBF provides a bit mask "1111 1111 1011 1111." If applied to the subtree 1.3.6.1.2.1.2.2.1.1.23, the zero corresponds to the 10th subtree ID. When there are more subtree IDs than bits in the mask, the mask is padded with ones.

Example

```
Enterprise AP(config)#snmp-server filter trapfilter include .1
Enterprise AP(config)#snmp-server filter trapfilter exclude .1.3.6.1.2.1.2.2.1.1.23
```

5.9.11 snmp-server filter-assignments

This command assigns SNMP v3 notification filters to targets. Use the **no** form to remove an SNMP v3 filter assignment.

Syntax

snmp-server filter-assignments *<target-id>* *<filter-id>*
no snmp-server filter-assignments *<target-id>*

- *target-id* - A user-defined name that identifies a receiver of SNMP notifications. (Maximum length: 32 characters)
- *filter-id* - A user-defined name that identifies an SNMP v3 notification filter. (Maximum length: 32 characters)

Default Setting

None

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#snmp-server filter-assignments mytraps trapfilter
Enterprise AP(config)#exit
Enterprise AP#show snmp target

Host ID       : mytraps
User          : chris
IP Address    : 192.168.1.33
UDP Port      : 162
=============================
Enterprise AP#show snmp filter-assignments

                         HostID   FilterID

                         mytraps  trapfilter

Enterprise AP(config)#
```

5.9.12 show snmp groups

This command displays the SNMP v3 pre-defined groups.

Syntax

show snmp groups

Command Mode

Exec

Example

```
Enterprise AP#show snmp groups


GroupName     :RO
SecurityModel :USM
SecurityLevel :NoAuthNoPriv

GroupName     :RWAuth
SecurityModel :USM
SecurityLevel :AuthNoPriv

GroupName     :RWPriv
SecurityModel :USM
SecurityLevel :AuthPriv
Enterprise AP#
```

5.9.13 show snmp users

This command displays the SNMP v3 users and settings.

Syntax

show snmp users

Command Mode

Exec

Example

```
Enterprise AP#show snmp users

==========================================
UserName      :chris
GroupName     :RWPriv
AuthType      :MD5
   Passphrase:****************
PrivType      :DES
   Passphrase:****************
==========================================
Enterprise AP#
```

5.9.14   show snmp group-assignments

This command displays the SNMP v3 user group assignments.

Syntax

show snmp group-assignments

Command Mode

Exec

Example

```
Enterprise AP#show snmp group-assignments


GroupName     :RWPriv
UserName      :chris
Enterprise AP#

Enterprise AP#
```

5.9.15   show snmp target

This command displays the SNMP v3 notification target settings.

Syntax

show snmp target

Command Mode

Exec

Example

```
Enterprise AP#show snmp target

Host ID      : mytraps
User         : chris
IP Address   : 192.168.1.33
UDP Port     : 162
=============================
Enterprise AP#
```

5.9.16 show snmp filter

This command displays the SNMP v3 notification filter settings.

Syntax

show snmp filter [*filter-id*]

- *filter-id* - A user-defined name that identifies an SNMP v3 notification filter. (Maximum length: 32 characters)

Command Mode

Exec

Example

```
Enterprise AP#show snmp filter
Filter: trapfilter
     Type: include
  Subtree: iso.3.6.1.2.1.2.2.1

     Type: exclude
  Subtree: iso.3.6.1.2.1.2.2.1.1.23
=============================
Enterprise AP#
```

5.9.17 show snmp filter-assignments

This command displays the SNMP v3 notification filter assignments.

Syntax

show snmp filter-assignments

Command Mode

Exec

Example

```
Enterprise AP#show snmp filter-assignments

                        HostID   FilterID

                        mytraps  trapfilter
Enterprise AP#
```

5.9.18   show snmp

This command displays the SNMP configuration settings.

Command Mode

Exec

Example

```
Enterprise AP#show snmp

SNMP Information
================================================
Service State              : Enable
Community (ro)             : *****
Community (rw)             : *****
Location                   : WC-19
Contact                    : Paul

EngineId   :80:00:07:e5:80:00:00:2e:62:00:00:00:18
EngineBoots:1

Trap Destinations:
   1:       192.168.1.9, Community: *****, State: Enabled
   2:           0.0.0.0, Community: *****, State: Disabled
   3:           0.0.0.0, Community: *****, State: Disabled
   4:           0.0.0.0, Community: *****, State: Disabled


  dot11InterfaceGFail  Enabled         dot11InterfaceBFail  Enabled
  dot11StationAssociation  Enabled dot11StationAuthentication
  Enabled
  dot11StationReAssociation  Enabled    dot11StationRequestFail
  Enabled
  dot1xAuthFail  Enabled       dot1xAuthNotInitiated  Enabled
  dot1xAuthSuccess  Enabled        dot1xMacAddrAuthFail  Enabled
  dot1xMacAddrAuthSuccess  Enabled         iappContextDataSent
    Enabled
  iappStationRoamedFrom  Enabled         iappStationRoamedTo
    Enabled
  localMacAddrAuthFail  Enabled    localMacAddrAuthSuccess  Enabled
    pppLogonFail  Enabled             sntpServerFail  Enabled
  configFileVersionChanged  Enabled        radiusServerChanged
    Enabled
  systemDown  Enabled                     systemUp  Enabled

================================================
Enterprise AP#
```

5.10 Flash/File Commands

These commands are used to manage the system code or configuration files.

Table 5-11: Flash/File Commands

Command	Function	Mode	Page
bootfile	Specifies the file or image used to start up the system	GC	181
copy	Copies a code image or configuration between flash memory and a FTP/TFTP server	Exec	181
delete	Deletes a file or code image	Exec	182
dir	Displays a list of files in flash memory	Exec	183
show bootfile	Displays the name of the current operation code file that booted the system	Exec	184

5.10.1 bootfile

This command specifies the image used to start up the system.

Syntax

bootfile <*filename*>

filename - Name of the image file.

Default Setting

None

Command Mode

Exec

Command Usage

- The file name should not contain slashes (\ or /), the leading letter of the file name should not be a period (.), and the maximum length for file names is 32 characters. (Valid characters: A-Z, a-z, 0-9, ".", "-", "_")
- If the file contains an error, it cannot be set as the default file.

Example

```
Enterprise AP#bootfile -img.bin
Enterprise AP#
```

5.10.2 copy

This command copies a boot file, code image, or configuration file between the AP's flash memory and a FTP/TFTP server. When you save the configuration settings to a file on a FTP/TFTP server, that file can later be downloaded to the AP to restore system operation. The success of the file transfer depends on the accessibility of the FTP/TFTP server and the quality of the network connection.

Syntax

copy <**ftp** | **tftp**> **file**
copy config <**ftp** | **tftp**>

- **ftp** - Keyword that allows you to copy to/from an FTP server.
- **tftp** - Keyword that allows you to copy to/from a TFTP server.
- **file** - Keyword that allows you to copy to/from a flash memory file.
- **config** - Keyword that allows you to upload the configuration file from flash memory.

Default Setting

None

Command Mode

Exec

Command Usage

- The system prompts for data required to complete the copy command.
- Only a configuration file can be uploaded to an FTP/TFTP server, but every type of file can be downloaded to the AP.
- The destination file name should not contain slashes (\ or /), the leading letter of the file name should not be a period (.), and the maximum length for file names on the FTP/TFTP server is 255 characters or 32 characters for files on the AP. (Valid characters: A-Z, a-z, 0-9, ".", "-", "_")
- Due to the size limit of the flash memory, the AP supports only two operation code files.
- The system configuration file must be named "syscfg" in all copy commands.

Example

The following example shows how to upload the configuration settings to a file on the TFTP server:

```
Enterprise AP#copy config tftp
TFTP Source file name:syscfg
TFTP Server IP:192.168.1.19
Enterprise AP#
```

The following example shows how to download a configuration file:

```
Enterprise AP#copy tftp file
1. Application image
2. Config file
3. Boot block image
Select the type of download<1,2,3>:  [1]:2
TFTP Source file name:syscfg
TFTP Server IP:192.168.1.19
Enterprise AP#
```

5.10.3 delete

This command deletes a file or image.

Syntax

delete <*filename*>

filename - Name of the configuration file or image name.

Default Setting

None

Command Mode

Exec

⚠	**CAUTION**
	Beware of deleting application images from flash memory. At least one application image is required in order to boot the AP. If there are multiple image files in flash memory, and the one used to boot the AP is deleted, be sure you first use the bootfile command to update the application image file booted at startup before you reboot the AP.

Example

This example shows how to delete the test.cfg configuration file from flash memory.

```
Enterprise AP#delete test.cfg
Are you sure you wish to delete this file? <y/n>:
Enterprise AP#
```

Related Commands

bootfile (page 181)
dir (page 183)

5.10.4 dir

This command displays a list of files in flash memory.

Command Mode

Exec

Command Usage

File information is shown below:

Column Heading	Description
File Name	The name of the file.
Type	(2) Operation Code and (5) Configuration file
File Size	The length of the file in bytes.

Example

The following example shows how to display all file information:

```
Enterprise AP#dir
File Name                     Type    File Size
--------------------------    ----    -----------
dflt-img.bin                   2      1044140
syscfg                         5        16860
syscfg_bak                     5        16860
zz-img.bin                     2      1044140

    1048576 byte(s) available

Enterprise AP#
```

5.10.5   show bootfile

This command displays the name of the current operation code file that booted the system.

Syntax

show snmp filter-assignments

Command Mode

Exec

Example

```
Enterprise AP#show bootfile

Bootfile Information
=================================
Bootfile : ec-img.bin
=================================
Enterprise AP#
```

5.11 RADIUS Client

Remote Authentication Dial-in User Service (RADIUS) is a logon authentication protocol that uses software running on a central server to control access for RADIUS-aware devices to the network. An authentication server contains a database of credentials, such as users names and passwords, for each wireless client that requires access to the AP.

Table 5-12: RADIUS Client

Command	Function	Mode	Page
radius-server address	Specifies the RADIUS server	GC	185
radius-server port	Sets the RADIUS server network port	GC	186
radius-server key	Sets the RADIUS encryption key	GC	186
radius-server retransmit	Sets the number of retries	GC	186
radius-server timeout	Sets the interval between sending authentication requests	GC	187
radius-server port-accounting	Sets the RADIUS Accounting server network port	GC	187
radius-server timeout-interim	Sets the interval between transmitting accounting updates to the RADIUS server	GC	188
radius-server radius-mac-format	Sets the format for specifying MAC addresses on the RADIUS server	GC	188
radius-server vlan-format	Sets the format for specifying VLAN IDs on the RADIUS server	GC	189
show radius	Shows the current RADIUS settings	Exec	189

5.11.1 radius-server address

This command specifies the primary and secondary RADIUS servers.

Syntax

radius-server [**secondary**] **address** <*host_ip_address | host_name*>

- **secondary** - Secondary server.
- *host_ip_address* - IP address of server.
- *host_name* - Host name of server. (Range: 1-20 characters)

Default Setting

None

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#radius-server address 192.168.1.25
Enterprise AP(config)#
```

5.11.2 radius-server port

This command sets the RADIUS server network port.

Syntax

radius-server [**secondary**] **port** *<port_number>*

- **secondary** - Secondary server.
- *port_number* - RADIUS server UDP port used for authentication messages. (Range: 1024-65535)

Default Setting

1812

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#radius-server port 181
Enterprise AP(config)#
```

5.11.3 radius-server key

This command sets the RADIUS encryption key.

Syntax

radius-server [**secondary**] **key** *<key_string>*

- **secondary** - Secondary server.
- *key_string* - Encryption key used to authenticate logon access for client. Do not use blank spaces in the string. (Maximum length: 20 characters)

Default Setting

DEFAULT

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#radius-server key green
Enterprise AP(config)#
```

5.11.4 radius-server retransmit

This command sets the number of retries.

Syntax

radius-server [**secondary**] **retransmit** *number_of_retries*

- **secondary** - Secondary server.
- *number_of_retries* - Number of times the AP will try to authenticate logon access via the RADIUS server. (Range: 1 - 30)

Default Setting

3

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#radius-server retransmit 5
Enterprise AP(config)#
```

5.11.5 radius-server timeout

This command sets the interval between transmitting authentication requests to the RADIUS server.

Syntax

radius-server [**secondary**] **timeout** *number_of_seconds*

- **secondary** - Secondary server.
- *number_of_seconds* - Number of seconds the AP waits for a reply before resending a request. (Range: 1-60)

Default Setting

5

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#radius-server timeout 10
Enterprise AP(config)#
```

5.11.6 radius-server port-accounting

This command sets the RADIUS Accounting server network port.

Syntax

radius-server [**secondary**] **port-accounting** *<port_number>*

- **secondary** - Secondary server. If **secondary** is not specified, then the AP assumes you are configuring the primary RADIUS server.
- *port_number* - RADIUS Accounting server UDP port used for accounting messages. (Range: 0 or 1024-65535)

Default Setting

0 (disabled)

Command Mode

Global Configuration

Command Usage

- When the RADIUS Accounting server UDP port is specified, a RADIUS accounting session is automatically started for each user that is successfully authenticated to the AP.

Example

```
Enterprise AP(config)#radius-server port-accounting 1813
Enterprise AP(config)#
```

5.11.7 radius-server timeout-interim

This command sets the interval between transmitting accounting updates to the RADIUS server.

Syntax

radius-server [**secondary**] **timeout-interim** *<number_of_seconds>*

- **secondary** - Secondary server.
- *number_of_seconds* - Number of seconds the waits between transmitting accounting updates. (Range: 60-86400)

Default Setting

3600

Command Mode

Global Configuration

Command Usage

- The
- sends periodic accounting updates after every interim period until the user logs off and a "stop" message is sent.

Example

```
Enterprise AP(config)#radius-server timeout-interim 500
Enterprise AP(config)#
```

5.11.8 radius-server radius-mac-format

This command sets the format for specifying MAC addresses on the RADIUS server.

Syntax

radius-server radius-mac-format <**multi-colon** | **multi-dash** | **no-delimiter** | **single-dash**>

- **multi-colon** - Enter MAC addresses in the form xx:xx:xx:xx:xx:xx.
- **multi-dash** - Enter MAC addresses in the form xx-xx-xx-xx-xx-xx.
- **no-delimiter** - Enter MAC addresses in the form xxxxxxxxxxxx.
- **single-dash** - Enter MAC addresses in the form xxxxxx-xxxxxx.

Default Setting

No delimiter

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#radius-server radius-mac-format multi-dash
Enterprise AP(config)#
```

5.11.9 radius-server vlan-format

This command sets the format for specifying VLAN IDs on the RADIUS server.

Syntax

radius-server vlan-format <**hex** | **ascii**>

- **hex** - Enter VLAN IDs as a hexadecimal number.
- **ascii** - Enter VLAN IDs as an ASCII string.

Default Setting

Hex

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#radius-server vlan-format ascii
Enterprise AP(config)#
```

5.11.10 show radius

This command displays the current settings for the RADIUS server.

Default Setting

None

Command Mode

Exec

Example

```
Enterprise AP#show radius

Radius Server Information
=======================================
IP                 : 0.0.0.0
Port               : 1812
Key                : *****
Retransmit         : 3
Timeout            : 5
Radius MAC format  : no-delimiter
Radius VLAN format : HEX
=======================================

Radius Secondary Server Information
=======================================
IP                 : 0.0.0.0
Port               : 1812
Key                : *****
Retransmit         : 3
Timeout            : 5
Radius MAC format  : no-delimiter
Radius VLAN format : HEX
=======================================
Enterprise AP#
```

5.12   802.1X Authentication

The AP supports IEEE 802.1X access control for wireless clients. This control feature prevents unauthorized access to the network by requiring an 802.1X client application to submit user credentials for authentication. Client authentication is then verified by a RADIUS server using EAP (Extensible Authentication Protocol) before the AP grants client access to the network. The 802.1X EAP packets are also used to pass dynamic unicast session keys and static broadcast keys to wireless clients.

Table 5-13: 802.1X Authentication

Command	Function	Mode	Page
802.1x	Configures 802.1X as disabled, supported, or required	IC-W-VAP	191
802.1x broadcast-key-refresh-rate	Sets the interval at which the primary broadcast keys are refreshed for stations using 802.1X dynamic keying	IC-W-VAP	
802.1x session-key-refresh-rate	Sets the interval at which unicast session keys are refreshed for associated stations using dynamic keying	IC-W-VAP	
802.1x session-timeout	Sets the timeout after which a connected client must be re-authenticated	IC-W-VAP	
802.1x-supplicant enable	Enables the AP to operate as a 802.1X supplicant	GC	192
802.1x-supplicant user	Sets the supplicant user name and password for the AP	GC	192
show authentication	Shows all 802.1X authentication settings, as well as the address filter table	Exec	192

5.12.1 802.1x

This command configures 802.1X as optionally supported or as required for wireless clients. Use the **no** form to disable 802.1X support.

Syntax

802.1x <**supported** | **required**>
no 802.1x

- **supported** - Authenticates clients that initiate the 802.1X authentication process. Uses standard 802.11 authentication for all others.
- **required** - Requires 802.1X authentication for all clients.

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

- When 802.1X is disabled, the AP does not support 802.1X authentication for any station. After

successful 802.11 association, each client is allowed to access the network.

- When 802.1X is supported, the AP supports 802.1X authentication only for clients initiating the 802.1X authentication process (i.e., the AP does NOT initiate 802.1X authentication). For stations initiating 802.1X, only those stations successfully authenticated are allowed to access the network. For those stations not initiating 802.1X, access to the network is allowed after successful 802.11 association.
- When 802.1X is required, the AP enforces 802.1X authentication for all 802.11 associated stations. If 802.1X authentication is not initiated by the station, the AP will initiate authentication. Only those stations successfully authenticated with 802.1X are allowed to access the network.
- 802.1X does not apply to the 10/100Base-TX port.

Example

```
Enterprise AP(config)#802.1x supported
Enterprise AP(config)#
```

5.12.2 802.1x-supplicant enable

This command enables the AP to operate as an 802.1X supplicant for authentication. Use the **no** form to disable 802.1X authentication of the AP.

Syntax

802.1x-supplicant enable
no 802.1x-supplicant

Default

Disabled

Command Mode

Global Configuration

Command Usage

A user name and password must be configured first before the 802.1X supplicant feature can be enabled.

Example

```
Enterprise AP(config)#802.1x-supplicant enable
Enterprise AP(config)#
```

5.12.3 802.1x-supplicant user

This command sets the user name and password used for authentication of the AP when operating as a 802.1X supplicant. Use the **no** form to clear the supplicant user name and password.

Syntax

802.1x-supplicant user *<username> <password>*
no 802.1x-supplicant user

- *username* - The AP name used for authentication to the network. (Range: 1-32 alphanumeric characters)
- *password* - The MD5 password used for AP authentication. (Range: 1-32 alphanumeric characters)

Default

None

Command Mode

Global Configuration

Command Usage

The AP currently only supports EAP-MD5 CHAP for 802.1X supplicant authentication.

Example

```
Enterprise AP(config)#802.1x-supplicant user WA6102 dot1xpass
Enterprise AP(config)#
```

5.12.4 show authentication

This command shows all 802.1X authentication settings, as well as the address filter table.

Command Mode

Exec

Example

```
Enterprise AP#show authentication

Authentication Information
=============================================================
MAC Authentication Server      : DISABLED
MAC Auth Session Timeout Value : 0 min
802.1x supplicant              : DISABLED
802.1x supplicant user         : EMPTY
802.1x supplicant password     : EMPTY
Address Filtering              : ALLOWED

System Default : ALLOW addresses not found in filter table.
Filter Table

MAC Address            Status
-----------------      ----------
00-70-50-cc-99-1a      DENIED
00-70-50-cc-99-1b      ALLOWED
=============================================================
Enterprise AP(config)#
```

5.13   MAC Address Authentication

Use these commands to define MAC authentication on the AP. For local MAC authentication, first define the default filtering policy using the address filter default command. Then enter the MAC addresses to be filtered, indicating if they are allowed or denied. For RADIUS MAC authentication, the MAC addresses and filtering policy must be configured on the RADIUS server.

Table 5-14: MAC Address Authentication

Command	Function	Mode	Page
address filter default	Sets filtering to allow or deny listed addresses	GC	194
address filter entry	Enters a MAC address in the filter table	GC	195
address filter delete	Removes a MAC address from the filter table	GC	195
mac- authentication server	Sets address filtering to be performed with local or remote options	GC	196
mac- authentication session-timeout	Sets the interval at which associated clients will be re-authenticated with the RADIUS server authentication database	GC	196
show authentication	Shows all 802.1X authentication settings, as well as the address filter table	Exec	192

5.13.1   address filter default

This command sets filtering to allow or deny listed MAC addresses.

Syntax

address filter default <**allowed** | **denied**>

- **allowed** - Only MAC addresses entered as "denied" in the address filtering table are denied.
- **denied** - Only MAC addresses entered as "allowed" in the address filtering table are allowed.

Default

allowed

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#address filter default denied
Enterprise AP(config)#
```

Related Commands

address filter entry (page 195)
802.1x-supplicant user (page 192)

5.13.2 address filter entry

This command enters a MAC address in the filter table.

Syntax

address filter entry *<mac-address>* **<allowed | denied>**

- *mac-address* - Physical address of client. (Enter six pairs of hexadecimal digits separated by hyphens; e.g., 00-90-D1-12-AB-89.)
- **allowed** - Entry is allowed access.
- **denied** - Entry is denied access.

Default

None

Command Mode

Global Configuration

Command Mode

- The AP supports up to 1024 MAC addresses.
- An entry in the address table may be allowed or denied access depending on the global setting configured for the **address entry default** command.

Example

```
Enterprise AP(config)#address filter entry 00-70-50-cc-99-1a allowed
Enterprise AP(config)#
```

Related Commands

address filter default (page 194)
802.1x-supplicant user (page 192)

5.13.3 address filter delete

This command deletes a MAC address from the filter table.

Syntax

address filter delete *<mac-address>*

mac-address - Physical address of client. (Enter six pairs of hexadecimal digits separated by hyphens.)

Default

None

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#address filter delete 00-70-50-cc-99-1b
Enterprise AP(config)#
```

Related Commands

5.13.4 mac-authentication server

This command sets address filtering to be performed with local or remote options. Use the **no** form to disable MAC address authentication.

Syntax

mac-authentication server [**local** | **remote**]

- **local** - Authenticate the MAC address of wireless clients with the local authentication database during 802.11 association.
- **remote** - Authenticate the MAC address of wireless clients with the RADIUS server during 802.1X authentication.

Default

Disabled

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#mac-authentication server remote
Enterprise AP(config)#
```

Related Commands

5.13.5 mac-authentication session-timeout

This command sets the interval at which associated clients will be re-authenticated with the RADIUS server authentication database. Use the **no** form to disable reauthentication.

Syntax

mac-authentication session-timeout *<minutes>*

minutes - Re-authentication interval. (Range: 0-1440)

Default

0 (disabled)

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#mac-authentication session-timeout 1
Enterprise AP(config)#
```

5.14   Filtering Commands

The commands described in this section are used to filter communications between wireless clients, control access to the management interface from wireless clients, and filter traffic using specific Ethernet protocol types.

Table 5-15: Filtering Commands

Command	Function	Mode	Page
filter ap-manage	Prevents wireless clients from accessing the management interface	GC	198
filter uplink enable	Ethernet port MAC address filtering	GC	198
filter uplink	Adds or deletes a MAC address from the filtering table	GC	199
filter ethernet-type enable	Checks the Ethernet type for all incoming and outgoing Ethernet packets against the protocol filtering table	GC	199
filter ethernet-type protocol	Sets a filter for a specific Ethernet type	GC	200
show filters	Shows the filter configuration	Exec	201

5.14.1   filter ap-manage

This command prevents wireless clients from accessing the management interface on the AP. Use the **no** form to disable this filtering.

Syntax

filter ap-manage
no filter ap-manage

Default

Enabled

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#filter AP-manage
Enterprise AP(config)#
```

5.14.2   filter uplink enable

This command enables filtering of MAC addresses from the Ethernet port.

Syntax

[no] filter uplink enable

Default

Disabled

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#filter uplink enable
Enterprise AP(config)#
```

5.14.3 filter uplink

This command adds or deletes MAC addresses from the uplink filtering table.

Syntax

filter uplink <add | delete> *MAC address*

MAC address - Specifies a MAC address in the form xx-xx-xx-xx-xx-xx.
A maximum of four addresses can be added to the filtering table.

Default

Disabled

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#filter uplink add 00-12-34-56-78-9a
Enterprise AP(config)#
```

5.14.4 filter ethernet-type enable

This command checks the Ethernet type on all incoming and outgoing Ethernet packets against the protocol filtering table. Use the **no** form to disable this feature.

Syntax

filter ethernet-type enable
no filter ethernet-type enable

Default

Disabled

Command Mode

Global Configuration

Command Usage

This command is used in conjunction with the **filter ethernet-type protocol** command to determine which Ethernet protocol types are to be filtered.

Example

```
Enterprise AP(config)#filter ethernet-type enable
Enterprise AP(config)#
```

Related Commands

filter ethernet-type protocol

5.14.5 filter ethernet-type protocol

This command sets a filter for a specific Ethernet type. Use the **no** form to disable filtering for a specific Ethernet type.

Syntax

filter ethernet-type protocol *<protocol>*
no filter ethernet-type protocol *<protocol>*

protocol - An Ethernet protocol type. (Options: ARP, RARP, Berkeley-Trailer-Negotiation, LAN-Test, X25-Level-3, Banyan, CDP, DEC XNS, DEC-MOP-Dump-Load, DEC-MOP, DEC-LAT, Ethertalk, Appletalk-ARP, Novell-IPX(old), Novell-IPX(new), EAPOL, Telxon-TXP, Aironet-DDP, Enet-Config-Test, IP, IPv6, NetBEUI, PPPoE_Discovery, PPPoE_PPP_Session)

Default

None

Command Mode

Global Configuration

Command Usage

Use the **filter ethernet-type enable** command to enable filtering for Ethernet types specified in the filtering table, or the no **filter ethernet-type enable** command to disable all filtering based on the filtering table.

Example

```
Enterprise AP(config)#filter ethernet-type protocol ARP
Enterprise AP(config)#
```

Related Commands

filter ethernet-type enable

5.14.6   show filters

This command shows the filter options and protocol entries in the filter table.

Command Mode

Exec

Example

```
Enterprise AP#show filters

Protocol Filter Information
=======================================================================
Local AP             :Traffic among all client STAs blocked
AP Management        :ENABLED
Ethernet Type Filter :DISABLED

UPlink Access Table
-----------------------------------------------------------------------
UPlink access control:Enabled
UPlink MAC access control list       :
00-12-34-56-78-9a
-----------------------------------------------------------------------
Enabled Protocol Filters
-----------------------------------------------------------------------
No protocol filters are enabled
=======================================================================
Enterprise AP#
```

5.15 WDS Bridge Commands

The WDS Bridge commands are not applicable for the current release.

5.16 Spanning Tree Commands

The Spanning Tree commands are not applicable for the current version.

5.17   Ethernet Interface Commands

The commands described in this section configure connection parameters for the Ethernet port and wireless interface.

Table 5-16: Ethernet Interface Commands

Command	Function	Mode	Page
interface ethernet	Enters Ethernet interface configuration mode	GC	204
dns primary- server	Specifies the primary name server	IC-E	204
dns secondary- server	Specifies the secondary name server	IC-E	204
ip address	Sets the IP address for the Ethernet interface	IC-E	205
ip dhcp	Submits a DHCP request for an IP address	IC-E	206
speed-duplex	Configures speed and duplex operation on the Ethernet interface	IC-E	206
shutdown	Disables the Ethernet interface	IC-E	207
show interface ethernet	Shows the status for the Ethernet interface	Exec	207

5.17.1 interface ethernet

This command enters Ethernet interface configuration mode.

Default Setting

None

Command Mode

Global Configuration

Example

To specify the 10/100Base-TX network interface, enter the following command:

```
Enterprise AP(config)#interface ethernet
Enterprise AP(if-ethernet)#
```

5.17.2 dns server

This command specifies the address for the primary or secondary domain name server to be used for name-to-address resolution.

Syntax

dns primary-server *<server-address>*
dns secondary-server *<server-address>*

- **primary-server** - Primary server used for name resolution.
- **secondary-server** - Secondary server used for name resolution.
- *server-address* - IP address of domain-name server.

Default Setting

None

Command Mode

Global Configuration

Command Usage

The primary and secondary name servers are queried in sequence.

Example

This example specifies two domain-name servers.

```
Enterprise AP(if-ethernet)#dns primary-server 192.168.1.55
Enterprise AP(if-ethernet)#dns secondary-server 10.1.0.55
Enterprise AP(if-ethernet)#
```

Related Commands

show interface ethernet

5.17.3 ip address

This command sets the IP address for the AP. Use the **no** form to restore the default IP address.

Syntax

ip address *<ip-address> <netmask> <gateway>*
no ip address

- *ip-address* - IP address
- *netmask* - Network mask for the associated IP subnet. This mask identifies the host address bits used for routing to specific subnets.
- *gateway* - IP address of the default gateway

Default Setting

IP address: 192.168.1.1
Netmask: 255.255.255.0

Command Mode

Interface Configuration (Ethernet)

Command Usage

- DHCP is enabled by default. To manually configure a new IP address, you must first disable the DHCP client with the **no ip dhcp** command.
- You must assign an IP address to this device to gain management access over the network or to connect the AP to existing IP subnets. You can manually configure a specific IP address using this command, or direct the device to obtain an address from a DHCP server using the **ip dhcp** command. Valid IP addresses consist of four numbers, 0 to 255, separated by periods. Anything outside this format will not be accepted by the configuration program.

Example

```
Enterprise AP(config)#interface ethernet
Enter Ethernet configuration commands, one per line.
Enterprise AP(if-ethernet)#ip address 192.168.1.2 255.255.255.0 192.168.1.253
Enterprise AP(if-ethernet)#
```

Related Commands

ip dhcp (page 206)

5.17.4 ip dhcp

This command enables the AP to obtain an IP address from a DHCP server. Use the **no** form to restore the default IP address.

Syntax

ip dhcp
no ip dhcp

Default Setting

Enabled

Command Mode

Interface Configuration (Ethernet)

Command Usage

- You must assign an IP address to this device to gain management access over the network or to connect the AP to existing IP subnets. You can manually configure a specific IP address using the **ip address** command, or direct the device to obtain an address from a DHCP server using this command.
- When you use this command, the AP will begin broadcasting DHCP client requests. The current IP address (i.e., default or manually configured address) will continue to be effective until a DHCP reply is received. Requests will be broadcast periodically by this device in an effort to learn its IP address. (DHCP values can include the IP address, subnet mask, and default gateway.)

Example

```
Enterprise AP(config)#interface ethernet
Enter Ethernet configuration commands, one per line.
Enterprise AP(if-ethernet)#ip dhcp
Enterprise AP(if-ethernet)#
```

Related Commands

ip address (page 205)

5.17.5 speed-duplex

This command configures the speed and duplex mode of a given interface when autonegotiation is disabled. Use the **no** form to restore the default.

Syntax

speed-duplex <auto | 10MH | 10MF | 100MF | 100MH>

- **auto** - autonegotiate speed and duplex mode
- **10MH** - Forces 10 Mbps, half-duplex operation
- **10MF** - Forces 10 Mbps, full-duplex operation

- **100MH** - Forces 100 Mbps, half-duplex operation
- **100MF** - Forces 100 Mbps, full-duplex operation

Default Setting

Auto-negotiation is enabled by default.

Command Mode

Interface Configuration (Ethernet)

Command Usage

If autonegotiation is disabled, the speed and duplex mode must be configured to match the setting of the attached device.

Example

The following example configures the Ethernet port to 100 Mbps, full-duplex operation.

```
Enterprise AP(if-ethernet)#speed-duplex 100mf
Enterprise AP(if-ethernet)#
```

5.17.6   shutdown

This command disables the Ethernet interface. To restart a disabled interface, use the **no** form.

Syntax

shutdown
no shutdown

Default Setting

Interface enabled

Command Mode

Interface Configuration (Ethernet)

Command Usage

This command allows you to disable the Ethernet port due to abnormal behavior (e.g., excessive collisions), and reenable it after the problem has been resolved. You may also want to disable the Ethernet port for security reasons.

Example

The following example disables the Ethernet port.

```
Enterprise AP(if-ethernet)#shutdown
Enterprise AP(if-ethernet)#
```

5.17.7   show interface ethernet

This command displays the status for the Ethernet interface.

Syntax

show interface [**ethernet**]

Default Setting

Ethernet interface

Command Mode

Exec

Example

```
Enterprise AP#show interface ethernet
Ethernet Interface Information
========================================
IP Address          : 192.168.1.1
Subnet Mask         : 255.255.255.0
Default Gateway     : 192.168.1.253
Primary DNS         : 192.168.1.55
Secondary DNS       : 10.1.0.55
Speed-duplex        : 100Base-TX Half Duplex
Admin status        : Up
Operational status  : Up
========================================
Enterprise AP#
```

5.18 Wireless Interface Commands

The commands described in this section configure connection parameters for the wireless interfaces.

Table 5-17: Wireless Interface Commands

Command	Function	Mode	Page
interface wireless	Enters wireless interface configuration mode	GC	210
vap	Provides access to the VAP interface configuration mode	IC-W	210
speed	Configures the maximum data rate at which the AP transmits unicast packets	IC-W	211
multicast-data-rate	Configures the maximum rate for transmitting multicast packets on the wireless interface	IC-W	211
channel	Configures the radio channel	IC-W	213
transmit-power	Adjusts the power of the radio signals transmitted from the AP	IC-W	213
radio-mode	Forces the operating mode of the 802.11g radio	IC-W (b/g)	214
preamble	Sets the length of the 802.11g signal preamble	IC-W (b/g)	214
antenna control	Selects the antenna control method to use for the radio	IC-W	215
antenna id	Selects the antenna ID to use for the radio	IC-W	215
antenna location	Selects the location of the antenna	IC-W	216
beacon-interval	Configures the rate at which beacon signals are transmitted from the AP	IC-W	216
dtim-period	Configures the rate at which stations in sleep mode must wake up to receive broadcast/multicast transmissions	IC-W	216
fragmentation- length	Configures the minimum packet size that can be fragmented	IC-W	217
rts-threshold	Sets the packet size threshold at which an RTS must be sent to the receiving station prior to the sending station starting communications	IC-W	218
super-g	Enables Atheros proprietary Super G performance enhancements	IC-W (b/g)	218
description	Adds a description to the wireless interface	IC-W-VAP	219
ssid	Configures the service set identifier	IC-W-VAP	219
closed system	Opens access to clients without a pre-configured SSID	IC-W-VAP	220
max-association	Configures the maximum number of clients that can be associated with the AP at the same time	IC-W-VAP	220

Table 5-17: Wireless Interface Commands

Command	Function	Mode	Page
assoc- timeout-interval	Configures the idle time interval (when no frames are sent) after which a client is disassociated from the VAP interface	IC-W-VAP	221
auth- timeout-value	Configures the time interval after which clients must be re-authenticated	IC-W-VAP	221
shutdown	Disables the wireless interface	IC-W-VAP	221
show interface wireless	Shows the status for the wireless interface	Exec	222
show station	Shows the wireless clients associated with the AP	Exec	224

5.18.1 interface wireless

This command enters wireless interface configuration mode.

Syntax

interface wireless < **g**>

- **g** - 802.11g radio interface.

Default Setting

None

Command Mode

Global Configuration

Example

To specify the 802.11g interface, enter the following command:

```
Enterprise AP(config)#interface wireless g
Enterprise AP(if-wireless g)#
```

5.18.2 vap

This command provides access to the VAP (Virtual Access Point) interface configuration mode.

Syntax

vap <*vap-id*>

vap-id - The number that identifies the VAP interface. (Options: 0-3)

Default Setting

None

Command Mode

Interface Configuration (Wireless)

Example

```
Enterprise AP(if-wireless g)#vap 0
Enterprise AP(if-wireless g: VAP[0])#
```

5.18.3 speed

This command configures the maximum data rate at which the transmits unicast packets.

Syntax

speed *<speed>*

speed - Maximum access speed allowed for wireless clients.   (Options for 802.11b/g: 1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48, 54 Mbps))

Default Setting

54 Mbps

Command Mode

Interface Configuration (Wireless)

Command Usage

- The maximum transmission distance is affected by the data rate. The lower the data rate, the longer the transmission distance. Please refer to the table for maximum distances .
- When turbo mode is enabled ( ), the effective maximum speed specified by this command is double the entered value (e.g., setting the speed to 54 Mbps limits the effective maximum speed to 108 Mbps).

Example

```
Enterprise AP(if-wireless g)#speed 6
Enterprise AP(if-wireless g)#
```

5.18.4 multicast-data-rate

This command configures the maximum data rate at which the AP transmits multicast and management packets (excluding beacon packets) on the wireless interface.

Syntax

multicast-data-rate *<speed>*

speed - Maximum transmit speed allowed for multicast data.
(Options for 802.11b/g; 1, 2, 5.5, 11 Mbps

Default Setting

1 Mbps for 802.11b/g

Command Mode

Interface Configuration (Wireless)

Example

```
Enterprise AP(if-wireless g)#multicast-data-rate 5.5
Enterprise AP(if-wireless g)#
```

5.18.5 channel

This command configures the radio channel through which the AP communicates with wireless clients.

Syntax

channel <*channel* | **auto**>

- *channel* - Manually sets the radio channel used for communications with wireless clients. (Range for 802.11b/g: 1 to 14)
- **auto** - Automatically selects an unoccupied channel (if available). Otherwise, the lowest channel is selected.

Default Setting

Automatic channel selection

Command Mode

Interface Configuration (Wireless)

Command Usage

- The available channel settings are limited by local regulations, which determine the number of channels that are available.
- When multiple APs are deployed in the same area, be sure to choose channels separated by at least four channels from each other . You can deploy up to three APs in the same area for 802.11b/g (e.g., channels 1, 6, 11).
- When using Turbo Mode (Super G enabled), select channel 6.
- For most wireless adapters, the channel for wireless clients is automatically set to the same as that used by the AP to which it is linked.

Example

```
Enterprise AP(if-wireless g)#channel 1
Enterprise AP(if-wireless g)#
```

5.18.6 transmit-power

This command adjusts the power of the radio signals transmitted from the AP.

Syntax

transmit-power <*signal-strength*>

signal-strength - Signal strength transmitted from the AP. (Options: full, half, quarter, eighth, min)

Default Setting

full

Command Mode

Interface Configuration (Wireless)

Command Usage

- The "min" keyword indicates minimum power.
- The longer the transmission distance, the higher the transmission power required. But to support the maximum number of users in an area, you must keep the power as low as possible. Power selection is not just a trade off between coverage area and maximum supported clients. You also have to ensure that high strength signals do not interfere with the operation of other radio devices in your area.

Example

```
Enterprise AP(if-wireless g)#transmit-power half
Enterprise AP(if-wireless g)#
```

5.18.7 radio-mode

This command forces the operating mode for the 802.11g wireless interface.

Syntax

radio-mode <**b** | **g** | **b+g**>

- **b** - b-only mode: Both 802.11b and 802.11g clients can communicate with the AP, but 802.11g clients can only transfer data at 802.11b standard rates (up to 11 Mbps).
- **g** - g-only mode: Only 802.11g clients can communicate with the AP (up to 54 Mbps).
- **b+g** - b & g mixed mode: Both 802.11b and 802.11g clients can communicate with the AP (up to 54 Mbps).

Default Setting

b+g mode

Command Mode

Interface Configuration (Wireless - 802.11g)

Command Usage

- For Japan, only 13 channels are available when set to **g** or **b+g** modes. When set to **b** mode, 14 channels are available.
- Both the 802.11g and 802.11b standards operate within the 2.4 GHz band. If you are operating in **g** mode, any 802.11b devices in the service area will contribute to the radio frequency noise and affect network performance.

Example

```
Enterprise AP(if-wireless g)#radio-mode g
Enterprise AP(if-wireless g)#
```

5.18.8 preamble

This command sets the length of the signal preamble that is used at the start of a 802.11b/g data transmission.

Syntax

preamble [**long** | **short-or-long**]

- **long** - Sets the preamble to long (192 microseconds).
- **short-or-long** - Sets the preamble to short if no 802.11b clients are detected (96 microseconds).

Default Setting

Short-or-Long

Command Mode

Interface Configuration (Wireless - 802.11b/g)

Command Usage

- Using a short preamble instead of a long preamble can increase data throughput on the AP, but requires that all clients can support a short preamble.
- Set the preamble to long to ensure the AP can support all 802.11b and 802.11g clients.

Example

```
Enterprise AP(if-wireless g)#preamble short
Enterprise AP(if-wireless g)#
```

5.18.9 antenna control

This command selects the use of two diversity antennas or a single antenna for the radio interface.

Syntax

antenna control <**diversity** | **left** | **right**>

- **diversity** - The radio uses two identical antennas in a diversity mode.
- **left** - The radio uses a single antenna on the left side.
- **right** - The radio uses a single antenna on the right side.

Default Setting

Diversity

Command Mode

Interface Configuration (Wireless)

Command Usage

The antenna ID must be selected in conjunction with the antenna control method to configure proper use of any of the antenna options.

Example

```
Enterprise AP(if-wireless g)#antenna control right
Enterprise AP(if-wireless g)#
```

5.18.10 antenna id

This command specifies the antenna type connected to the AP represented by a four-digit hexadecimal ID number.

Syntax

antenna id <*antenna-id*>

- *antenna-id* - Specifies the ID number of an approved antenna that is connected to the AP (Range: 0x0000 - 0xFFFF)

Default Setting

0x0000 (None). The unit will not transmit until an antenna is defined

Command Mode

Interface Configuration (Wireless)

Command Usage

- The optional external antennas (if any) that are certified for use with the AP are listed by typing **antenna control id ?**. Selecting the correct antenna ID ensures that the AP's radio transmissions are within regulatory power limits for the country of operation.
- The antenna ID must be selected in conjunction with the antenna control method to configure proper use of any of the antenna options.
- In the current release, select id=0x0108 for the 8dBi omni antenna.

Example

```
Enterprise AP(if-wireless g)#antenna id 0000
Enterprise AP(if-wireless g)#
```

5.18.11 antenna location

This command selects the antenna mounting location for the radio interface.

Syntax

antenna location <**outdoor**>

- **outdoor** - The antenna is mounted outdoors.

Default Setting

Outdoor

Command Mode

Interface Configuration (Wireless)

Command Usage

- Selecting the correct location ensures that the AP only uses radio channels that are permitted in the country of operation.

Example

```
Enterprise AP(if-wireless g)#antenna location outdoor
Enterprise AP(if-wireless g)#
```

5.18.12 beacon-interval

This command configures the rate at which beacon signals are transmitted from the AP.

Syntax

beacon-interval <*interval*>

interval - The rate for transmitting beacon signals. (Range: 20-1000 milliseconds)

Default Setting

100

Command Mode

Interface Configuration (Wireless)

Command Usage

The beacon signals allow wireless clients to maintain contact with the AP. They may also carry power-management information.

Example

```
Enterprise AP(if-wireless g)#beacon-interval 150
Enterprise AP(if-wireless g)#
```

5.18.13 dtim-period

This command configures the rate at which stations in sleep mode must wake up to receive broadcast/multicast transmissions.

Syntax

dtim-period *<interval>*

interval - Interval between the beacon frames that transmit broadcast or multicast traffic. (Range: 1-255 beacon frames)

Default Setting

1

Command Mode

Interface Configuration (Wireless)

Command Usage

- The Delivery Traffic Indication Map (DTIM) packet interval value indicates how often the MAC layer forwards broadcast/multicast traffic. This parameter is necessary to wake up stations that are using Power Save mode.
- The DTIM is the interval between two synchronous frames with broadcast/multicast information. The default value of 2 indicates that the AP will save all broadcast/multicast frames for the Basic Service Set (BSS) and forward them after every second beacon.
- Using smaller DTIM intervals delivers broadcast/multicast frames in a more timely manner, causing stations in Power Save mode to wake up more often and drain power faster. Using higher DTIM values reduces the power used by stations in Power Save mode, but delays the transmission of broadcast/multicast frames.

Example

```
Enterprise AP(if-wireless g)#dtim-period 100
Enterprise AP(if-wireless g)#
```

5.18.14 fragmentation-length

This command configures the minimum packet size that can be fragmented when passing through the AP.

Syntax

fragmentation-length *<length>*

length - Minimum packet size for which fragmentation is allowed. (Range: 256-2346 bytes)

Default Setting

2346

Command Mode

Interface Configuration (Wireless)

Command Usage

- If the packet size is smaller than the preset Fragment size, the packet will not be segmented.
- Fragmentation of the PDUs (Package Data Unit) can increase the reliability of transmissions because it increases the probability of a successful transmission due to smaller frame size. If there is significant interference present, or collisions due to high network utilization, try setting the fragment size to send smaller fragments. This will speed up the retransmission of smaller frames. However, it is more efficient to set the fragment size larger if very little or no interference is present because it requires overhead to send multiple frames.

Example

```
Enterprise AP(if-wireless g)#fragmentation-length 512
Enterprise AP(if-wireless g)#
```

5.18.15 rts-threshold

This command sets the packet size threshold at which a Request to Send (RTS) signal must be sent to the receiving station prior to the sending station starting communications.

Syntax

rts-threshold *<threshold>*

threshold - Threshold packet size for which to send an RTS. (Range: 0-2347 bytes)

Default Setting

2347

Command Mode

Interface Configuration (Wireless)

Command Usage

- If the threshold is set to 0, the AP always sends RTS signals. If set to 2347, the AP never sends RTS signals. If set to any other value, and the packet size equals or exceeds the RTS threshold, the RTS/CTS (Request to Send / Clear to Send) mechanism will be enabled.
- The AP sends RTS frames to a receiving station to negotiate the sending of a data frame. After receiving an RTS frame, the station sends a CTS frame to notify the sending station that it can start sending data.
- APs contending for the wireless medium may not be aware of each other. The RTS/CTS mechanism can solve this "Hidden Node" problem.

Example

```
Enterprise AP(if-wireless g)#rts-threshold 256
Enterprise AP(if-wireless g)#
```

5.18.16 super-g

This command enables Atheros proprietary Super G performance enhancements. Use the **no** form to disable this function.

Syntax

[**no**] **super-g**

Default Setting

Disabled

Command Mode

Interface Configuration (Wireless - 802.11g)

Command Usage

These enhancements include bursting, compression, fast frames and dynamic turbo. Maximum throughput ranges between 40 to 60 Mbps for connections to Atheros-compatible clients.

Example

```
Enterprise AP(if-wireless g)#super g
Enterprise AP(if-wireless g)#
```

5.18.17 description

This command adds a description to a the wireless interface. Use the **no** form to remove the description.

Syntax

description *<string>*
no description

string - Comment or a description for this interface.
(Range: 1-80 characters)

Default Setting

Radio G: Enterprise 802.11g Access Point

Command Mode

Interface Configuration (Wireless-VAP)

Example

```
Enterprise AP(if-wireless g: VAP[0])#description RD-AP#3
Enterprise AP(if-wireless g: VAP[0])#
```

5.18.18 ssid

This command configures the service set identifier (SSID).

Syntax

ssid *<string>*

string - The name of a basic service set supported by the AP. (Range: 0 - 7 characters)

Default Setting

802.11g Radio: VAP_TEST_11G (0 to 3)

Command Mode

Interface Configuration (Wireless-VAP)

Command Usage

Clients that want to connect to the wireless network via an AP must set their SSIDs to the same as that of the AP.

Example

```
Enterprise AP(if-wireless g: VAP[0])#ssid RD-AP#3
Enterprise AP(if-wireless g)#
```

5.18.19 closed-system

This command prohibits access to clients without a pre-configured SSID. Use the **no** form to disable this feature.

Syntax

closed-system
no closed-system

Default Setting

Disabled

Command Mode

Interface Configuration (Wireless-VAP)

Command Usage

When closed system is enabled, the AP will not include its SSID in beacon messages. Nor will it respond to probe requests from clients that do not include a fixed SSID.

Example

```
Enterprise AP(if-wireless g: VAP[0])#closed-system
Enterprise AP(if-wireless g)#
```

5.18.20 max-association

This command configures the maximum number of clients that can be associated with the AP at the same time.

Syntax

max-association *<count>*

count - Maximum number of associated stations. (Range: 0-64)

Default Setting

64

Command Mode

Interface Configuration (Wireless-VAP)

Example

```
Enterprise AP(if-wireless g: VAP[0])#max-association 32
Enterprise AP(if-wireless g)#
```

5.18.21 assoc-timeout-interval

This command configures the idle time interval (when no frames are sent) after which the client is disassociated from the VAP interface.

Syntax

assoc-timeout-interval *<minutes>*

minutes - The number of minutes of inactivity before disassociation. (Range: 5-60)

Default Setting

30

Command Mode

Interface Configuration (Wireless-VAP)

Example

```
Enterprise AP(if-wireless g: VAP[0])#association-timeout-interval 20
Enterprise AP(if-wireless g: VAP[0])#
```

5.18.22 auth-timeout-value

This command configures the time interval within which clients must complete authentication to the VAP interface.

Syntax

auth-timeout-value *<minutes>*

minutes - The number of minutes before re-authentication. (Range: 5-60)

Default Setting

60

Command Mode

Interface Configuration (Wireless-VAP)

Example

```
Enterprise AP(if-wireless g: VAP[0])#auth-timeout-value 40
Enterprise AP(if-wireless g: VAP[0])#
```

5.18.23 shutdown

This command disables the wireless interface. Use the **no** form to restart the interface.

Syntax

shutdown
no shutdown

Default Setting

Interface enabled

Command Mode

Interface Configuration (Wireless-VAP)

Command Usage

You must first enable VAP interface 0 before you can enable VAP interfaces 1, 2, 3, 4, 5, 6, or 7.

Example

```
Enterprise AP(if-wireless g: VAP[0])#shutdown
Enterprise AP(if-wireless g)#
```

5.18.24 show interface wireless

This command displays the status for the wireless interface.

Syntax

show interface wireless < **g**> *vap-id*

- **g** - 802.11g radio interface.
- *vap-id* - The number that identifies the VAP interface. (Options: 0~3)

Command Mode

Exec

Example

```
Enterprise AP#show interface wireless g 0

Wireless Interface Information
==========================================================================
----------------Identification---------------------------------------------
Description                    : Enterprise 802.11g Access Point
SSID                          : VAP_TEST_11G 0
Channel                       : 1 (AUTO)
Status                        : ENABLED
MAC Address                   : 00:03:7f:fe:03:02
----------------802.11 Parameters------------------------------------------
Radio Mode                    : b & g mixed mode
Protection Method             : CTS only
Transmit Power                : FULL (16 dBm)
Max Station Data Rate         : 54Mbps
Multicast Data Rate           : 5.5Mbps
Fragmentation Threshold       : 2346 bytes
RTS Threshold                 : 2347 bytes
Beacon Interval               : 100 TUs
Authentication Timeout Interval : 60 Mins
Association Timeout Interval   : 30 Mins
DTIM Interval                 : 1 beacon
Preamble Length               : LONG
Maximum Association           : 64 stations
MIC Mode                      : Software
Super G                       : Disabled
VLAN ID                       : 1
----------------Security---------------------------------------------------
Closed System                 : Disabled
Multicast cipher              : WEP
Unicast cipher                : TKIP and AES
WPA clients                   : DISABLED
WPA Key Mgmt Mode             : PRE SHARED KEY
WPA PSK Key Type              : PASSPHRASE
WPA PSK Key                   : EMPTY
PMKSA Lifetime                : 720 minutes
Encryption                    : ENABLED
Default Transmit Key          : 1
Common Static Keys            : Key 1: EMPTY      Key 2: EMPTY
                                Key 3: EMPTY      Key 4: EMPTY
Pre-Authentication            : DISABLED
Authentication Type           : SHARED
```

```
----------------802.1x-----------------------------------------------
802.1x                         : DISABLED
Broadcast Key Refresh Rate     : 30 min
Session Key Refresh Rate       : 30 min
802.1x Session Timeout Value   : 0 min
----------------Antenna-----------------------------------------------
Antenna Control method         : Diversity
Antenna ID                     : 0x0000(Default Antenna)
Antenna Location               : Outdoor
----------------Quality of Service------------------------------------
WMM Mode                       : SUPPORTED
WMM Acknowledge Policy
AC0(Best Effort)               : Acknowledge
AC1(Background)                : Acknowledge
AC2(Video)                     : Acknowledge
AC3(Voice)                     : Acknowledge
WMM BSS Parameters
AC0(Best Effort)               : logCwMin:  4  logCwMax: 10  AIFSN:  3
                                 Admission Control: No
                                 TXOP Limit: 0.000 ms
AC1(Background)                : logCwMin:  4  logCwMax: 10  AIFSN:  7
                                 Admission Control: No
                                 TXOP Limit: 0.000 ms
AC2(Video)                     : logCwMin:  3  logCwMax:  4  AIFSN:  2
                                 Admission Control: No
                                 TXOP Limit: 3.008 ms
AC3(Voice)                     : logCwMin:  2  logCwMax:  3  AIFSN:  2
                                 Admission Control: No
                                 TXOP Limit: 1.504 ms
WMM AP Parameters
AC0(Best Effort)               : logCwMin:  4  logCwMax:  6  AIFSN:  3
                                 Admission Control: No
                                 TXOP Limit: 0.000 ms
AC1(Background)                : logCwMin:  4  logCwMax: 10  AIFSN:  7
                                 Admission Control: No
                                 TXOP Limit: 0.000 ms
AC2(Video)                     : logCwMin:  3  logCwMax:  4  AIFSN:  1
                                 Admission Control: No
                                 TXOP Limit: 3.008 ms
AC3(Voice)                     : logCwMin:  2  logCwMax:  3  AIFSN:  1
                                 Admission Control: No
                                 TXOP Limit: 1.504 ms
======================================================================
Enterprise AP#
```

5.18.25 show station

This command shows the wireless clients associated with the AP.

Command Mode

Exec

Example

```
Enterprise AP#show station

Station Table Information
=========================================================
if-wireless g VAP [0]   :
802.11g Channel : 60

No 802.11g Channel Stations.
.
.
.
if-wireless G VAP [0]   :
802.11g Channel : 1
802.11g Channel Station Table

Station Address   : 00-04-23-94-9A-9C VLAN ID: 0
Authenticated Associated    Forwarding    KeyType
TRUE          FALSE          FALSE         NONE
Counters:pkts   Tx   /   Rx    bytes   Tx   /   Rx
                20/        0           721/        0
Time:Associated  LastAssoc   LastDisAssoc LastAuth
            0           0          0          0

if-wireless G VAP [1]   :
802.11g Channel : 1

No 802.11g Channel Stations.
.
.
.
Enterprise AP#
```

5.19   Rogue AP Detection Commands

A "rogue AP" is either an AP that is not authorized to participate in the wireless network, or an AP that does not have the correct security configuration. Rogue APs can potentially allow unauthorized users access to the network. Alternatively, client stations may mistakenly associate to a rogue AP and be prevented from accessing network resources. Rogue APs may also cause radio interference and degrade the wireless LAN performance.

The AP can be configured to periodically scan all radio channels and find other APs within range. A database of nearby APs is maintained where any rogue APs can be identified.

Table 5-18: Rogue AP Detection Commands

Command	Function	Mode	Page
rogue-ap enable	Enables the periodic detection of other nearby APs	GC	226
rogue-ap authenticate	Enables identification of all APs	GC	227
rogue-ap duration	Sets the duration that all channels are scanned	GC	227
rogue-ap interval	Sets the time between each scan	GC	228
rogue-ap scan	Forces an immediate scan of all radio channels	GC	228
show rogue-ap	Shows the current database of detected APs	Exec	229

5.19.1   rogue-ap enable

This command enables the periodic detection of nearby APs. Use the **no** form to disable periodic detection.

Syntax

[no] rogue-ap enable

Default Setting

Disabled

Command Mode

Interface Configuration (Wireless)

Command Usage

- While the AP scans a channel for rogue APs, wireless clients will not be able to connect to the AP. Therefore, avoid frequent scanning or scans of a long duration unless there is a reason to believe that more intensive scanning is required to find a rogue AP.
- A "rogue AP" is either an AP that is not authorized to participate in the wireless network, or an AP that does not have the correct security configuration. Rogue APs can be identified by unknown BSSID (MAC address) or SSID configuration. A database of nearby sh
- s should therefore be maintained on a RADIUS server, allowing any rogue APs to be identified (see "rogue-ap authenticate" on page 227). The rogue AP database can be viewed using

the **show rogue-ap** command.
- The AP sends Syslog messages for each detected AP during a rogue AP scan.

Example

```
Enterprise AP(if-wireless g)#rogue-ap enable
configure either syslog or trap or both to receive the rogue APs detected.
Enterprise AP(if-wireless g)#
```

5.19.2 rogue-ap authenticate

This command forces the unit to authenticate all APs on the network. Use the **no** form to disable this function.

Syntax

[**no**] **rogue-ap authenticate**

Default Setting

Disabled

Command Mode

Interface Configuration (Wireless)

Command Usage

Enabling authentication in conjunction with a database of approved APs stored on a RADIUS server allows the AP to discover rogue APs. With authentication enabled and a configure RADIUS server, the AP checks the MAC address/Basic Service Set Identifier (BSSID) of each AP that it finds against a RADIUS server to determine whether the AP is allowed. With authentication disabled, the AP can identify its neighboring APs only; it cannot identify whether the APs are allowed or are rogues. If you enable authentication, you should also configure a RADIUS server for this AP (see "RADIUS" on page 48).

Example

```
Enterprise AP(if-wireless g)#rogue-ap authenticate
Enterprise AP(if-wireless g)#
```

5.19.3 rogue-ap duration

This command sets the scan duration for detecting APs.

Syntax

rogue-ap duration *<milliseconds>*

milliseconds - The duration of the scan. (Range: 100-1000 milliseconds)

Default Setting

350 milliseconds

Command Mode

Interface Configuration (Wireless)

Command Usage

- During a scan, client access may be disrupted and new clients may not be able to associate to the AP. If clients experience severe disruption, reduce the scan duration time.
- A long scan duration time will detect more APs in the area, but causes more disruption to client access.

Example

```
Enterprise AP(if-wireless g)#rogue-ap duration 200
Enterprise AP(if-wireless g)#
```

Related Commands

rogue-ap interval (page 228)

5.19.4 rogue-ap interval

This command sets the interval at which to scan for APs.

Syntax

rogue-ap interval *<minutes>*

minutes - The interval between consecutive scans. (Range: 30-10080 minutes)

Default Setting

720 minutes

Command Mode

Interface Configuration (Wireless)

Command Usage

This command sets the interval at which scans occur. Frequent scanning will more readily detect other APs, but will cause more disruption to client access.

Example

```
Enterprise AP(if-wireless g)#rogue-ap interval 120
Enterprise AP(if-wireless g)#
```

Related Commands

rogue-ap duration (page 227)

5.19.5 rogue-ap scan

This command starts an immediate scan for APs on the radio interface.

Default Setting

Disabled

Command Mode

Interface Configuration (Wireless)

Command Usage

While the AP scans a channel for rogue APs, wireless clients will not be able to connect to the AP. Therefore, avoid frequent scanning or scans of a long duration unless there is a reason to believe that more intensive scanning is required to find a rogue AP.

Example

```
Enterprise AP(if-wireless g)#rogue-ap scan
Enterprise AP(if-wireless g)#rogueApDetect Completed (Radio G) : 9 APs detected
rogueAPDetect (Radio G): refreshing ap database now

Enterprise AP(if-wireless g)#
```

5.19.6 show rogue-ap

This command displays the current rogue AP database.

Command Mode

Exec

Example

```
Enterprise AP#show rogue-ap

802.11g Channel : Rogue AP Status
AP Address(BSSID)          SSID    Channel(MHz) RSSI Type Privacy RSN
======================================================================
00-04-e2-2a-37-23         WLAN1AP  11(2462 MHz)   17  ESS      0   0
00-04-e2-2a-37-3d             ANY   7(2442 MHz)   42  ESS      0   0
00-04-e2-2a-37-49         WLAN1AP   9(2452 MHz)   42  ESS      0   0
00-90-d1-08-9d-a7         WLAN1AP   1(2412 MHz)   12  ESS      0   0
00-30-f1-fb-31-f4            WLAN   6(2437 MHz)   16  ESS      0   0
Enterprise AP#
```

5.20   Wireless Security Commands

The commands described in this section configure parameters for wireless security on the 802.11g interface.

Table 5-19: Wireless Security Commands

Command	Function	Mode	Page
auth	Defines the 802.11 authentication type allowed by the AP	IC-W-VAP	232
encryption	Defines whether or not WEP encryption is used to provide privacy for wireless communications	IC-W-VAP	232
key	Sets the keys used for WEP encryption	IC-W	232
transmit-key	Sets the index of the key to be used for encrypting data frames sent between the AP and wireless clients	IC-W-VAP	233
cipher-suite	Selects an encryption method for the global key used for multicast and broadcast traffic	IC-W-VAP	234
mic_mode	Specifies how to calculate the Message Integrity Check (MIC)	IC-W	235
wpa-pre-shared- key	Defines a WPA preshared-key value	IC-W-VAP	235
pmksa-lifetime	Sets the lifetime PMK security associations	IC-W-VAP	236
pre-authentication	Enables WPA2 pre-authentication for fast roaming	IC-W-VAP	236

5.20.1   auth

This command configures authentication for the VAP interface.

Syntax

auth <**open-system** | **shared-key** | **wpa** | **wpa-psk** | **wpa2** | **wpa2-psk** | **wpa-wpa2-mixed** | **wpa-wpa2-psk-mixed** | > <required | supported>

- **open-system** - Accepts the client without verifying its identity using a shared key. "Open" authentication means either there is no encryption (if encryption is disabled) or WEP-only encryption is used (if encryption is enabled).
- **shared-key** - Authentication is based on a shared key that has been distributed to all stations.
- **wpa** - Clients using WPA are accepted for authentication.
- **wpa-psk** - Clients using WPA with a Pre-shared Key are accepted for authentication.
- **wpa2** - Clients using WPA2 are accepted for authentication.
- **wpa2-psk** - Clients using WPA2 with a Pre-shared Key are accepted for authentication.
- **wpa-wpa2-mixed** - Clients using WPA or WPA2 are accepted for authentication.
- **wpa-wpa2-psk-mixed** - Clients using WPA or WPA2 with a Pre-shared Key are accepted for authentication
- **required** - Clients are required to use WPA or WPA2.
- **supported** - Clients may use WPA or WPA2, if supported.

Default Setting

open-system

Command Mode

Interface Configuration (Wireless-VAP)

Command Usage

- The **auth** command automatically configures settings for each authentication type, including encryption, 802.1X, and cipher suite. The command **auth open-system** disables encryption and 802.1X.

- To use WEP shared-key authentication, set the authentication type to "shared-key" and define at least one static WEP key with the **key** command. Encryption is automatically enabled by the command.

- To use WEP encryption only (no authentication), set the authentication type to "open-system." Then enable WEP with the **encryption** command, and define at least one static WEP key with the **key** command.

- When any WPA or WPA2 option is selected, clients are authenticated using 802.1X via a RADIUS server. Each client must be WPA-enabled or support 802.1X client software. The 802.1X settings (see "802.1X Authentication" on page 191) and RADIUS server details (see "RADIUS Client" on page 185) must be configured on the AP. A RADIUS server must also be configured and be available in the wired network.

- If a WPA/WPA2 mode that operates over 802.1X is selected (WPA, WPA2, WPA-WPA2-mixed, or WPA-WPA2-PSK-mixed), the 802.1X settings (see "802.1X Authentication" on page 191) and RADIUS server details (see "RADIUS Client" on page 185) must be configured. Be sure you have also configured a RADIUS server on the network before enabling authentication. Also, note that each client has to be WPA-enabled or support 802.1X client software. A RADIUS server must also be configured and be available in the wired network.

- If a WPA/WPA2 Pre-shared Key mode is selected (WPA-PSK, WPA2-PSK or WPA-WPA2-PSK-mixed), the key must first be generated and distributed to all wireless clients before they can successfully associate with the AP. Use the wpa-preshared-key command to configure the key (see "key" on page 232 and "transmit-key" on page 233).

- WPA2 defines a transitional mode of operation for networks moving from WPA security to WPA2. WPA2 Mixed Mode allows both WPA and WPA2 clients to associate to a common VAP interface. When the encryption cipher suite is set to TKIP, the unicast encryption cipher (TKIP or AES-CCMP) is negotiated for each client. The AP advertises it's supported encryption ciphers in beacon frames and probe responses. WPA and WPA2 clients select the cipher they support and return the choice in the association request to the . For mixed-mode operation, the cipher used for broadcast frames is always TKIP. WEP encryption is not allowed.

- The "required" option places the VAP into TKIP only mode. The "supported" option places the VAP into TKIP+AES+WEP mode. The "required" mode is used in WPA-only environments.

- The "supported" mode can be used for mixed environments with legacy WPA products, specifically WEP. (For example, WPA+WEP. The WPA2+WEP environment is not available because WPA2 does not support WEP). To place the VAP into AES only mode, use "required" and then select the "cipher-ccmp" option for the cipher-suite command.

Example

```
Enterprise AP(if-wireless g: VAP[0])#auth shared-key
Enterprise AP(if-wireless g)#
```

Related Commands

encryption (page 232)
key (page 232)

5.20.2 encryption

This command enables data encryption for wireless communications. Use the **no** form to disable data encryption.

Syntax

encryption
no encryption

Default Setting

disabled

Command Mode

Interface Configuration (Wireless-VAP)

Command Usage

- Wired Equivalent Privacy (WEP) is implemented in this device to prevent unauthorized access to your wireless network. For more secure data transmissions, enable encryption with this command, and set at least one static WEP key with the **key** command.
- The WEP settings must be the same on each client in your wireless network.
- Note that WEP protects data transmitted between wireless nodes, but does not protect any transmissions over your wired network or over the Internet.
- You must enable data encryption in order to enable all types of encryption (WEP, TKIP, and AES-CCMP) in the AP.

Example

```
Enterprise AP(if-wireless g: VAP[0])#encryption
Enterprise AP(if-wireless g)#
```

Related Commands

key (page 232)

5.20.3 key

This command sets the keys used for WEP encryption. Use the **no** form to delete a configured key.

Syntax

key *<index> <size> <type> <value>*
no key *index*

- *index* - Key index. (Range: 1-4)
- *size* - Key size. (Options: 64, 128, or 152 bits)
- *type* - Input format. (Options: ASCII, HEX)
- *value* - The key string.
  - For 64-bit keys, use 5 alphanumeric characters or 10 hexadecimal digits.

- For 128-bit keys, use 13 alphanumeric characters or 26 hexadecimal digits.
- For 152-bit keys, use 16 alphanumeric characters or 32 hexadecimal digits.

Default Setting

None

Command Mode

Interface Configuration (Wireless)

Command Usage

- To enable Wired Equivalent Privacy (WEP), use the **auth shared-key** command to select the "shared key" authentication type, use the **key** command to configure at least one key, and use the **transmit-key** command to assign a key to one of the VAP interfaces.
- If WEP option is enabled, all wireless clients must be configured with the same shared keys to communicate with the AP.
- The encryption index, length and type configured in the AP must match those configured in the clients.

Example

```
Enterprise AP(if-wireless g)#key 1 64 hex 1234512345
Enterprise AP(if-wireless g)#key 2 128 ascii asdeipadjsipd
Enterprise AP(if-wireless g)#key 3 64 hex 12345123451234512345123456
Enterprise AP(if-wireless g)#
```

Related Commands

key (page 232)
encryption (page 232)
transmit-key (page 233)

5.20.4 transmit-key

This command sets the index of the key to be used for encrypting data frames for broadcast or multicast traffic transmitted from the VAP to wireless clients.

Syntax

transmit-key *<index>*

index - Key index. (Range: 1-4)

Default Setting

1

Command Mode

Interface Configuration (Wireless-VAP)

Command Usage

- If you use WEP key encryption option, the AP uses the transmit key to encrypt multicast and broadcast data signals that it sends to client devices. Other keys can be used for decryption of data from clients.
- When using IEEE 802.1X, the AP uses a dynamic key to encrypt unicast and broadcast messages to 802.1X-enabled clients. However, because the AP sends the keys during the 802.1X authentication process, these keys do not have to appear in the client's key list.
- In a mixed-mode environment with clients using static and dynamic keys, select transmit key index 2, 3, or 4. The AP uses transmit key index 1 for the generation of dynamic keys.

Example

```
Enterprise AP(if-wireless g: VAP[0])#transmit-key 2
Enterprise AP(if-wireless g)#
```

5.20.5   cipher-suite

This command defines the cipher algorithm used to encrypt the global key for broadcast and multicast traffic when using WiFi Protected Access (WPA) security.

Syntax

multicast-cipher <**aes-ccmp** | **tkip** | **wep**>

- **aes-ccmp** - Use AES-CCMP encryption for the unicast and multicast cipher.
- **tkip** - Use TKIP encryption for the multicast cipher. TKIP or AES-CCMP can be used for the unicast cipher depending on the capability of the client.
- **wep** - Use WEP encryption for the multicast cipher. TKIP or AES-CCMP can be used for the unicast cipher depending on the capability of the client.

Default Setting

wep

Command Mode

Interface Configuration (Wireless-VAP)

Command Usage

- WPA enables the AP to support different unicast encryption keys for each client. However, the global encryption key for multicast and broadcast traffic must be the same for all clients.
- If any clients supported by the AP are not WPA enabled, the multicast-cipher algorithm must be set to WEP.
- WEP is the first generation security protocol used to encrypt data crossing the wireless medium using a fairly short key. Communicating devices must use the same WEP key to encrypt and decrypt radio signals. WEP has many security flaws, and is not recommended for transmitting highly sensitive data.
- TKIP provides data encryption enhancements including per-packet key hashing (i.e., changing the encryption key on each packet), a message integrity check, an extended initialization vector with sequencing rules, and a re-keying mechanism. Select TKIP if there are clients in the network that are not WPA2 compliant.
- TKIP defends against attacks on WEP in which the unencrypted initialization vector in encrypted packets is used to calculate the WEP key. TKIP changes the encryption key on each packet, and rotates not just the unicast keys, but the broadcast keys as well. TKIP is a replacement for WEP that removes the predictability that intruders relied on to determine the WEP key.
- AES-CCMP (Advanced Encryption Standard Counter-Mode/CBCMAC Protocol): WPA2 is backward compatible with WPA, including the same 802.1X and PSK modes of operation and support for TKIP encryption. The main enhancement is its use of AES Counter-Mode encryption with Cipher Block Chaining Message Authentication Code (CBC-MAC) for message integrity. The AES Counter-Mode/CBCMAC Protocol (AES-CCMP) provides extremely robust data confidentiality using a 128-bit key. The AES-CCMP encryption cipher is specified as a standard requirement for WPA2. However, the computational intensive operations of AES-CCMP requires hardware support on client devices. Therefore to implement WPA2 in the network, wireless clients must be upgraded to WPA2-compliant hardware.

Example

```
Enterprise AP(if-wireless g: VAP[0])#multicast-cipher TKIP
Enterprise AP(if-wireless g)#
```

5.20.6 mic_mode

This command specifies how to calculate the Message Integrity Check (MIC).

Syntax

mic_mode <**hardware** | **software**>

- **hardware** - Uses hardware to calculate the MIC.
- **software** - Uses software to calculate the MIC.

Default Setting

software

Command Mode

Interface Configuration (Wireless)

Command Usage

- The Michael Integrity Check (MIC) is part of the Temporal Key Integrity Protocol (TKIP) encryption used in WiFi Protected Access (WPA) security. The MIC calculation is performed in the AP for each transmitted packet and this can impact throughput and performance. The AP supports a choice of hardware or software for MIC calculation. The performance of the AP can be improved by selecting the best method for the specific deployment.
- Using the "hardware" option provides best performance when the number of supported clients is less than 27.
- Using the "software" option provides the best performance for a large number of clients on one radio interface. Throughput may be reduced when the 802.11g interface supports a high number of clients simultaneously.

Example

```
Enterprise AP(if-wireless g)#mic_mode hardware
Enterprise AP(if-wireless g)#
```

5.20.7 wpa-pre-shared-key

This command defines a WiFi Protected Access (WPA/WPA2) Pre-shared-key.

Syntax

wpa-pre-shared-key <**hex** | **passphrase-key**> <*value*>

- **hex** - Specifies hexadecimal digits as the key input format.
- **passphrase-key** - Specifies an ASCII pass-phrase string as the key input format.
- *value* - The key string. For ASCII input, specify a string between 8 and 63 characters. For HEX input, specify exactly 64 digits.

Command Mode

Interface Configuration (Wireless-VAP)

Command Usage

- To support WPA or WPA2 for client authentication, use the **auth** command to specify the authentication type, and use the **wpa-preshared-key** command to specify one static key.
- If WPA or WPA2 is used with pre-shared-key mode, all wireless clients must be configured with the same pre-shared key to communicate with the AP's VAP interface.

Example

```
Enterprise AP(if-wireless g: VAP[0])#wpa-pre-shared-key ASCII agoodsecret
Enterprise AP(if-wireless g)#
```

Related Commands

auth (page 230)

5.20.8 pmksa-lifetime

This command sets the time for aging out cached WPA2 Pairwise Master Key Security Association (PMKSA) information for fast roaming.

Syntax

pmksa-lifetime *<minutes>*

  minutes - The time for aging out PMKSA information. (Range: 0 - 14400 minutes)

Default Setting

720 minutes

Command Mode

Interface Configuration (Wireless-VAP)

Command Usage

- WPA2 provides fast roaming for authenticated clients by retaining keys and other security information in a cache, so that if a client roams away from an AP and then returns reauthentication is not required.
- When a WPA2 client is first authenticated, it receives a Pairwise Master Key (PMK) that is used to generate other keys for unicast data encryption. This key and other client information form a Security Association that the AP names and holds in a cache. The lifetime of this security association can be configured with this command. When the lifetime expires, the client security association and keys are deleted from the cache. If the client returns to the AP, it requires full reauthentication.
- The AP can store up to 256 entries in the PMKSA cache.

Example

```
Enterprise AP(if-wireless g: VAP[0])#wpa-pre-shared-key ASCII agoodsecret
Enterprise AP(if-wireless g: VAP[0])#
```

5.20.9 pre-authentication

This command enables WPA2 pre-authentication for fast secure roaming.

Syntax

pre-authentication <**enable** | **disable**>

- **enable** - Enables pre-authentication for the VAP interface.
- **disable** - Disables pre-authentication for the VAP interface.

Default Setting

Disabled

Command Mode

Interface Configuration (Wireless-VAP)

Command Usage

- Each time a client roams to another AP it has to be fully re-authenticated. This authentication process is time consuming and can disrupt applications running over the network. WPA2 includes a mechanism, known as pre-authentication, that allows clients to roam to a new AP and be quickly associated. The first time a client is authenticated to a wireless network it has to be fully authenticated. When the client is about to roam to another AP in the network, the AP sends pre-authentication messages to the new AP that include the client's security association information. Then when the client sends an association request to the new AP, the client is known to be already authenticated, so it proceeds directly to key exchange and association.
- To support pre-authentication, both clients and APs in the network must be WPA2 enabled.
- Pre-authentication requires all APs in the network to be on the same IP subnet.

Example

```
Enterprise AP(if-wireless g: VAP[0])#wpa-pre-shared-key ASCII agoodsecret
Enterprise AP(if-wireless g: VAP[0])#
```

5.21 Link Integrity Commands

The AP provides a link integrity feature that can be used to ensure that wireless clients are connected to resources on the wired network. The AP does this by periodically sending Ping messages to a host device in the wired Ethernet network. If the AP detects that the connection to the host has failed, it disables the radio interfaces, forcing clients to find and associate with another AP. When the connection to the host is restored, the AP re-enables the radio interfaces.

Table 5-20: Link Integrity Commands

Command	Function	Mode	Page
link-integrity ping-detect	Enables link integrity detection	GC	238
link-integrity ping-host	Specifies the IP address of a host device in the wired network	GC	239
link-integrity ping-interval	Specifies the time between each Ping sent to the link host	GC	239
link-integrity ping-fail-retry	Specifies the number of consecutive failed Ping counts before the link is determined as lost	GC	239
link-integrity ethernet-detect	Enables integrity check for Ethernet link	GC	240
show link-integrity	Displays the current link integrity configuration	Exec	240

5.21.1 link-integrity ping-detect

This command enables link integrity detection. Use the **no** form to disable link integrity detection.

Syntax

[**no**] **link-integrity ping-detect**

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

- When link integrity is enabled, the IP address of a host device in the wired network must be specified.
- The AP periodically sends an ICMP echo request (Ping) packet to the link host IP address. When the number of failed responses (either the host does not respond or is unreachable) exceeds the limit set by the **link-integrity ping-fail-retry** command, the link is determined as lost.

Example

```
Enterprise AP(config)#link-integrity ping-detect
Enterprise AP(config)#
```

5.21.2 link-integrity ping-host

This command configures the link host name or IP address. Use the **no** form to remove the host setting.

Syntax

link-integrity ping-host *<host_name | ip_address>*
no link-integrity ping-host

- *host_name* - Alias of the host.
- *ip_address* - IP address of the host.

Default Setting

None

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#link-integrity ping-host 192.168.1.10
Enterprise AP(config)#
```

5.21.3 link-integrity ping-interval

This command configures the time between each Ping sent to the link host.

Syntax

link-integrity ping-interval *<interval>*

  interval - The time between Pings. (Range: 5 - 60 seconds)

Default Setting

30 seconds

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#link-integrity ping-interval 20
Enterprise AP(config)#
```

5.21.4 link-integrity ping-fail-retry

This command configures the number of consecutive failed Ping counts before the link is determined as lost.

Syntax

link-integrity ping-fail-retry *<counts>*

  counts - The number of failed Ping counts before the link is determined as lost. (Range: 1 - 10)

Default Setting

6

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#link-integrity ping-fail-retry 10
Enterprise AP(config)#
```

5.21.5 link-integrity ethernet-detect

This command enables an integrity check to determine whether or not the AP is connected to the wired Ethernet.

Syntax

[**no**] **link-integrity ethernet-detect**

Default Setting

Disabled

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#link-integrity ethernet-detect

Notification : Ethernet Link Detect SUCCESS - RADIO(S) ENABLED

Enterprise AP(config)#
```

5.21.6 show link-integrity

This command displays the current link integrity configuration.

Command Mode

Exec

Example

```
Enterprise AP#show link-integrity

Link Integrity Information
============================================================
 Ethernet Detect : Enabled
 Ping Detect     : Enabled
 Target IP/Name  : 192.168.0.140
 Ping Fail Retry : 6
 Ping Interval   : 30
============================================================
Enterprise AP#
```

5.22   IAPP Commands

The command described in this section enables the protocol signaling required to ensure the successful handover of wireless clients roaming between different 802.11f-compliant APs. In other words, the 802.11f protocol can ensure successful roaming between APs in a multi-vendor environment.

5.22.1   iapp

This command enables the protocol signaling required to hand over wireless clients roaming between different 802.11f-compliant APs. Use the **no** form to disable 802.11f signaling.

Syntax

[**no**] **iapp**

Default

Enabled

Command Mode

Global Configuration

Command Usage

The current 802.11 standard does not specify the signaling required between APs in order to support clients roaming from one AP to another. In particular, this can create a problem for clients roaming between APs from different vendors. This command is used to enable or disable 802.11f handover signaling between different APs, especially in a multi-vendor environment.

Example

```
Enterprise AP(config)#iapp
Enterprise AP(config)#
```

5.23 VLAN Commands

The AP can enable the support of VLAN-tagged traffic passing between wireless clients and the wired network. Up to 64 VLAN IDs can be mapped to specific wireless clients, allowing users to remain within the same VLAN as they move around a campus site.

When VLAN is enabled on the AP, a VLAN ID (a number between 1 and 4094) can be assigned to each client after successful authentication using IEEE 802.1X and a central RADIUS server. The user VLAN IDs must be configured on the RADIUS server for each user authorized to access the network. If a user does not have a configured VLAN ID, the AP assigns the user to its own configured native VLAN ID.

CAUTION

When VLANs are enabled, the AP's Ethernet port drops all received traffic that does not include a VLAN tag. To maintain network connectivity to the AP and wireless clients, be sure that the AP is connected to a device port on a wired network that supports IEEE 802.1Q VLAN tags.

The VLAN commands supported by the AP are listed below.

Table 5-21: VLAN Commands

Command	Function	Mode	Page
vlan	Enables a single VLAN for all traffic	GC	242
management-vlanid	Configures the management VLAN for the AP	GC	243
vlan-id	Configures the default VLAN for the VAP interface	IC-W-VAP	243

5.23.1 vlan

This command enables VLANs for all traffic. Use the **no** form to disable VLANs.

Syntax

[**no**] **vlan enable**

Default

Disabled

Command Mode

Global Configuration

Command Description

- When VLANs are enabled, the AP tags frames received from wireless clients with the VLAN ID configured for each client on the RADIUS server. If the VLAN ID has not been configured for a client on the RADIUS server, then the frames are tagged with the AP's native VLAN ID.

- Traffic entering the Ethernet port must be tagged with a VLAN ID that matches the AP's native VLAN ID, or with a VLAN tag that matches one of the wireless clients currently associated with the AP.

Example

```
Enterprise AP(config)#vlan enable
Reboot system now? <y/n>: y
```

Related Commands

management-vlanid

5.23.2 management-vlanid

This command configures the management VLAN ID for the AP.

Syntax

management-vlanid *<vlan-id>*

vlan-id - Management VLAN ID. (Range: 1-4094)

Default Setting

1

Command Mode

Global Configuration

Command Usage

The management VLAN is for managing the AP. For example, the AP allows traffic that is tagged with the specified VLAN to manage the AP via remote management, SSH, SNMP, Telnet, etc.

Example

```
Enterprise AP(config)#management-vlanid 3
Enterprise AP(config)#
```

Related Commands

vlan

5.23.3 vlan-id

This command configures the default VLAN ID for the VAP interface.

Syntax

vlan-id *<vlan-id>*

vlan-id - Native VLAN ID. (Range: 1-4094)

Default Setting

1

Command Mode

Interface Configuration (Wireless-VAP)

Command Usage

- To implement the default VLAN ID setting for VAP interface, the AP must enable VLAN support using the **vlan** command.
- When VLANs are enabled, the AP tags frames received from wireless clients with the default

VLAN ID for the VAP interface. If IEEE 802.1X is being used to authenticate wireless clients, specific VLAN IDs can be configured on the RADIUS server to be assigned to each client. Using IEEE 802.1X and a central RADIUS server, up to 64 VLAN IDs can be mapped to specific wireless clients.

- If the VLAN ID has not been configured for a client on the RADIUS server, then the frames are tagged with the default VLAN ID of the VAP interface.

Example

```
Enterprise AP(if-wireless g: VAP[0])#vlan-id 3
Enterprise AP(if-wireless g: VAP[0])#
```

5.24 WMM Commands

The AP implements QoS using the WiFi Multimedia (WMM) standard. Using WMM, the AP is able to prioritize traffic and optimize performance when multiple applications compete for wireless network bandwidth at the same time. WMM employs techniques that are a subset of the developing IEEE 802.11e QoS standard and it enables the AP to inter-operate with both WMM- enabled clients and other devices that may lack any WMM functionality.

The WMM commands supported by the AP are listed below.

Table 5-22: WMM Commands

Command	Function	Mode	Page
wmm	Sets the WMM operational mode on the AP	IC-W	245
wmm-acknowledge-policy	Allows the acknowledgement wait time to be enabled or disabled for each Access Category (AC)	IC-W	245
wmmparam	Configures detailed WMM parameters that apply to the AP (AP) or the wireless clients (BSS)	IC-W	246

5.24.1 wmm

This command sets the WMM operational mode on the AP. Use the **no** form to disable WMM.

Syntax

[**no**] **wmm** <**supported** | **required**>

- **supported** - WMM will be used for any associated device that supports this feature. Devices that do not support this feature may still associate with the AP.
- **required** - WMM must be supported on any device trying to associated with the AP. Devices that do not support this feature will not be allowed to associate with the AP.

Default

supported

Command Mode

Interface Configuration (Wireless)

Example

```
Enterprise AP(if-wireless g)#wmm required
Enterprise AP(if-wireless g)#
```

5.24.2 wmm-acknowledge-policy

This command allows the acknowledgement wait time to be enabled or disabled for each Access Category (AC).

Syntax

wmm-acknowledge-policy <*ac_number*> <**ack** | **noack**>

- *ac_number* - Access categories. (Range: 0-3)
- **ack** - Require the sender to wait for an acknowledgement from the receiver.
- **noack** - Does not require the sender to wait for an acknowledgement from the receiver.

Default

ack

Command Mode

Interface Configuration (Wireless)

Command Usage

- WMM defines four access categories (ACs) – voice, video, best effort, and background. These categories correspond to traffic priority levels and are mapped to IEEE 802.1D priority tags (see Table 4-5). The direct mapping of the four ACs to 802.1D priorities is specifically intended to facilitate interpretability with other wired network QoS policies. While the four ACs are specified for specific types of traffic, WMM allows the priority levels to be configured to match any network-wide QoS policy. WMM also specifies a protocol that APs can use to communicate the configured traffic priority levels to QoS-enabled wireless clients.
- Although turning off the requirement for the sender to wait for an acknowledgement can increases data throughput, it can also result in a high number of errors when traffic levels are heavy.

Example

```
Enterprise AP(if-wireless g)#wmm-acknowledge-policy 0 noack
Enterprise AP(if-wireless g)#
```

5.24.3   wmmparam

This command configures detailed WMM parameters that apply to the AP (AP) or the wireless clients (BSS).

Syntax

wmmparam <**AP** | **BSS**> <*ac_number*> <*LogCwMin*> <*LogCwMax*> <*AIFS*> <*TxOpLimit*> <*admission_control*>

- **AP** - Access Point
- **BSS** - Wireless client
- *ac_number* - Access categories (ACs) – voice, video, best effort, and background. These categories correspond to traffic priority levels and are mapped to IEEE 802.1D priority tags as shown in Table 4-5. (Range: 0-3)
- *LogCwMin* - Minimum log value of the contention window. This is the initial upper limit of the random backoff wait time before wireless medium access can be attempted. The initial wait time is a random value between zero and the LogCwMin value. Specify the LogCwMin value. Note that the LogCwMin value must be equal or less than the LogCwMax value.
  (Range: 1-15 microseconds)
- *LogCwMax* - Maximum log value of the contention window. This is the maximum upper limit of the random backoff wait time before wireless medium access can be attempted. The contention window is doubled after each detected collision up to the LogCwMax value. Note that the CWMax value must be greater or equal to the LogCwMin value. (Range: 1-15 microseconds)
- *AIFS* - Arbitrary InterFrame Space specifies the minimum amount of wait time before the next data transmission attempt. (Range: 1-15 microseconds)
- *TXOPLimit* - Transmission Opportunity Limit specifies the maximum time an AC transmit queue has access to the wireless medium. When an AC queue is granted a transmit opportunity, it can transmit data for a time up to the TxOpLimit. This data bursting greatly improves the efficiency for

high data-rate traffic. (Range: 0-65535 microseconds)

- *admission_control* - The admission control mode for the access category. When enabled, clients are blocked from using the access category. (Options: 0 to disable, 1 to enable)

Default

Table 5-23: AP Parameters

WMM Parameters	AC0 (Best Effort)	AC1 (Background)	AC2 (Video)	AC3 (Voice)
LogCwMin	4	4	3	2
LogCwMax	10	10	4	3
AIFS	3	7	2	2
TXOP Limit	0	0	94	47
Admission Control	Disabled	Disabled	Disabled	Disabled

Table 5-24: BSS Parameters

WMM Parameters	AC0 (Best Effort)	AC1 (Background)	AC2 (Video)	AC3 (Voice)
LogCwMin	4	4	3	2
LogCwMax	6	10	4	3
AIFS	3	7	1	1
TXOP Limit	0	0	94	47
Admission Control	Disabled	Disabled	Disabled	Disabled

Command Mode

Interface Configuration (Wireless)

Example

```
Enterprise AP(if-wireless g)#wmmparams ap 0 4 6 3 1 1
Enterprise AP(if-wireless g)#
```

A

Appendix A - Troubleshooting

In This Chapter:

This appendix provides a lists of things to check in case of problems before contacting local Technical Support.

Check the following before you contact local Technical Support.

1   If wireless clients cannot access the network, check the following:

◇ Be sure the AP and the wireless clients are configured with the same Service Set ID (SSID).

◇ If authentication or encryption are enabled, ensure that the wireless clients are properly configured with the appropriate authentication or encryption keys.

◇ If authentication is being performed through a RADIUS server, ensure that the clients are properly configured on the RADIUS server.

◇ If authentication is being performed through IEEE 802.1X, be sure the wireless users have installed and properly configured 802.1X client software.

◇ If MAC address filtering is enabled, be sure the client's address is included in the local filtering database or on the RADIUS server database.

◇ If the wireless clients are roaming between access points, make sure that all the access points and wireless devices in the Extended Service Set (ESS) are configured to the same SSID, and authentication method.

2   If the AP cannot be configured using the Telnet, a web browser, or SNMP software:

◇ Be sure that the AP has been configured with a valid IP address, subnet mask and default gateway.

◇ If VLANs are enabled on the AP, the management station should be configured to send tagged frames with a VLAN ID that matches the AP's management VLAN (default VLAN 1, page 60). However, to manage the AP from a wireless client, the AP Management Filter should be disabled (page 57).

◇ Check that you have a valid network connection to the AP and that the Ethernet port or the wireless interface that you are using has not been disabled.

◇ If you are connecting to the AP through the wired Ethernet interface, check the network cabling between the management station and the access point. If you are connecting to AP from a wireless client, ensure that you have a valid connection to the AP.

◇ If you cannot connect using Telnet, you may have exceeded the maximum number of concurrent Telnet sessions permitted (i.e, four sessions). Try connecting again at a later time.

3 If you cannot access the on-board configuration program via a serial port connection:

◇ Be sure you have set the terminal emulator program to VT100 compatible, 8 data bits, 1 stop bit, no parity and 9600 bps.

4 If you forgot or lost the password:

◇ Set the AP to its default configuration by pressing the reset button on the back panel for 5 seconds or more. Then use the default user name *admin* and a null password to access the management interface.

5 If all other recovery measure fail, and the AP is still not functioning properly, take one of the following steps:

◇ Reset the AP's hardware using the console interface, web interface, or through a power reset.

◇ Reset the AP to its default configuration by pressing the reset button on the back panel for 5 seconds or more. Then use the default user name *admin* and a null password to access the management interface.

100BASE-TX	IEEE 802.3u specification for 100 Mbps Fast Ethernet over two pairs of Category 5 or better UTP cable.
10BASE-T	IEEE 802.3 specification for 10 Mbps Ethernet over two pairs of Category 3 or better UTP cable
AES	Advanced Encryption Standard: An encryption algorithm that implements symmetric key cryptography. AES provides very strong encryption using a completely different ciphering algorithm to TKIP and WEP.
AP	Access Point: The device that acts as a communication hub, connecting wireless clients to the network.
Authentication	The process to verify the identity of a client requesting network access. IEEE 802.11 specifies two forms of authentication: open system and shared key.
Beacon	A signal periodically transmitted from the access point that is used to identify the service set, and to maintain contact with wireless clients.
Broadcast Key	Broadcast keys are sent to stations using 802.1X dynamic keying. Dynamic broadcast key rotation is often used to allow the access point to generate a random group key and periodically update all key-management capable wireless clients.
BSS	Basic Service Set: A set of 802.11-compliant stations and an access point that operate as a fully-connected wireless network.
CPE	Customer Premise Equipment: Communications equipment that resides on the customer's premises.
CSMA/CA	Carrier Sense Multiple Access with Collision Avoidance

DHCP	Dynamic Host Configuration Protocol: Provides a framework for passing configuration information to hosts on a TCP/IP network. DHCP is based on the Bootstrap Protocol (BOOTP), adding the capability of automatic allocation of reusable network addresses and additional configuration options.
EAP	Extensible Authentication Protocol: An authentication protocol used to authenticate network clients. EAP is combined with IEEE 802.1X port authentication and a RADIUS authentication server to provide "mutual authentication" between a client, the Wi², and a RADIUS server.
ESS	Extended Service Set: More than one wireless cell can be configured with the same Service Set Identifier to allow mobile users can roam between different cells with the Extended Service Set.
FTP	File Transfer Protocol: A TCP/IP protocol used for file transfer.
HTTP	Hypertext Transfer Protocol: HTTP is a standard used to transmit and receive all data over the World Wide Web.
IAPP	Inter Access Point Protocol: A protocol that specifies the wireless signaling required to ensure the successful handover of wireless clients roaming between different 802.11f-compliant Wi²s.
IEEE 802.11b	A wireless standard that supports wireless communications in the 2.4 GHz band using Direct Sequence Spread Spectrum (DSSS). The standard provides for data rates of 1, 2, 5.5, and 11 Mbps.
IEEE 802.11g	A wireless standard that supports wireless communications in the 2.4 GHz band using using Orthogonal Frequency Division Multiplexing (OFDM). The standard provides for data rates of 6, 9, 11, 12, 18, 24, 36, 48, 54 Mbps. IEEE 802.11g is also backward compatible with IEEE 802.11b.
IEEE 802.1X	Port Authentication controls access to the switch ports by requiring users to first enter a user ID and password for authentication.
LAN	Local Area Network: A group of interconnected computer and support devices.

MAC	Media Access Control: The lower of the two sub-layers of the data link layer defined by the IEEE. The MAC sub-layer handles access to shared media, such as whether token passing or contention will be used.
MAC Address	Standardized data link layer address that is required for every port or device that connects to a LAN. Other devices in the network use these addresses to locate specific ports in the network and to create and update routing tables and data structures. MAC addresses are 6bytes long and are controlled by the IEEE.
NTP	Network Time Protocol: NTP provides the mechanisms to synchronize time across the network. The time servers operate in a hierarchical-master-slave configuration in order to synchronize local clocks within the subnet and to national time standards via wire or radio.
ODFM	Orthogonal Frequency Division Multiplexing: OFDM/ allows multiple users to transmit in an allocated band by dividing the bandwidth into many narrow bandwidth carriers.
Open System	A security option for the AP which broadcasts a beacon signal including the configured SSID. Wireless clients can read the SSID from the beacon, and automatically reset their SSID to allow immediate connection to the nearest AP.
PoE	Power over Ethernet: A specification for providing both power and data to low-power network devices using a single Category 5 Ethernet cable. PoE provides greater flexibility in the locating of Wi²s and network devices, and significantly decreased installation costs.
PSK	WPA Pre-shared Key: PSK can be used for small office networks that may not have the resources to configure and maintain a RADIUS server, WPA provides a simple operating mode that uses just a pre-shared password for network access.
RADIUS	Remote Authentication Dial-In User Service: A logon authentication protocol that uses software running on a central server to control access to the network.
Session Key	Session keys are unique to each client, and are used to authenticate a client connection, and correlate traffic passing between a specific client and the Wi².

Shared Key	A shared key can be used to authenticate each client attached to a wireless network. Shared Key authentication must be used along with the 802.11 Wireless Equivalent Privacy algorithm.
SNMP	Simple Network Management Protocol: The application protocol in the Internet suite of protocols which offers network management services.
SNTP	Simple Network Time Protocol: SNTP allows a device to set its internal clock based on periodic updates from a Network Time Protocol (NTP) server. Updates can be requested from a specific NTP server, or can be received via broadcasts sent by NTP servers.
SSID	Service Set Identifier: An identifier that is attached to packets sent over the wireless LAN and functions as a password for joining a particular radio cell; i.e., Basic Service Set (BSS).
SU-ODU	Subscriber Outdoor Unit
TFTP	Trivial File Transfer Protocol: A TCP/IP protocol commonly used for software downloads.
TKIP	Temporal Key Integrity Protocol: A data encryption method designed as a replacement for WEP. TKIP avoids the problems of WEP static keys by dynamically changing data encryption keys.
VAP	Virtual Access Point: Virtual AP technology multiplies the number of Access Points present within the RF footprint of a single physical access device. With Virtual AP technology, WLAN users within the device's footprint can associate with what appears to be different Wi²s and their associated network services. All the services are delivered using a single radio channel, enabling Virtual AP technology to optimize the use of limited WLAN radio spectrum.
VLAN	Virtual Local Area Network: A group of devices on one or more LANs that are configured with the same VLAN ID so that they can communicate as if they were attached to the same wire, when in fact they are located on a number of different LAN segments. Used also to create separation between different user groups.

WEP   Wired Equivalent Privacy: WEP is based on the use of security
                             keys and the popular RC4 encryption algorithm. Wireless
                             devices without a valid WEP key will be excluded from network
                             traffic.

WPA   WiFi Protected Access: WPA employs 802.1X as its basic
                             framework for user authentication and dynamic key
                             management to provide an enhanced security solution for
                             802.11 wireless networks.

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Index