3com®

User Guide

3Com Wireless 8760 Dual-radio 11a/b/g PoE Access Point

3CRWE876075 / WL-546

www.3Com.com

Part Number 10015153 Rev. AA

Published June, 2006

3Com Corporation
350 Campus Drive
Marlborough, MA
01752-3064

3Com Corporation reserves the right to revise this documentation and to make changes in content from time to time without obligation on the part of 3Com Corporation to provide notification of such revision or change.

3Com Corporation provides this documentation without warranty, term, or condition of any kind, either implied or expressed, including, but not limited to, the implied warranties, terms or conditions of merchantability, satisfactory quality, and fitness for a particular purpose. 3Com may make improvements or changes in the product(s) and/or the program(s) described in this documentation at any time.

If there is any software on removable media described in this documentation, it is furnished under a license agreement included with the product as a separate document, in the hard copy documentation, or on the removable media in a directory file named LICENSE.TXT or !LICENSE.TXT. If you are unable to locate a copy, please contact 3Com and a copy will be provided to you.

UNITED STATES GOVERNMENT LEGEND

If you are a United States government agency, then this documentation and the software described herein are provided to you subject to the following:

All technical data and computer software are commercial in nature and developed solely at private expense. Software is delivered as "Commercial Computer Software" as defined in DFARS 252.227-7014 (June 1995) or as a "commercial item" as defined in FAR 2.101(a) and as such is provided with only such rights as are provided in 3Com's standard commercial license for the Software. Technical data is provided with limited rights only as provided in DFAR 252.227-7015 (November 1995) or FAR 52.227-14 (June 1987), whichever is applicable. You agree not to remove or deface any portion of any legend provided on any licensed program or documentation contained in, or delivered to you in conjunction with, this User Guide.

Unless otherwise indicated, 3Com registered trademarks are registered in the United States and may or may not be registered in other countries.

3Com, the 3Com logo, and SuperStack are registered trademarks of 3Com Corporation.

Wi-Fi is a trademark of the Wireless Ethernet Compatibility Alliance.

All other company and product names may be trademarks of the respective companies with which they are associated.

EXPORT RESTRICTIONS: This product contains Encryption and may require US and/or Local Government authorization prior to export or import to another country.

Contents

1 Introduction

2 Installing the Access Point

3 Initial Configuration

4 System Configuration

5 Command Line Interface

6 Troubleshooting

Index

TERMINOLOGY

Access Point—An internetworking device that seamlessly connects wired and wireless networks.

Ad Hoc—An ad hoc wireless LAN is a group of computers, each with wireless adapters, connected as an independent wireless LAN.

Backbone—The core infrastructure of a network. The portion of the network that transports information from one central location to another central location where it is unloaded onto a local system.

Base Station—In mobile telecommunications, a base station is the central radio transmitter/receiver that maintains communications with the mobile radiotelephone sets within its range. In cellular and personal communications applications, each cell or micro-cell has its own base station; each base station in turn is interconnected with other cells' bases.

BSS—Basic Service Set. It is an access point and all the LAN PCs that are associated with it.

CSMA/CA—Carrier Sense Multiple Access with Collision Avoidance.

EAP—Extensible Authentication Protocol, which provides a generalized framework for several different authentication methods.

ESS—Extended Service Set. More than one BSS is configured to become an ESS. LAN mobile users can roam between different BSSs in an ESS (ESS-ID, SSID).

Ethernet—A popular local area data communications network, which accepts transmission from computers and terminals.

Infrastructure—An integrated wireless and wired LAN is called an infrastructure configuration.

RADIUS—Remote Access Dial-In User Server is an authentication method used in conjunction with EAP for 802.1x authentication and session based keys.

Roaming—A wireless LAN mobile user moves around an ESS and maintains a continuous connection to the infrastructure network.

RTS Threshold—Transmitters contending for the medium may not be aware of each other (they are "hidden nodes"). The RTS/CTS mechanism can solve this problem. If the packet size is smaller than the preset RTS Threshold size, the RTS/CTS mechanism will not be enabled.

VAP—Virtual Access Point. An access point radio capable of operating as four separate access points.

VLAN—Virtual Local Area Network. A LAN consisting of groups of hosts that are on physically different segments but that communicate as though they were on the same segment.

WEP—Wired Equivalent Privacy 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.

WDS—Wireless Distribution System.

WPA—Wi-Fi Protected Access.

1 INTRODUCTION

The 3Com® Wireless 8760 Dual-radio 11a/b/g PoE Access Point offers a dual-mode architecture that supports 802.11g, 802.11a, and 802.11b wireless users on a single device. This means you can mix and match radio bands to meet different coverage and bandwidth needs within the same area.

With their flexibility and unfettered access, wireless LANs are changing the way people work. Now with 3Com's enterprise-class wireless access point, you can build a cost-effective, reliable, secure wireless network that provides users with seamless connectivity to the Internet, company intranet, and the wired corporate network from anywhere they happen to be—conference room, cafeteria or office.

3Com's dual-mode design supports 802.11g, 802.11a, and 802.11b wireless standards on a single access point. This capability increases configuration and coverage flexibility and protects your network investment for both existing and emerging wireless standards.

Industry-leading security features and comprehensive management and performance features combine to make these enterprise class wireless access points an ideal choice for organizations ready to serve their increasingly mobile workforce.

PRODUCT FEATURES

Access Point 8760—Creates an enterprise-class wireless LAN supporting up to 256 simultaneous users. The access point supports two radios and external antennas including WDS bridging ability on both radios.

SECURITY

3Com offers one of the most robust suite of standards-based security on the market today.

To protect sensitive data broadcast over the wireless LAN, 3Com supports WPA and WPA2 security standards. 3Com strengthens this basic security mechanism with additional security features, including:

- MAC address access control lists
- IEEE 802.1x per-port user authentication with RADIUS server support
- IEEE 802.1x supplicant support
- SSH v2
- HTTP/HTTPS
- SNMP v3
- Legacy WEP 40/64 bit, 128 bit and 152 bit
- Wireless Protected Access (WPA) and WPA2
- Extensible Authentication Protocol (EAP) support: EAP-MD5, EAP-TLS, EAP-TTLS, and PEAP

PERFORMANCE AND RELIABILITY

3Com wireless access point performance features ensure reliable and seamless connections for users wherever they roam:

- Automatic channel selection automatically finds the least loaded channel for interference-free communication.
- Auto network connect and dynamic rate shifting keep users connected through a wide variety of conditions by changing to the optimum connection speed as they move through the network.
- Virtual Access Point (VAP) support provides flexibility by allowing a single access point radio to operate as up to four separate access points.
- Wireless Distribution System (WDS) Bridging support allows you to create large wireless networks in areas where pulling wires is restricted or cost-prohibitive by linking several wireless access points together with WDS links.

Virtual Access Point (VAP) Support

Virtual Access Point (VAP) support allows an access point radio to operate as four separate access points, providing multiple wireless services to clients in a network. Each VAP can be configured to provide access to different network resources and can support different levels of security.

For example, in a university network, an access point (AP) could be used to offer two services: The first service provides access to protected data for authenticated university staff members, while the second service provides open access to the Internet for unauthenticated users, such as students or visitors.

Up to four VAPs per radio are available, and each VAP can be configured with its own security settings.

For information on setting up and configuring VAPs, see “Wired Equivalent Privacy (WEP)” on page 4-52.

WDS Bridging and Spanning Tree Protocol (STP) Support

A Distribution System (DS) is a network (typically a wired network) that interconnects separate access points into a single LAN. With WDS, the interconnection no longer needs to be physically wired. WDS uses the wireless medium to interconnect separate access points, thereby eliminating the cost and inconvenience that may hinder wire installations.

A WDS link can be used in a simple point-to-point link, a complex point-to-multipoint link, or a multilayer topology.

MANAGEABILITY

3Com offers a wide range of standards-based management support, from SNMP to 3Com Network Supervisor and HP OpenView for seamless integration with your wired network.

Wireless Infrastructure Device Manager lets you configure parameters, run diagnostics, backup and restore configurations, and monitor performance from anywhere on the network using an embedded web server browser.

With Power over Ethernet (PoE) support, the same Category 5 cable that connects your access point to the data network also provides its power. A single cable installation dramatically improves your choice of mounting configurations because you no longer need to consider AC power outlet locations. PoE support makes it easier than ever to overcome installation problems with difficult-to-wire or hard-to-reach locations.

WIRELESS NETWORK STANDARDS

Understanding the characteristics of the 802.11g and 802.11a standards can help you make the best choice for your wireless implementation plans.

802.11G

802.11g operates in the 2.4 GHz band at up to 54Mbps, and supports the widest coverage—up to 100 meters (328 feet). However, is subject to a greater risk of radio interference because it operates in the more popular 2.4 GHz band.

For those organizations demanding even higher speeds, a “turbo mode” feature can boost throughput rates up to 108 Mbps. Consider 802.11g when you need wider coverage and vendor compatibility and you are:

- Maintaining support for existing 802.11b users and the existing wireless investment while providing for expansion into 802.11g.
- Implementing a complete wireless LAN solution, including bridges, gateways, access points and clients; Wi-Fi certification guarantees compatibility among vendors
- Providing access to hot spots in public spaces such as coffee shops or university cafeterias

802.11A

802.11a operates at the 5 GHz band and supports data rates at up to 54 Mbps. For those organizations demanding even higher speeds, a “turbo mode” feature can boost throughput rates up to 108 Mbps. And because there are fewer devices in the 5 GHz band, there’s less potential for RF interference. However, because it is at an entirely different radio spectrum, it is not compatible with 802.11g.

The higher spectrum provides about 50 meters (164 feet) of coverage—about half what 802.11g offers.

Consider 802.11a when you need high throughput in a confined space and you are:

- Running high-bandwidth applications like voice, video, or multimedia over a wireless network that can benefit from a fivefold increase in data throughput
- Transferring large files like computer aided design files, preprint publishing documents or graphics files, such as MRI scans for medical applications, that demand additional bandwidth
- Supporting a dense user base confined to a small coverage area. Because 802.11a has a greater number of non-overlapping channels, you can pack more access points in a tighter space.

APPROVED CHANNELS

Use of this product is only authorized for the channels approved by each country. For proper installation, select your country from the country selection list.

To conform to FCC and other country restrictions your product may be limited in the channels that are available. If other channels are permitted in your country please visit the 3Com website for the latest software version.

2 INSTALLING THE ACCESS POINT

This equipment must be installed in compliance with local and national building codes, regulatory restrictions, and FCC rules. For the safety of people and equipment, this product must be installed by a professional technician/installer.

⚠ ***CAUTION****: Before installing, see the important warnings and cautions in "Safety Information" on page 2-2.*

INSTALLATION REQUIREMENTS

The following items are required for installation:

- Access Point 8760.
- Two standard detachable antennas.
- 3Com installation CD.
- Wall-mount installation hardware (supplied): mounting plate, mounting screws, and plastic anchors for drywall mounting.
- If you do not have IEEE 802.3af power-over-Ethernet LAN equipment, use the 3Com Integrated Power-over-Ethernet power supply that comes with the access point.

  If your LAN equipment complies with the IEEE 802.3af power-over-Ethernet standard, you can connect directly to the equipment, and the 3Com power supply is not needed.
- Standard category 5 straight (8-wire) Ethernet cable.

  The cable must be long enough to reach the power supply or the power-over-Ethernet LAN port.

  If you use the 3Com power supply, you need an additional Ethernet cable to connect the access point to the LAN.

- To access and use the Web configuration management system, you need a computer that is running Internet Explorer 5.0 or newer and one of the following operating systems: Windows 2000, or Windows XP. It is recommended that this computer become the dedicated workstation for managing and configuring the access point and the wireless network.

POWER REQUIREMENTS

The access point complies with the IEEE 802.3af power-over-Ethernet standard. It receives power over standard category 5 straight (8-wire) Ethernet cable. Installation requires the use of either the 3Com power supply provided or IEEE 802.3af compliant power supply equipment (output power rated 48 V dc @ 400 mA maximum). Such equipment must be safety certified according to UL, CSA, IEC or other applicable national or international safety requirements for the country of use. All references to the power supply in this document refer to equipment that meets these requirements.

Because the power supply plug is the only means of disconnecting the access point from power, make sure the power outlet is accessible.

See “Using the Power Supply” on page 2-8 and “Using a Power-Over-Ethernet LAN Port” on page 2-8.

SAFETY INFORMATION

This equipment must be installed in compliance with local and national building codes, regulatory restrictions, and FCC rules. For the safety of people and equipment, only professional network personnel should install the access point, cables, and antennas.

⚠ ***CAUTION:*** *If you supply your own Ethernet cable for connecting power, be sure that it is category 5 straight-through (8-wire) cable that has not been altered in any way. Use of nonstandard cable could damage the access point.*

⚠ ***CAUTION:*** *To comply with FCC radio frequency (RF) exposure limits, a minimum body-to-antenna distance of 20 centimeter (8 inches) must be maintained when the access point is operational.*

⚠ ***CAUTION:*** *To avoid possible injury or damage to equipment, you must use either the provided power supply or IEEE 802.3af compliant power supply equipment that is safety certified according to UL, CSA, IEC, or other applicable national or international safety requirements for the country of use. All references to power supply in this document refer to equipment meeting these requirements.*

⚠ ***CAUTION:*** *The 3Com power supply input relies on a 16A rated building fuse or circuit protector for short circuit protection of the line to neutral conductors.*

⚠ ***CAUTION:*** *It is the responsibility of the installer to ensure that the Power-over-Ethernet (POE) power supply is properly connected. Connection to any other device, such as a standard Ethernet card or another POE supply, may result in permanent damage to equipment, electric shock, or fire. Refer to the installation instructions for proper installation.*

DECIDING WHERE TO PLACE EQUIPMENT AND PERFORMING A SITE SURVEY

The access point is ideally designed for vertical installation on a wall surface, but can also be flat-surface mounted in an elevated location where it will not be disturbed. Ceiling installation is not recommended.

Whether you choose to mount the access point on a wall or place it on a flat surface, make sure to select a clean, dry location that is elevated enough to provide good reception and network coverage. Do not mount the access point on any type of metal surface. Do not install the access point in wet or dusty areas. The site should not be close to transformers, heavy-duty motors, fluorescent lights, microwave ovens, refrigerators or any other electrical equipment that can interfere with radio signals.

If you are connecting the access point to a wired network, the location must provide an Ethernet connection. You will need to run an Ethernet cable from the power supply to the access point.

An access point provides coverage at distances of up to 100 Meters (300 Feet). Signal loss can occur if metal, concrete, brick, walls, floors or other architectural barriers block transmission. If your location includes these kinds of obstructions, you may need to add additional access points to improve coverage

Configuring a wireless LAN can be as easy as placing a 3Com Wireless Access Point in a central area and making the necessary connections to the AP and the clients. However, installing multiple Access Points may require more planning.

If you plan to use an optional antenna instead of the standard detachable antennas that are supplied, review "Selecting and Connecting a Different Antenna Model" on page 2-12 before selecting the final location and be sure to allow for routing the antenna cable as required.

For optimal performance, ensure the access point operates in temperature ranges between 0° C to 50° C (14° F to 122° F).

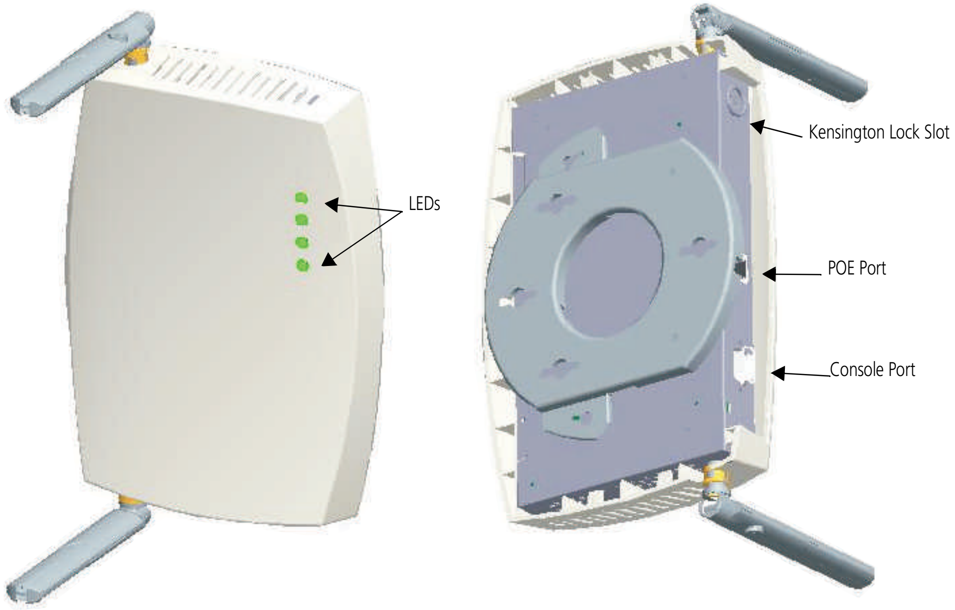
CAUTION: *Regulatory restrictions dictate that when this device is operational, the minimal body-to-antenna distance is 20 cm (8 inches).*

BEFORE YOU BEGIN

Record the access point MAC address in a safe place before the access point is installed in a hard-to-reach location. The MAC address is printed on the back of the access point housing.

The following illustration shows the front and rear views of the access point, including the LEDs and connecting ports.

Figure 1 Front and Rear Panel Description



CONNECTING THE STANDARD ANTENNAS

The Access Point 8760 is supplied with standard detachable antennas. These should be attached before the access point is installed. If using an alternate antenna, see “Selecting and Connecting a Different Antenna Model” on page 2-12.

1 Carefully unpack the standard detachable antennas.

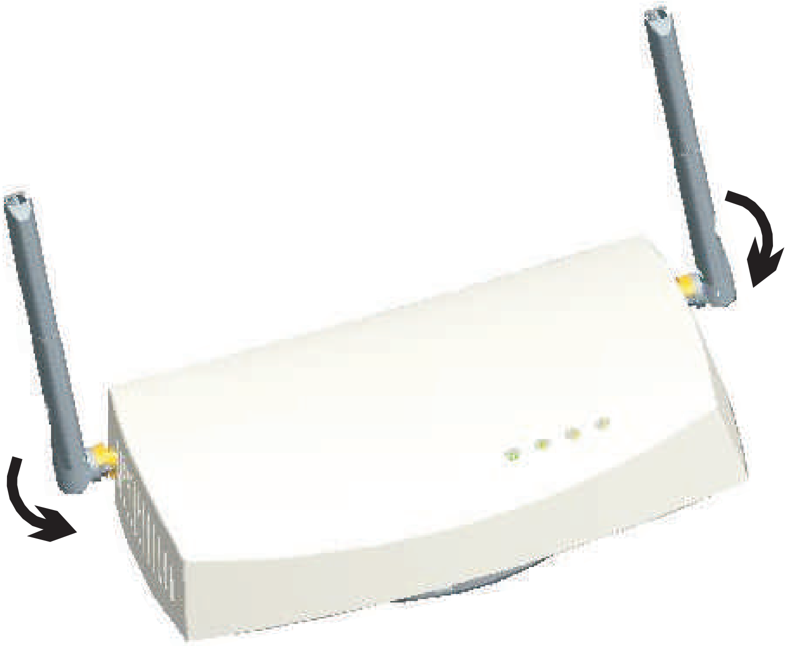
⚠ ***CAUTION:*** *Do not handle the antenna tips, especially after they are connected to the access point, as this could lead to electrostatic discharge (ESD), which could damage the equipment.*

2 Screw an antenna into each of the sockets in the access point housing.

3 Hand-tighten the antennas at the very base of the RSMA connectors.

4 Position the antennas so they turn out and away from the access point at a 45-degree angle. After network startup, you may need to adjust the antennas to fine-tune coverage in your area.

Figure 2 Antenna Adjustment



Depending on the coverage required for your site, you may want to replace the standard detachable antennas with one of the external antennas available for use with the access point. See "Selecting and Connecting a Different Antenna Model" on page 2-12.

CONNECTING POWER

It is advisable to connect the power and check the Ethernet cables and LEDs before installing the unit in a hard-to-reach location.

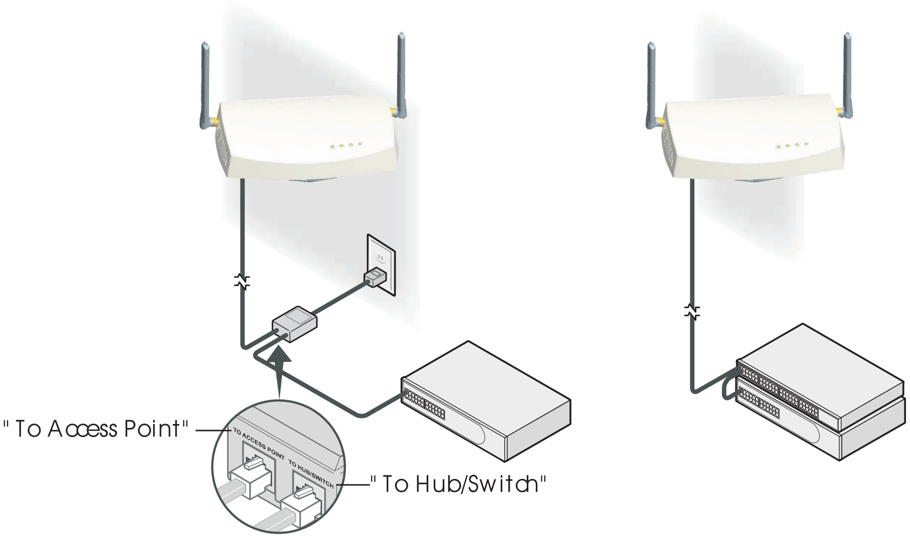
The access point complies with the IEEE 802.3af power-over-Ethernet standard. It receives power over a standard category 5 straight (8-wire) Ethernet cable.

There are two ways to supply power to the access point:

- Use the 3Com Integrated Power-over-Ethernet power supply. In this case, you need to supply a second Ethernet cable to connect to the wired LAN.
- Connect the access point directly to your own power-over-Ethernet hub or switch, which must also comply with the IEEE 802.3af standard.

If you supply your own Ethernet cable for connecting power, be sure that it is standard category 5 straight-through (8-wire) cable that has not been altered in any way. Use of nonstandard cable could damage the access point.

Figure 3 Connecting Power



Using the Power Supply

Using A Power-over-Ethernet LAN Port

USING THE POWER SUPPLY

CAUTION: *To avoid damaging network equipment, make sure that the cables are connected from access point to power supply to LAN as shown above and described below.*

The power supply can be located at any point between the access point and the LAN access port, wherever a convenient power outlet exists. If you supply your own Ethernet cable for connecting power, be sure that it is standard category 5 straight-through (8-wire) cable that has not been altered in any way. Use of nonstandard cable could damage the access point.

Refer to the illustration above, and follow these steps:

1 Connect one end of the Ethernet cable to the Ethernet port on the access point.

2 Connect the other end of the Ethernet cable to the port labeled *To Access Point* on the power supply.

3 Connect the power cord to the power supply and plug the cord into a power outlet.

4 To link the access point to your Ethernet network, plug one end of another Ethernet cable into the port labeled To *Hub/Switch* on the power supply, and plug the other end into a LAN port (on a hub or in a wall).

USING A POWER-OVER-ETHERNET LAN PORT

If your LAN equipment complies with the IEEE 802.3af power-over-Ethernet standard, you can connect the access point directly to a LAN port. For example, the illustration above right shows a connection through a 3Com Ethernet Power Supply to a 3Com Switch.

CHECKING THE LEDS

When power is connected, the access point LEDs light. The illustration and the following table describe the LEDs and their functions.

Table 1 System LEDs

LED	Color	Indicates
Power	Green	The access point is powered up and operating normally.
	Off	The access point is not receiving power or there is a fault with the power supply.
Link	Green	The access point has a 10/100 Mbps Fast Ethernet connection.
	Flashing	Indicates that the access point is transmitting or receiving data on a 10/100 Mbps Ethernet LAN. Flashing rate is proportional to network activity.
	Off	No link is present.
11a	Green	The access point has WLAN frame transmission over the 802.11a 5.3 GHz radio band.
	Off	No link is present.
11g	Green	The access point has WLAN frame transmission over the 802.11g 2.4 GHz radio band.
	Off	No link is present.

RESET BUTTON

This button is used to reset the access point or restore the factory default configuration. If you hold down the button for less than 5 seconds, the access point will perform a hardware reset. If you hold down the button for 10 seconds or more, any configuration changes you may have made are removed, and the factory default configuration is restored to the access point.

WALL, CEILING, OR ELECTRICAL BOX MOUNTING

To mount the access point to a wall, ceiling, or electrical box:

1 Remove the access point from the mounting bracket.

2 Screw the mounting bracket to a wall, ceiling, or electrical box (NEMA enclosure):

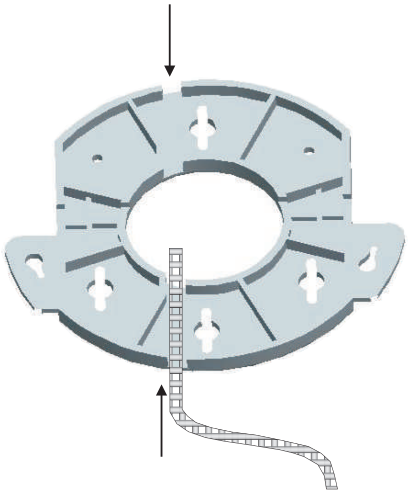
- If mounting to a solid surface wall or ceiling, use two of the sheet metal screws and two of the wall anchors (included).
- If mounting to drywall, use two sheet metal screws and two wall anchors (not included).
- If mounting to an electrical box (NEMA enclosure), use two threaded screws (not included).

3 Route the power cable (if using an external power supply) and Ethernet cable through the large opening on the back of the mounting bracket.

⚠ ***CAUTION:*** *For easy installation and removal of the access point from the mounting bracket, make sure that there is sufficient flexibility with the cable and that there is adequate service loop (that is, enough cable routed through the mounting bracket to easily connect the cable to the access point.) If not enough cable is routed through the back of the mounting bracket, or if the cable is inflexible, it can be difficult to install or remove the access point from the mounting bracket.*

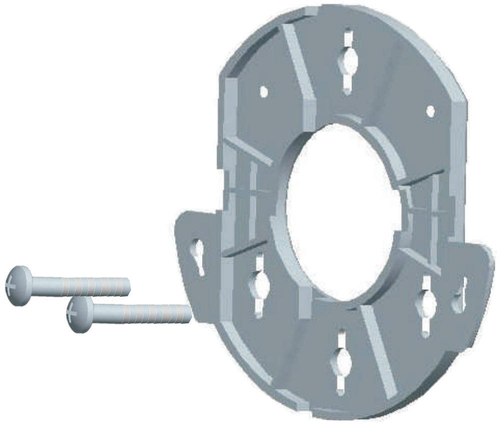
The figures below show a cable being routed through the large opening on the back of the mounting bracket and then the mounting bracket being mounted to a wall.

Figure 4 Routing a Cable



Routing a cable

Figure 5 Mounting Bracket



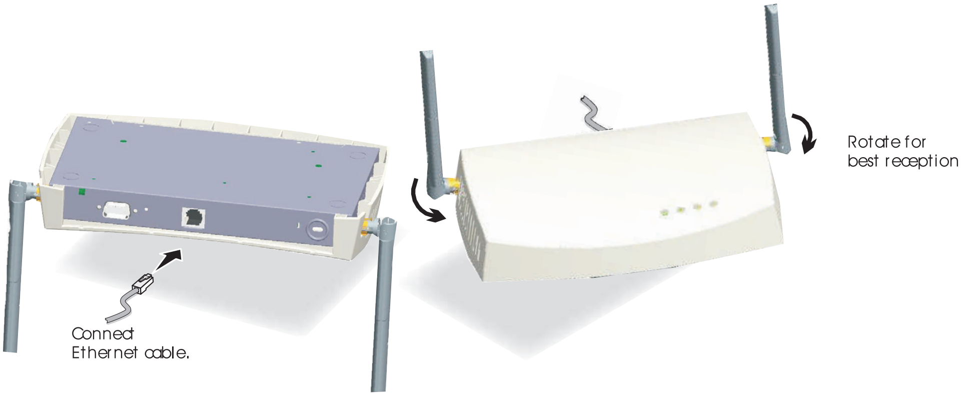
Installing the mounting bracket

4 Connect the Ethernet cable to the port on the back of the access point.

FLAT SURFACE INSTALLATION

The access point can also be placed on a flat surface such as a table, desktop or filing cabinet. Do not install the access point on any type of metal surface. If you choose a flat surface mount, select a location that is clear of obstructions and provides good reception.

Figure 6 Flat Surface Installation



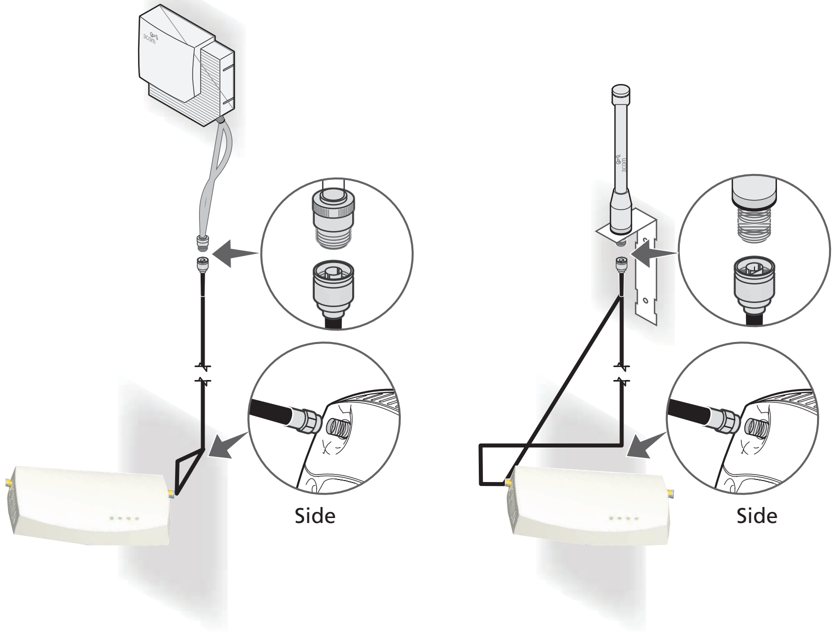
NOTE*: Regulatory restrictions dictate that when this device is operational, the minimal body-to-antenna distance is 20 cm (8 inches).*

SELECTING AND CONNECTING A DIFFERENT ANTENNA MODEL

The standard detachable antennas supplied with the Access Point are suitable for a broad variety of environments. If you require a different type of antenna for the Access Point, several options are available by model number from the 3Com Web site (www.3Com.com).

For each of the antenna models, you will need an RSMA to SMA adapter cable (model 3CRWE586), either a 6-foot accessory cable (model 3CWE580) or a 20-foot accessory cable (model 3CWE581) to provide the transition from the RSMA connector on the access point to the N-type connector on the antenna.

Figure 7 Connecting Antennae



1 Position the antenna so that there are minimal obstacles between it and any client with which it will communicate. While maintaining a direct line of sight between the antenna and a client is not strictly necessary, such an arrangement helps to ensure a strong signal. Ensure that access is available for routing the antenna cable from the antenna to the access point.

2 If they are installed, remove both standard detachable antennas.

3 Connect one end of the optional antenna cable to the antenna and secure the antenna in place.

4 Connect the free end of the antenna cable to the connection on the access point, as shown in the illustration above.

5 Make certain that the antennas and antenna masts are appropriately grounded to prevent injury or damage from lightning strikes. Proper grounding for outdoor installations may require the purchase of a third-party lightning arrestor.

INSTALLING SOFTWARE UTILITIES

The installation CD includes documentation and software utilities to help you set up and administer the wireless components of your network.

To view product documentation, select *View the Documentation* from the CD Startup Menu and then select the item you want to view.

The software Tools and Utilities include:

- **3Com Wireless Infrastructure Device Manager.** Use this tool to discover access points and select devices for administrative changes.
- **3Com 3CDaemon Server Tool.** This tool can act in four different capacities:
  - As a TFTP Server, necessary for firmware upgrades, and backup and restore functions. Use this option if you do not have a TFTP server set up.
  - As a SysLog Server, which is necessary to view SysLog messages.
  - As an optional TFTP Client.
  - As an optional FTP Server.

To install a tool from the CD:

1. Power up the computer and put the 3Com CD in the CD-ROM drive.
2. The setup menu should appear when the CD autostarts. If no menu appears, you can run the setup.exe startup program from the Windows Start menu. For example, if your CD drive is the D drive: Start / Run / d:setup.exe.
3. From the CD startup menu, select *Tools and Utilities*.
4. Select the item you want to install and follow the instructions on the screen.

3 INITIAL CONFIGURATION

The Access Point 8760 offers a variety of management options, including a web-based interface.

The initial configuration steps can be made through the web browser interface. The access point requests an IP address via DHCP by default. If no response is received from the DHCP server, then the access point uses the default address 169.254.2.1.

If the default AP configuration does not meet your network requirements, or if you want to customize the settings for your own network, you can use these tools to change the configuration:

1. Launch the 3Com Wireless Infrastructure Device Manager (Widman) utility
2. Directly connect to the device through it's Ethernet port or console port

NETWORKS WITH A DHCP SERVER

If your network has a DHCP server, an IP address is automatically assigned to the AP. It takes between one and two minutes for the Access Point to determine if there is a DHCP server on the network. Use the 3Com Wireless Infrastructure Device Manager (Widman) included on the 3Com Installation CD to locate the Access Point on the network and view its IP address. After you determine the AP's IP address, you can enter that IP address into a web browser on a computer on the same subnet to view the Access Point's system status or change its configuration.

NETWORKS WITHOUT A DHCP SERVER

If your network does not have a DHCP server, the Access Point uses a factory assigned IP address (169.254.2.1). You can use that IP address to configure the Access Point, or you can assign a new IP address to the Access Point. To verify that the Access Point is using the default IP address assigned at the factory:

1 Connect a computer directly to the Access Point using the supplied standard Category 5 UTP Ethernet cable.

2 Enter the Access Point's default IP address (169.254.2.1) into the computer's web browser. If the Configuration Management System starts, the Access Point is using the factory assigned IP address. You can configure the Access Point with the following login information:

- Login name: **admin**
- Password: **password**

If the Configuration Management System does not start, the Access Point is on a different subnet than the computer. Install and start the 3Com Wireless Infrastructure Device Manager to discover the Access Point's IP address.

USING THE 3COM INSTALLATION CD

The 3Com Installation CD contains the following tools and utilities: 3Com Wireless Infrastructure Device Manager-an administration tool that helps you select 3Com wireless LAN devices and launch their configurations in your Web browser.

LAUNCH THE 3COM WIRELESS INFRASTRUCTURE DEVICE MANAGER (WIDMAN) UTILITY

1 Turn on the computer.

2 Insert the 3Com Installation CD into the CD-ROM drive.

The CD will Autorun. If it does not Autorun, you can start the setup menu from the Windows Start menu. For example: **Start > Run > d: setup.exe**.

3 In the menu, click Tools and Utilities.

4 In the next screen, click the software you want to install.

5 Follow the on screen instructions to complete the installation.

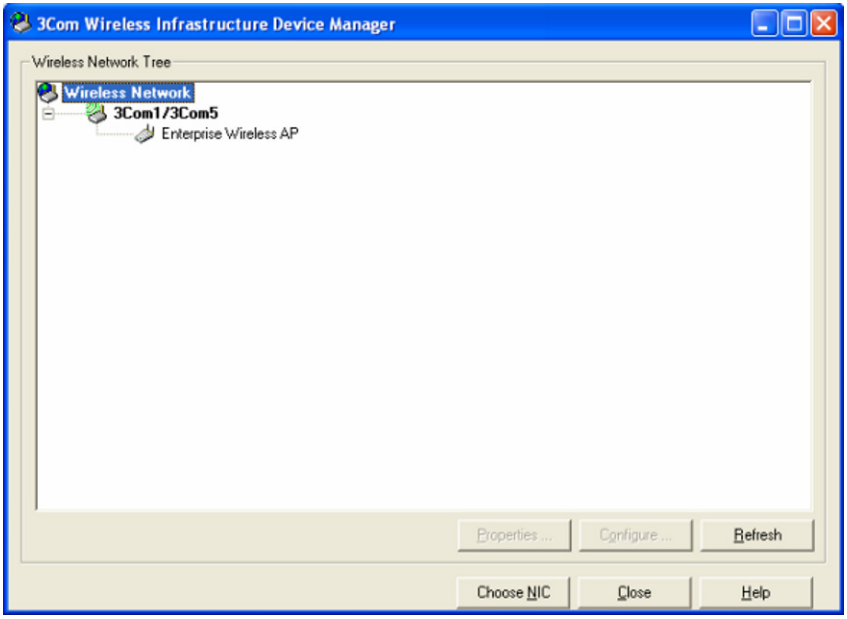
Reboot the computer if prompted to do so.

LAUNCHING THE 3COM WIRELESS INTERFACE DEVICE MANAGER

To be able to configure the Access Point you need to run the Wireless Interface Device Manager. Go to **Start > Programs > 3Com Wireless > Wireless Interface Device Manager**.

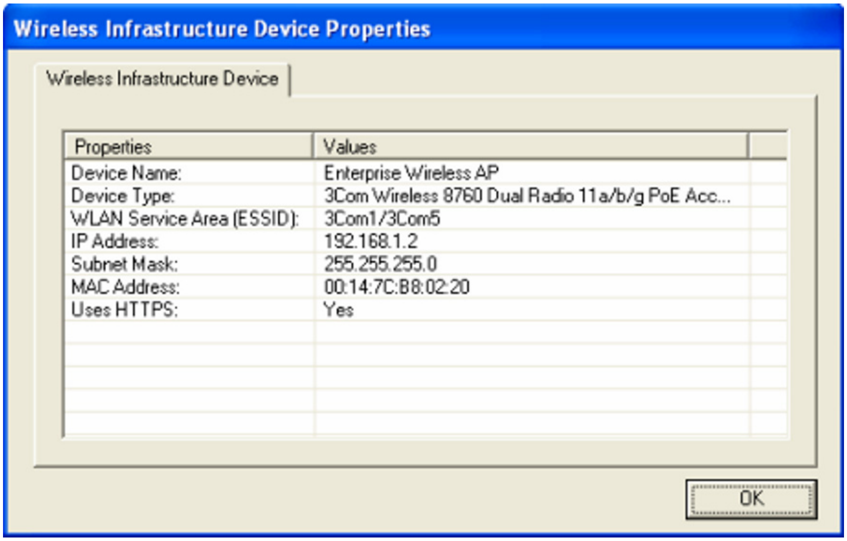
If the device is working correctly the following screen should be seen.

Figure 8 Wireless Interface Device Manager



Click on the Properties button to see the following screen

Figure 9 Wireless Interface Device Manager - Properties


Wireless Infrastructure Device Properties
Wireless Infrastructure Device
OK

Properties	Values
Device Name:	Enterprise Wireless AP
Device Type:	3Com Wireless 8760 Dual Radio 11a/b/g PoE Acc...
WLAN Service Area (ESSID):	3Com1/3Com5
IP Address:	192.168.1.2
Subnet Mask:	255.255.255.0
MAC Address:	00:14:7C:B8:02:20
Uses HTTPS:	Yes

Directly connect to the device through its Ethernet port or console port.

Follow the instructions below to login into the AP Configuration screen:

1 Load a web browser and enter <http://169.254.2.1>.

2 The Logon screen appears.

To log on to the Web interface:

1 Username, type **admin** (case sensitive).

2 Password, type **password**

3 Click **Log On**.

FIRST TIME ONLY

When you log in for the first time, you may be asked to select your country. Choose your country from the drop-down list and then click Apply.

Click on the Setup Wizard for initial configuration.

For a new access point installation, the default WLAN Service Area (ESSID) is 3Com1 to 3Com4 for the 11a interface, and 3Com5 to 3Com8 for the 11b/g interface, with no security set. Unless it detects a DHCP server on the network, the access point uses Auto IP to assign an IP address of the form 169.254.2.1.

Use the 3Com Wireless Infrastructure Device Manager to locate 3Com Wireless LAN devices and launch their configurations. When installing the device manager, make sure the computer is connected to the same network as the device to be configured. After installing and launching the device manager, select the device to be configured from network tree and click Configure to launch the configuration Web interface.

USING THE SETUP WIZARD

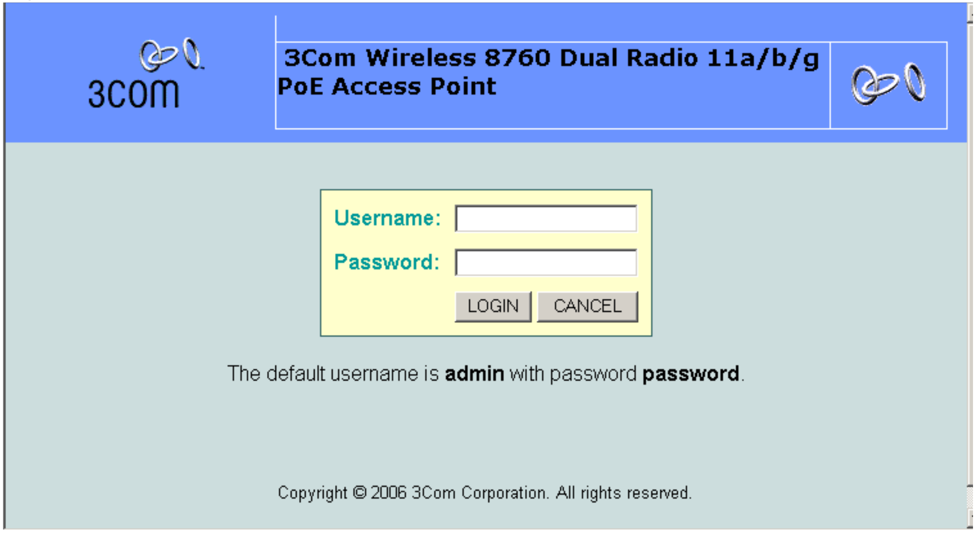
There are only a few basic steps you need to complete to connect the access point to your corporate network and provide network access to wireless clients. The Setup Wizard takes you through configuration procedures for the wireless Service Set Identifier, the radio channel selection, IP configuration and basic authentication for wireless clients.

The access point can be managed by any computer using a web browser (such as Internet Explorer 5.0 or above). Enter the default IP address: http://169.254.2.1.

***NOTE:** If you changed the default IP address via the command line interface above, use that address instead of the one shown here.*

Logging In – Enter the username “admin,” and password “password,” then click LOGIN. For information on configuring a user name and password, see page 4-22.

Figure 10 Login Page

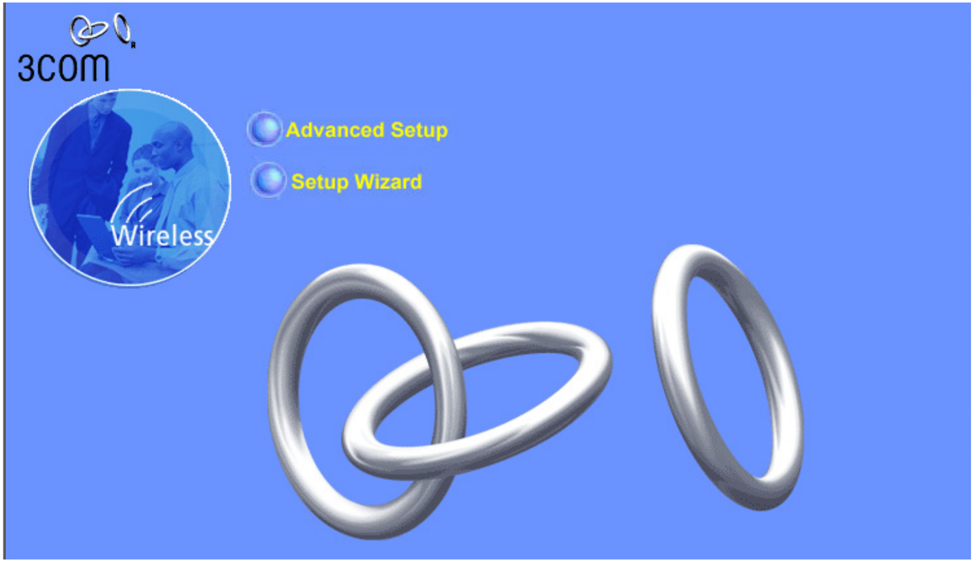


The default username is **admin** with password **password**.

Copyright © 2006 3Com Corporation. All rights reserved.

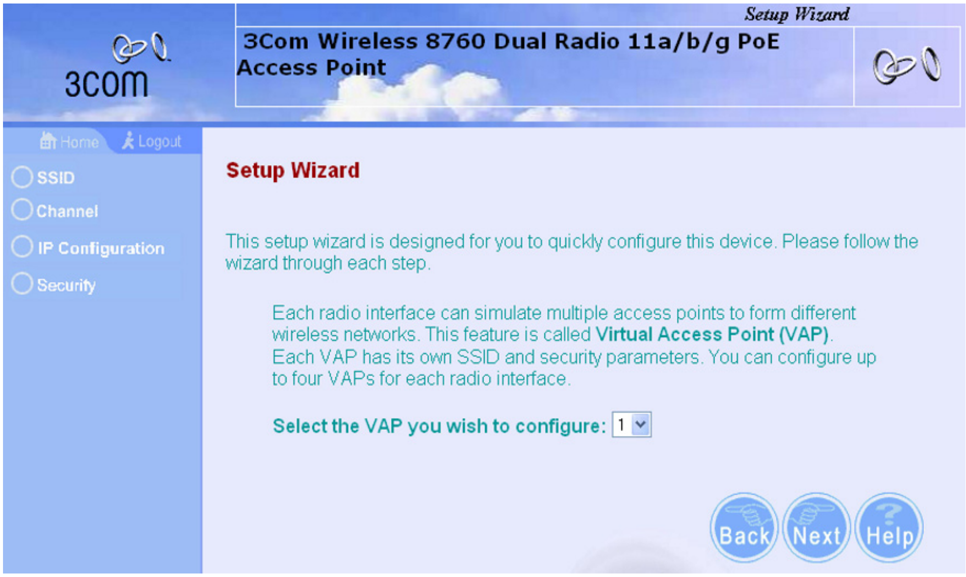
The home page displays the Main Menu.

Figure 11 Home Page



Launching the Setup Wizard – To perform initial configuration, click Setup Wizard on the home page, select the VAP you wish to configure, then click on the [Next] button to start the process.

Figure 12 Setup Wizard - Start



Setup Wizard

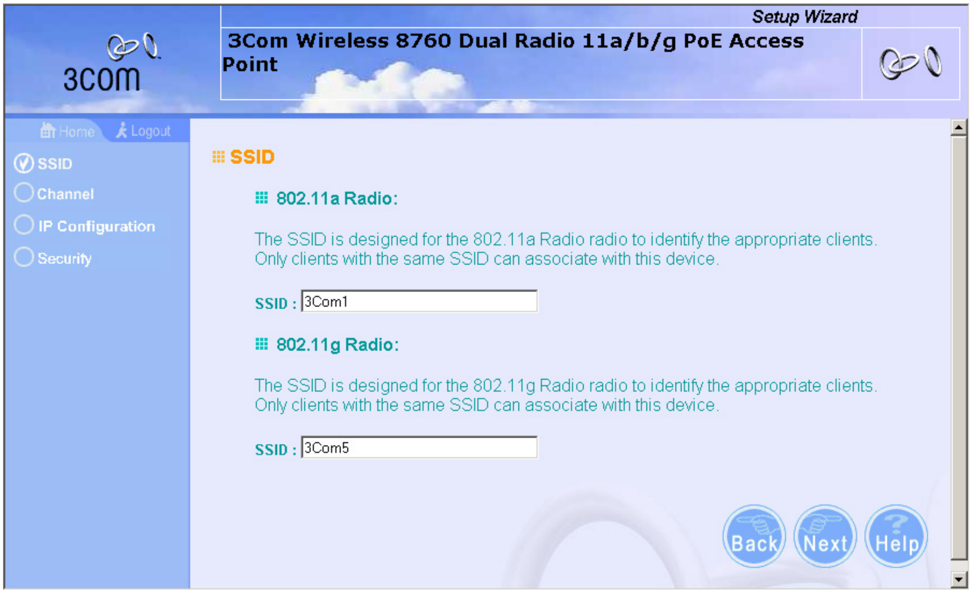
This setup wizard is designed for you to quickly configure this device. Please follow the wizard through each step.

Each radio interface can simulate multiple access points to form different wireless networks. This feature is called **Virtual Access Point (VAP)**. Each VAP has its own SSID and security parameters. You can configure up to four VAPs for each radio interface.

Select the VAP you wish to configure: 1

1 **Service Set ID** – Enter the service set identifier in the SSID box which all wireless clients must use to associate with the access point. The SSID is case sensitive and can consist of up to 32 alphanumeric characters.

Figure 13 Setup Wizard - Step 1



SSID

802.11a Radio:

The SSID is designed for the 802.11a Radio radio to identify the appropriate clients. Only clients with the same SSID can associate with this device.

SSID : 3Com1

802.11g Radio:

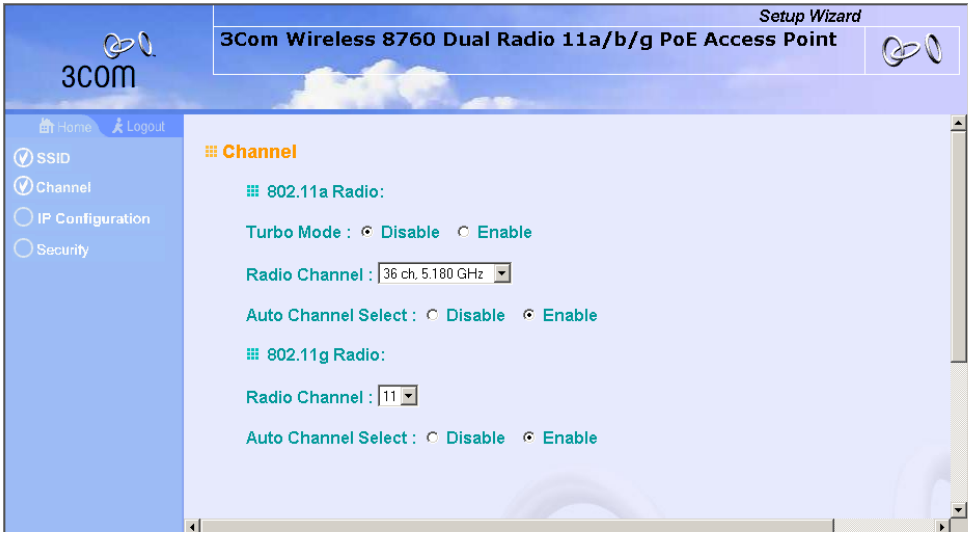
The SSID is designed for the 802.11g Radio radio to identify the appropriate clients. Only clients with the same SSID can associate with this device.

SSID : 3Com5

2 **Radio Channel** – You must enable radio communications for 802.11a and 802.11b/g, and set the operating radio channel.

NOTE: *Available channel settings are limited by local regulations, which determine the channels that are available. This User Guide shows channels and settings that apply to North America (United States and Canada), with 13 channels available for the 802.11a interface and 11 channels for the 802.11g interface. Other regions my have different channels and settings available.*

Figure 14 Setup Wizard - Step 2



Channel

802.11a Radio:

Turbo Mode : ● Disable ○ Enable

Radio Channel : 36 ch, 5.180 GHz

Auto Channel Select : ○ Disable ● Enable

802.11g Radio:

Radio Channel : 11

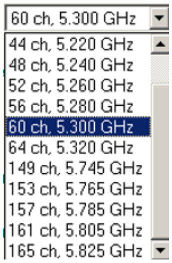
Auto Channel Select : ○ Disable ● Enable

- 802.11a

  Turbo Mode – If you select Enable, the access point will operate in turbo mode with a data rate of up to 108 Mbps. Normal mode support 13 channels, Turbo mode supports only 5 channels. (Default: Disabled)

  802.11a Radio Channel – Set the operating radio channel number. (Default: 60ch, 5.300 GHz when Auto Channel Select is not enabled.)

  Auto Channel Select – Select Enable for automatic radio channel detection. (Default: Enabled)



60 ch, 5.300 GHz

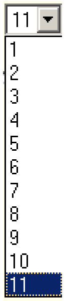
44 ch, 5.220 GHz
48 ch, 5.240 GHz
52 ch, 5.260 GHz
56 ch, 5.280 GHz
60 ch, 5.300 GHz
64 ch, 5.320 GHz
149 ch, 5.745 GHz
153 ch, 5.765 GHz
157 ch, 5.785 GHz
161 ch, 5.805 GHz
165 ch, 5.825 GHz

- 802.11b/g

  Turbo Mode - If you select Enable, the access point will operate in turbo mode with a data rate of up to 108 Mbps. Normal mode support 11 channels, Turbo mode supports only 1 channel. (Default: Disabled)

  802.11g Radio Channel - Set the operating radio channel number. (Range 1-11; Default: 1 when Auto Channel Select is not enabled.

  Auto Channel Select – Select Enable for automatic radio channel detection. (Default: Enabled)

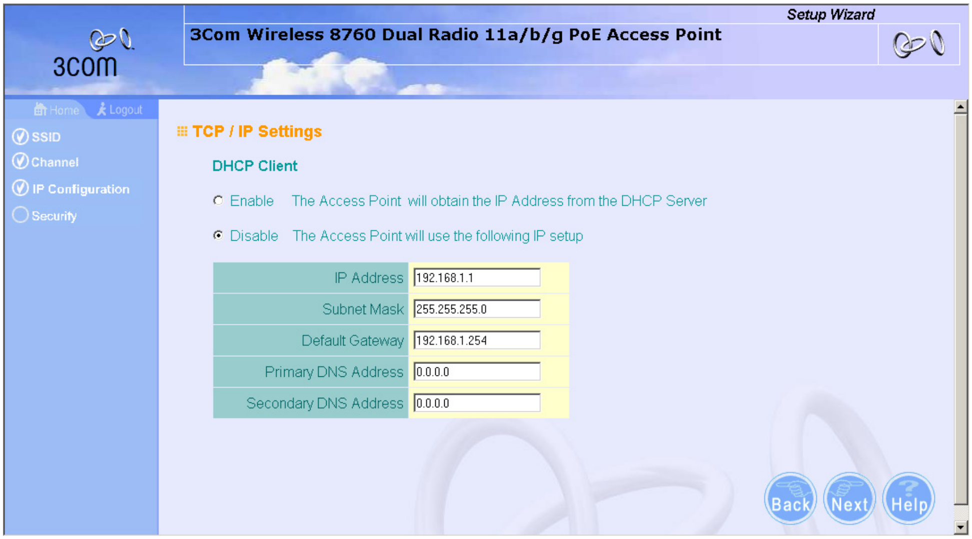


11

1
2
3
4
5
6
7
8
9
10
11

3 **IP Configuration** – Either enable or disable Dynamic Host Configuration Protocol (DHCP) for automatic IP configuration. If you disable DHCP, then manually enter the IP address and subnet mask. If a management station exists on another network segment, then you must enter the IP address for a gateway that can route traffic between these segments. Then enter the IP address for the primary and secondary Domain Name Servers (DNS) servers to be used for host-name to IP address resolution.

Figure 15 Setup Wizard - Step 3



TCP / IP Settings

DHCP Client

○ Enable The Access Point will obtain the IP Address from the DHCP Server

● Disable The Access Point will use the following IP setup

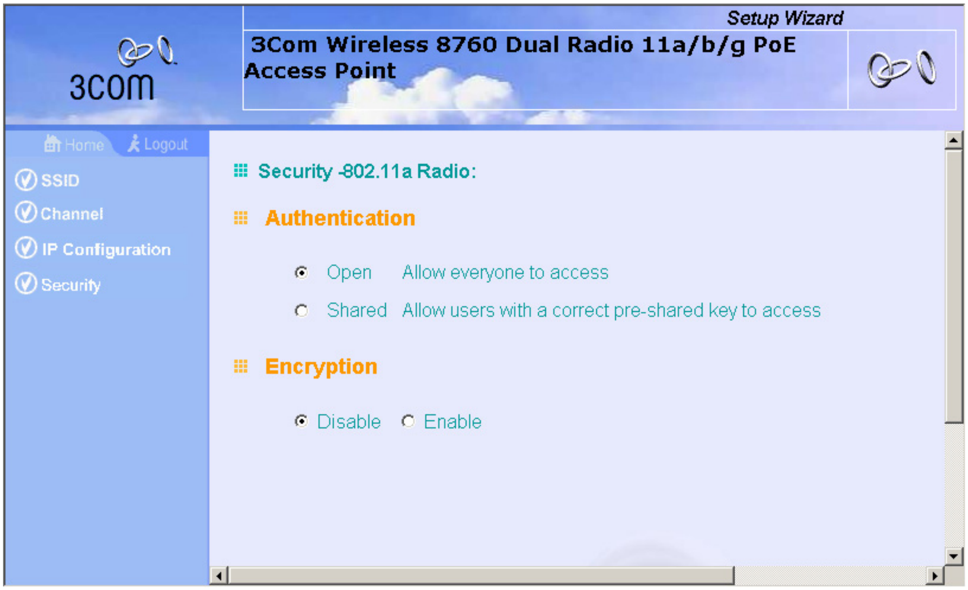
IP Address	192.168.1.1
Subnet Mask	255.255.255.0
Default Gateway	192.168.1.254
Primary DNS Address	0.0.0.0
Secondary DNS Address	0.0.0.0

DHCP Client – With DHCP Client enabled, the IP address, subnet mask and default gateway can be dynamically assigned to the access point by the network DHCP server. (Default: Disabled)

***NOTE:** If there is no DHCP server on your network, then the access point will automatically start up with its default IP address, 169.254.2.1.*

4 **Security** – Set the Authentication Type to "Open" to allow open access without authentication, or "Shared" to require authentication based on a shared key. Enable encryption to encrypt data transmissions. To configure other security features use the Advanced Setup menu as described in Chapter 4.

Figure 16 Setup Wizard - Step 4



Security -802.11a Radio:

Authentication

● Open Allow everyone to access

○ Shared Allow users with a correct pre-shared key to access

Encryption

● Disable ○ Enable

Authentication Type – Use “Open System” to allow open access to all wireless clients without performing authentication, or “Shared Key” to perform authentication based on a shared key that has been distributed to all stations. (Default: Open System)

WEP – Wired Equivalent Privacy is used to encrypt transmissions passing between wireless clients and the access point. (Default: Disabled)

Shared Key Setup – If you select “Shared Key” authentication, enable WEP, then configure the shared key by selecting 64-bit or 128-bit key type and entering a hexadecimal or ASCII string of the appropriate length. The key can be entered as alphanumeric characters or hexadecimal (0~9, A~F, e.g., D7 0A 9C 7F E5). (Default: 128 bit, hexadecimal key type)

64-Bit Manual Entry: The key can contain 10 hexadecimal digits, or 5 alphanumeric characters.

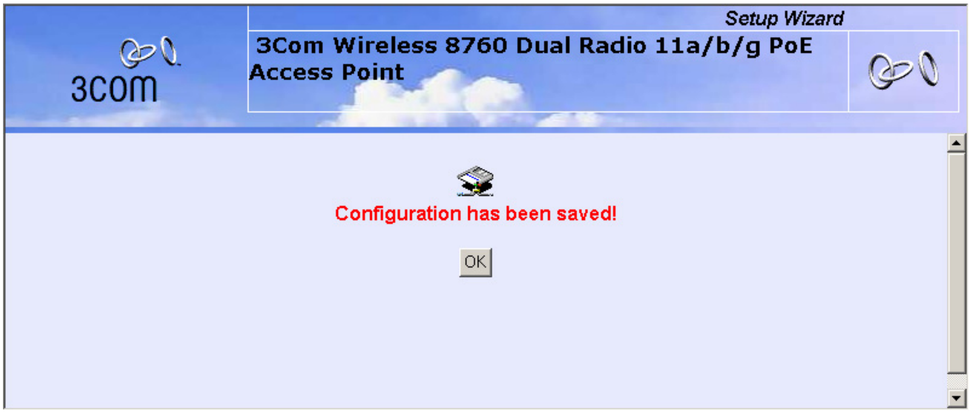
128-Bit Manual Entry: The key can contain 26 hexadecimal digits or 13 alphanumeric characters.

***NOTE:** All wireless devices must be configured with the same Key ID values to communicate with the access point.*

5 Click Finish.

6 Click the OK button to complete the wizard.

Figure 17 Setup Wizard - Completed



Configuration has been saved!

4 SYSTEM CONFIGURATION

Before continuing with advanced configuration, first complete the initial configuration steps described in Chapter 4 to set up an IP address for the access point.

The access point can be managed by any computer using a web browser (such as Internet Explorer 5.0 or above). Enter the configured IP address of the access point, or use the default address: http://169.254.2.1.

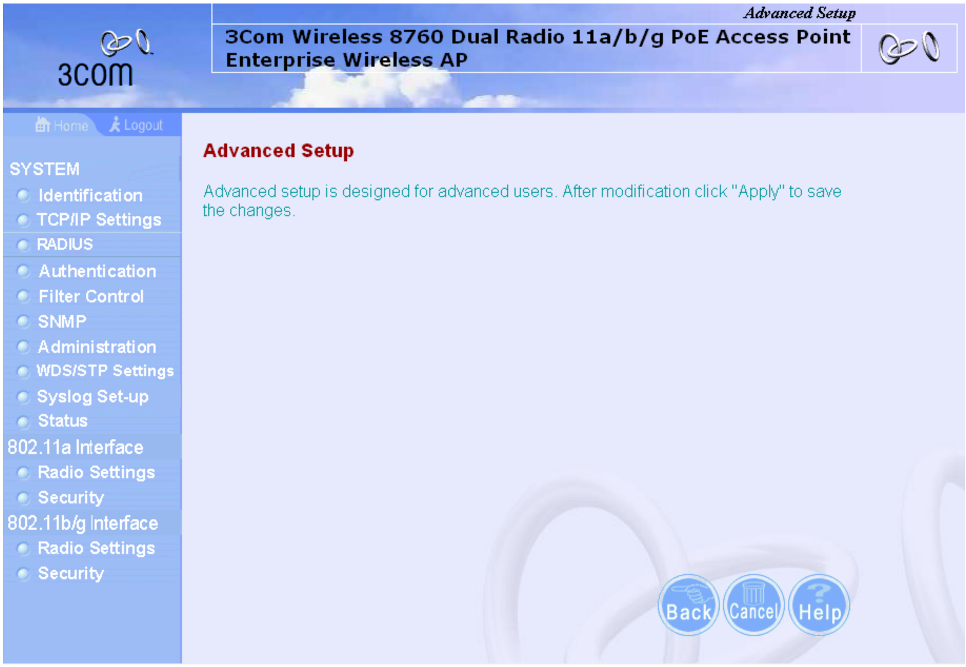
To log into the access point, enter the default user name “admin” and the password “password,” then press “LOGIN.”

For a new access point installation, the default WLAN Service Area (ESSID) is 3Com and no security is set. Unless it detects a DHCP server on the network, the access point uses Auto IP to assign an IP address of the form 169.254.2.1.

Use the 3Com Wireless Infrastructure Device Manager to locate 3Com Wireless LAN devices and launch their configurations. When installing the device manager, make sure the computer is connected to the same network as the device to be configured. After installing and launching the device manager, select the device to be configured from network tree and click Configure to launch the configuration Web interface.

When the home page displays, click on Advanced Setup. The following page will display.

Figure 18 Advanced Setup



Advanced Setup

Advanced setup is designed for advanced users. After modification click "Apply" to save the changes.

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 (page 4-22).

ADVANCED SETUP

The Advanced Setup pages include the following options.

Table 2 Advanced Setup

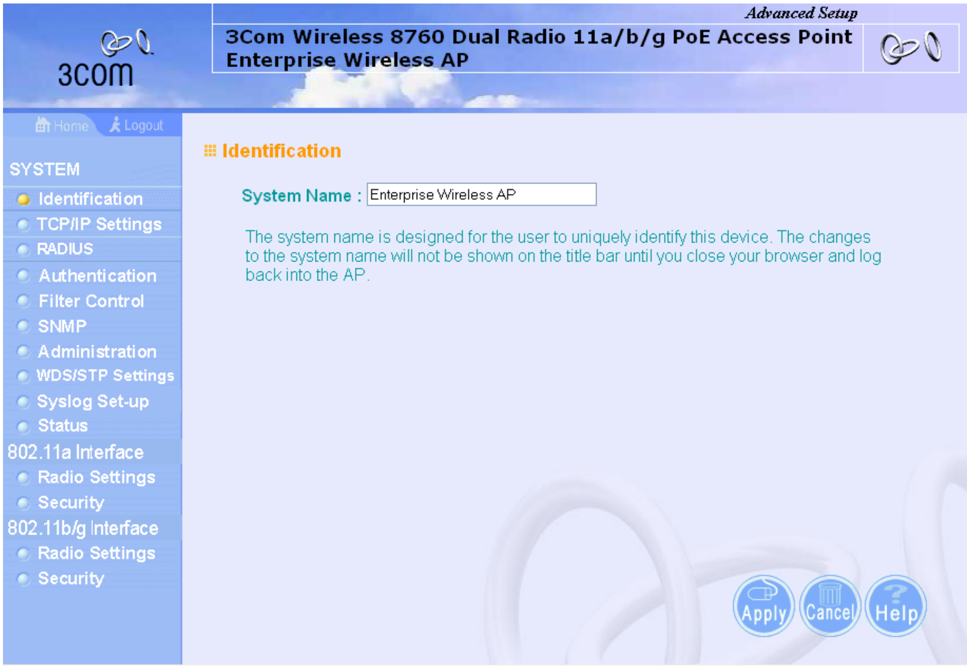
Menu	Description	Page
System	Configures basic administrative and client access	4-4
Identification	Specifies the host name	4-4
TCP / IP Settings	Configures the IP address, subnet mask, gateway, and domain name servers	4-5
RADIUS	Configures the RADIUS server for wireless client authentication	4-8
Authentication	Configures 802.1X client authentication, with an option for MAC address authentication	4-9
Filter Control	Filters communications between wireless clients, access to the management interface from wireless clients, and traffic matching specific Ethernet protocol types	4-14

Menu	Description	Page
SNMP	Configures SNMP settings	4-18
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 access point	4-22
WDS/STP Settings	Configures WDS bridging and Spanning Tree Protocol features	4-27
Syslog Set-up	Controls logging of error messages; sets the system clock via SNTP server or manual configuration	4-33
Status	Displays information about the access point and wireless clients	4-59
AP Status	Displays configuration settings for the basic system and the wireless interface	4-59
Station Status	Shows the wireless clients currently associated with the access point	4-60
Event Logs	Shows log messages stored in memory	4-61
802.11a Interface	Configures the IEEE 802.11a interface	4-35
Radio Settings	Configures common radio signal parameters and other settings for each VAP interface	4-36
Security	Enables each virtual access point (VAP) interface, sets the Service Set Identifier (SSID), and configures wireless security	4-49
802.11b/g Interface	Configures the IEEE 802.11g interface	4-35
Radio Settings	Configures common radio signal parameters and other settings for each VAP interface	4-42
Security	Enables each VAP interface, sets the SSID, and configures wireless security	4-49

SYSTEM IDENTIFICATION

The system name for the access point can be left at its default setting. However, modifying this parameter can help you to more easily distinguish different devices in your network.

Figure 19 System Identification



System Name : Enterprise Wireless AP

The system name is designed for the user to uniquely identify this device. The changes to the system name will not be shown on the title bar until you close your browser and log back into the AP.

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

TCP / IP SETTINGS

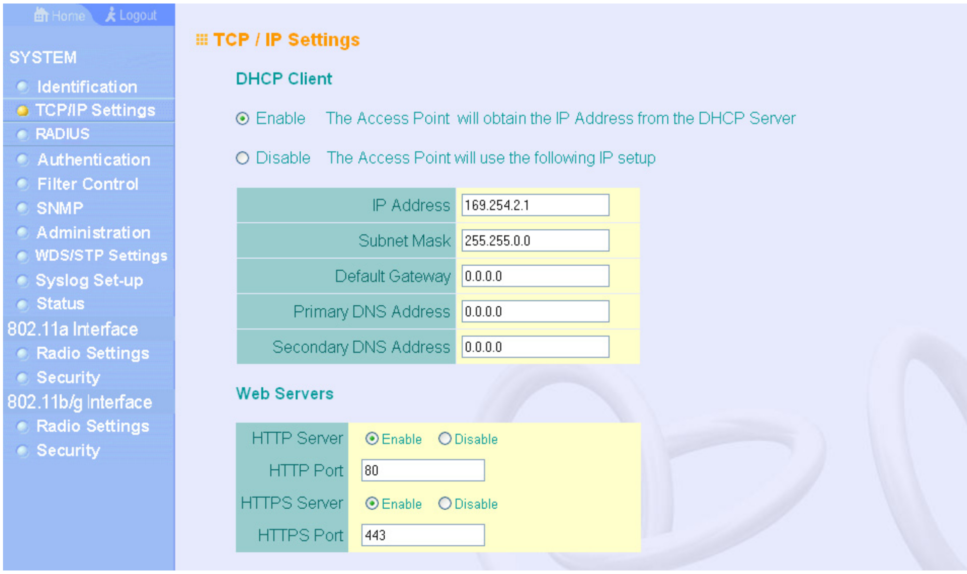
Configuring the access point with an IP address expands your ability to manage the access point. A number of access point features depend on IP addressing to operate.

NOTE: *You can use the web browser interface to access IP addressing only if the access point already has an IP address that is reachable through your network.*

By default, the access point will be automatically configured with IP settings from a Dynamic Host Configuration Protocol (DHCP) server. Use 3Com Wireless Infrastructure Device Manager to discover or set the initial IP address of the unit. WIDMAN will allow you to launch a web browser on the Access Point's web management interface by selecting the Access Point and the configure button.

NOTE: *If there is no DHCP server on your network, or DHCP fails, the access point will automatically start up with a default IP address of 169.254.2.1.*

Figure 20 TCP/IP Settings



TCP / IP Settings

DHCP Client

● Enable The Access Point will obtain the IP Address from the DHCP Server

○ Disable The Access Point will use the following IP setup

IP Address	169.254.2.1
Subnet Mask	255.255.0.0
Default Gateway	0.0.0.0
Primary DNS Address	0.0.0.0
Secondary DNS Address	0.0.0.0

Web Servers

HTTP Server	● Enable ○ Disable
HTTP Port	80
HTTPS Server	● Enable ○ Disable
HTTPS Port	443

DHCP Client (Enable) – Select this option to obtain the IP settings for the access point 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 access point by the network DHCP server.
(Default: Enabled)

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

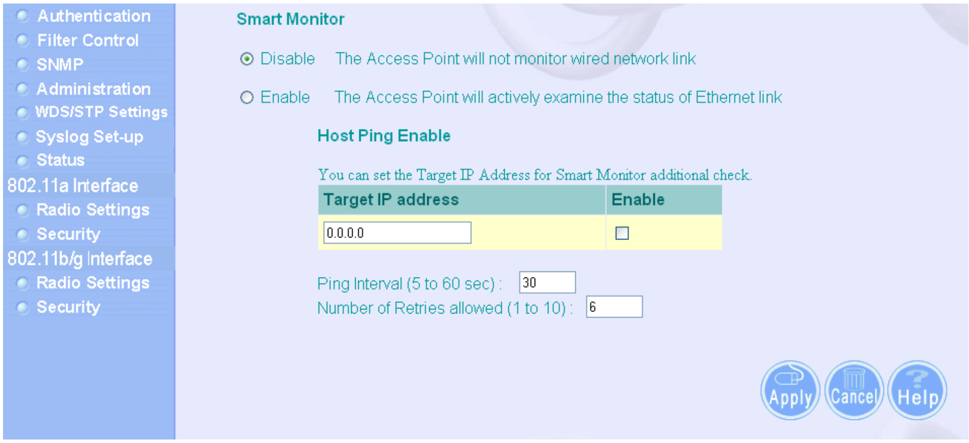
- IP Address: The IP address of the access point. Valid IP addresses consist of four decimal numbers, 0 to 255, separated by periods.
- Subnet Mask: The mask that identifies the host address bits used for routing to specific subnets.
- Default Gateway: The default gateway is the IP address of the router for the access point, 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).

Web Servers – Allows monitoring of the access point from a browser and secure connection.

- HTTP Server: Allows the access point to be monitored or configured from a browser.
- HTTP Port: Specifies the port to be used by the web browser interface.
- HTTPS Server: Enables the secure HTTP server on the access point.
- HTTPS Port: Specifies the UDP port number used for a secure HTTP connection to the access pointís Web interface.

Figure 21 Smart Monitor



Smart Monitor

● Disable The Access Point will not monitor wired network link

○ Enable The Access Point will actively examine the status of Ethernet link

Host Ping Enable

You can set the Target IP Address for Smart Monitor additional check.

Target IP address	Enable
0.0.0.0	□

Ping Interval (5 to 60 sec) : 30

Number of Retries allowed (1 to 10) : 6

By enabling Smart Monitor (known as Link Integrity in the CLI) and setting a target IP address, the AP will periodically (set by the ping interval) check to see if the target address responds to pings. If it fails to respond to a ping after the configured number of retries, it will disable both radios so that no clients can connect to the AP.

This is used to disable the AP when it cannot not reach a critical network element such as the RADIUS server, VPN Terminator, Mail Server etc.

- Disable / Enable: Disables or enables a link check to a host device on the wired network.
- Target IP address: Specifies the IP address of a host device in the wired network.
- Enable: Enables traffic between the host’s IP address and the AP.
- Ping Interval: Specifies the time between each Ping sent to the link host. (Range:300~30000 miliseconds; Default: 30 miliseconds)
- Number of Retries allowed: Specifies the number of consecutive failed Ping counts before the link is determined as lost. (Range:1~30; Default:6)

RADIUS

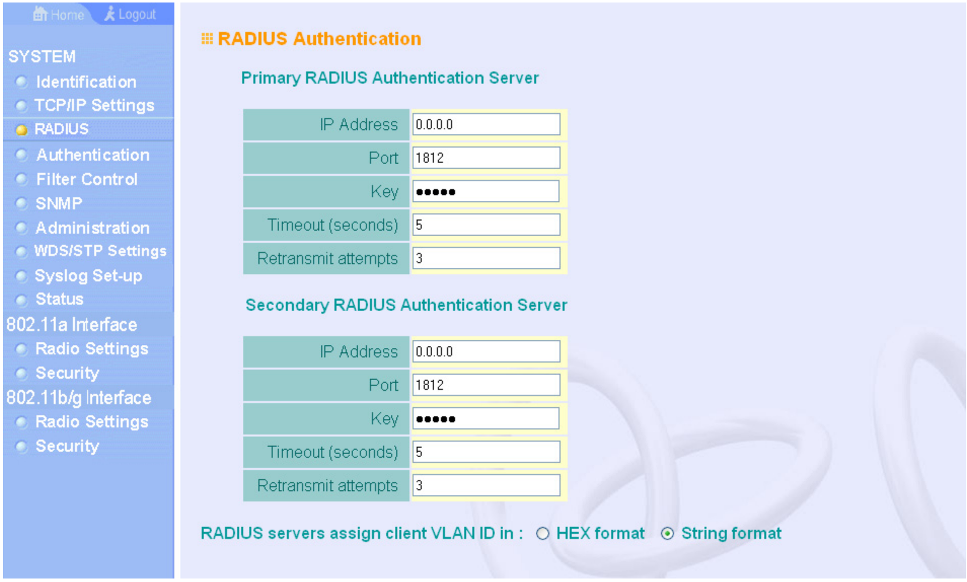
Remote Authentication Dial-in User Service (RADIUS) is an authentication protocol that uses software running on a central server to control access to RADIUS-aware devices on the network. An authentication server contains a database of user credentials for each user that requires access to the network.

A primary RADIUS server must be specified for the access point to implement IEEE 802.1X network access control and Wi-Fi 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 access point. RADIUS Accounting can be used to provide valuable information on user activity in the network.

NOTE: *This guide assumes that you have already configured RADIUS server(s) to support the access point. Configuration of RADIUS server software is beyond the scope of this guide, refer to the documentation provided with the RADIUS server software.*

Figure 22 RADIUS Authentication



RADIUS Authentication

Primary RADIUS Authentication Server

IP Address	0.0.0.0
Port	1812
Key	●●●●●
Timeout (seconds)	5
Retransmit attempts	3

Secondary RADIUS Authentication Server

IP Address	0.0.0.0
Port	1812
Key	●●●●●
Timeout (seconds)	5
Retransmit attempts	3

RADIUS servers assign client VLAN ID in : ○ HEX format ● String format

Primary RADIUS Server Setup – Configure the following settings to use RADIUS authentication on the access point.

- 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 access point 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 access point 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 access point tries to resend a request to the RADIUS server before authentication fails. (Range: 1-30; Default: 3)

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 access point uses the secondary server if the primary server fails or becomes inaccessible. Once the access point 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.

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.

AUTHENTICATION

Wireless clients can be authenticated for network access by checking their MAC address against the local database configured on the access point, 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.

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.

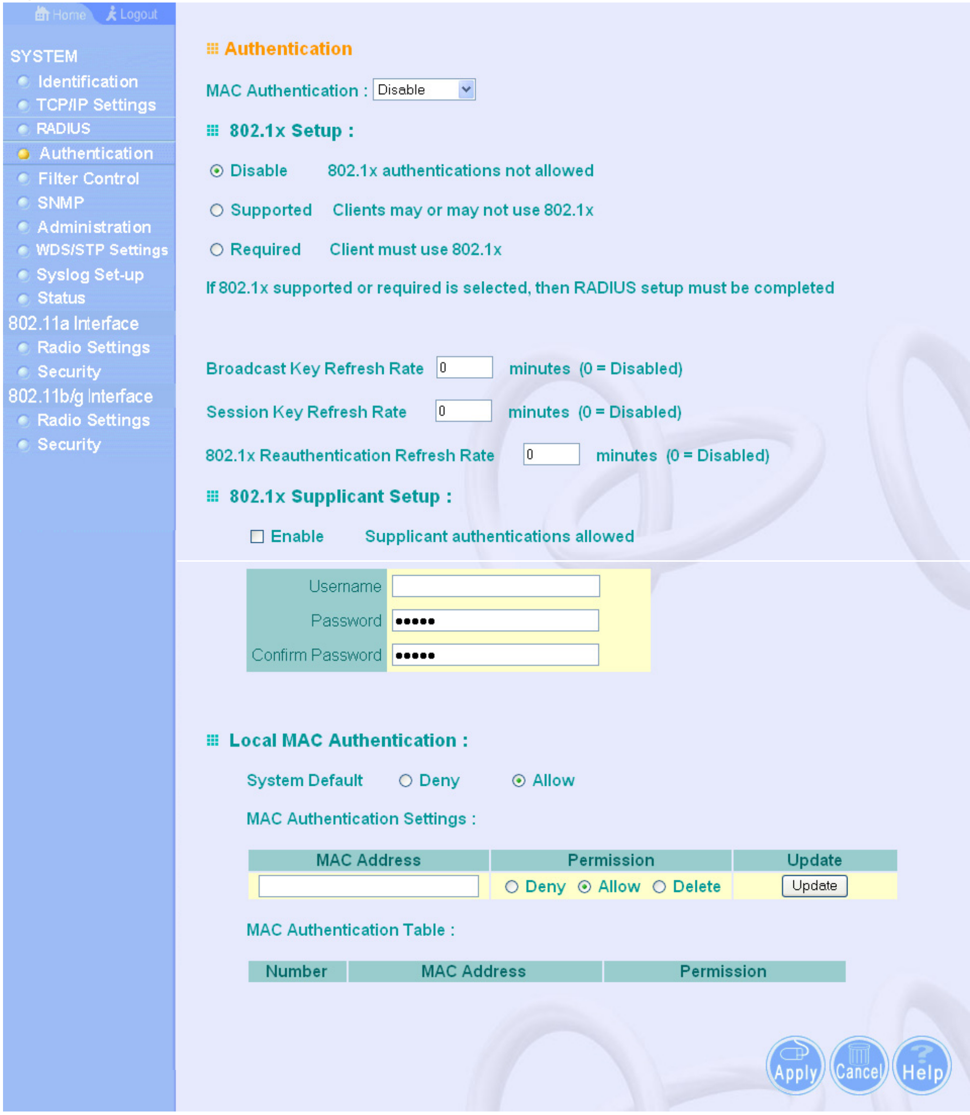
The access point can also operate in a 802.1X supplicant mode. This enables the access point itself to be authenticated with a RADIUS server using a configured MD5 user name and password. This prevents rogue access points from gaining access to the network.

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 access point itself without the need to set up a RADIUS server, but managing a large number of MAC addresses across many access points 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 W-Fi 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.*

Figure 23 Authentication



Authentication

MAC Authentication : Disable

802.1x Setup :

● Disable 802.1x authentications not allowed

○ Supported Clients may or may not use 802.1x

○ Required Client must use 802.1x

If 802.1x supported or required is selected, then RADIUS setup must be completed

Broadcast Key Refresh Rate 0 minutes (0 = Disabled)

Session Key Refresh Rate 0 minutes (0 = Disabled)

802.1x Reauthentication Refresh Rate 0 minutes (0 = Disabled)

802.1x Supplicant Setup :

□ Enable Supplicant authentications allowed

Username	
Password	•••••
Confirm Password	•••••

Local MAC Authentication :

System Default ○ Deny ● Allow

MAC Authentication Settings :

MAC Address	Permission	Update
	○ Deny ● Allow ○ Delete	Update

MAC Authentication Table :

Number	MAC Address	Permission

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 access point 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 access point. Use the Local MAC Authentication section of this web page to set up the local database, and configure all access points 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 on the RADIUS page (see "RADIUS" on page 4-8). The database of MAC addresses and filtering policy must be defined in the RADIUS server. The MAC address of the associating station is used for both the username and password. For example, an associating station with a MAC address of 12-34-56-78-9A-BC would use a username and password of "12345678abc." The username and password sent to the server will use the format defined by "radius-server radius-mac-format" (See *"RADIUS Client" on page 5-64*), which has a default setting of "no-delimiter."

NOTE: *MAC addresses on the RADIUS server can be entered in four different formats (see "radius-server radius-mac-format" on page 5-68).*

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

- Disable: The access point 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 access point 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 8.)*

When 802.1X is enabled, the broadcast and session key rotation intervals can also be configured.

- Broadcast Key Refresh Rate: Sets the interval at which the broadcast keys are refreshed for stations using 802.1X dynamic keying. (Range: 0-1440 minutes; Default: 0 means disabled)
- Session Key Refresh Rate: The interval at which the access point refreshes unicast session keys for associated clients. (Range: 0-1440 minutes; Default: 0 means disabled)
- 802.1X Reauthentication Refresh Rate: The time period after which a connected client must be re-authenticated. During the re-authentication process of verifying the client's credentials on the RADIUS server, the client remains connected the network. Only if re-authentication fails is network access blocked. (Range: 0-65535 seconds; Default: 0 means disabled)

802.1X Supplicant – The access point 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 access points from gaining access to the network.

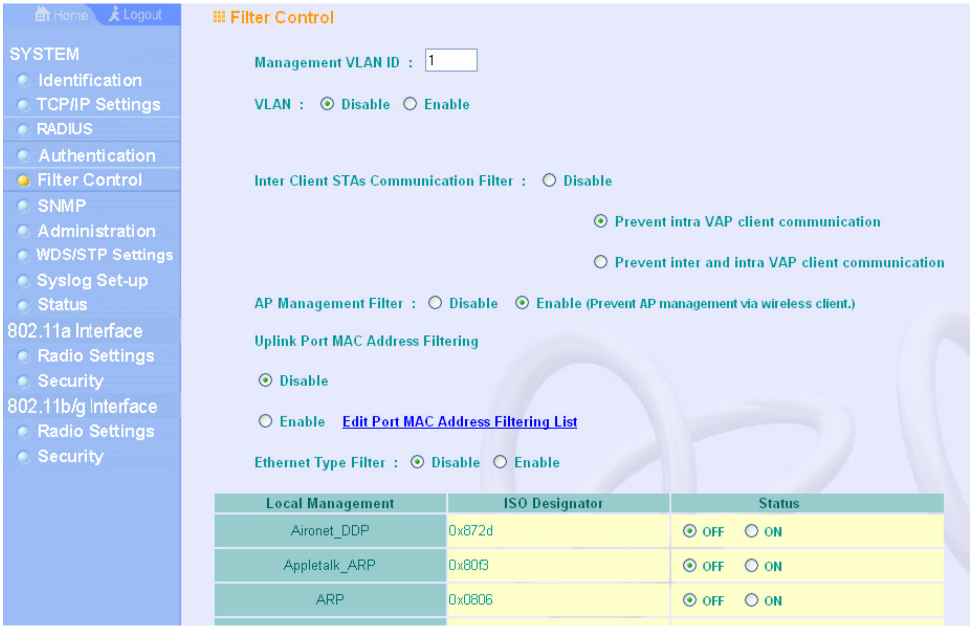
Local MAC Authentication – Configures the local MAC authentication database. The MAC database provides a mechanism to take certain actions based on a wireless client's MAC address. The MAC list can be configured to allow or deny network access to specific clients.

- 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.

FILTER CONTROL

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

Figure 24 Filter Control



Filter Control

Management VLAN ID : 1

VLAN : ● Disable ○ Enable

Inter Client STAs Communication Filter : ○ Disable

● Prevent intra VAP client communication

○ Prevent inter and intra VAP client communication

AP Management Filter : ○ Disable ● Enable (Prevent AP management via wireless client.)

Uplink Port MAC Address Filtering

● Disable

○ Enable Edit Port MAC Address Filtering List

Ethernet Type Filter : ● Disable ○ Enable

Local Management	ISO Designator	Status
Aironet_DDP	0x872d	● OFF ○ ON
Appletalk_ARP	0x80f3	● OFF ○ ON
ARP	0x0806	● OFF ○ ON

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

- Disable: 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 access point from wireless clients. Management interfaces include the web, Telnet, or SNMP. (Default: Disabled)

- 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 access point. You can add a maximum of eight 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: Access point does not filter Ethernet protocol types.
- Enabled: Access point 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 access point.

NOTE: *Ethernet protocol types not listed in the filtering table are always forwarded by the access point.*

VLAN

The access point can employ VLAN tagging support to control access to network resources and increase security. VLANs separate traffic passing between the access point, 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 access point.

Note the following points about the access point’s VLAN support:

- The management VLAN is for managing the access point through remote management tools, such as the web interface, SSH, SNMP, or Telnet. The access point only accepts management traffic that is tagged with the specified management VLAN ID.
- All wireless clients associated to the access point 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 access point 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 access point, 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 access point 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 access point, be sure to configure the attached network switch port to support tagged VLAN frames from the access point’s management VLAN ID, default VLAN IDs, and other client VLAN IDs. Otherwise, connectivity to the access point 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 access point 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 access point must have 802.1X authentication enabled and a RADIUS server configured. Wireless clients must also support 802.1X client software.*

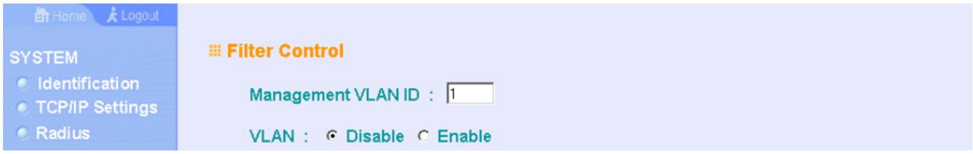
When setting up VLAN IDs for each user on the RADIUS server, be sure to use the RADIUS attributes and values as indicated in the following table.

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 5-69).

NOTE: *The specific configuration of RADIUS server software is beyond the scope of this guide. Refer to the documentation provided with the RADIUS server software.*

Figure 25 Filter Control - VLAN ID



Management VLAN ID : 1

VLAN : ● Disable ○ Enable

VLAN – Enables or disables VLAN tagging support on the access point.

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

SNMP

Simple Network Management Protocol (SNMP) is a communication protocol designed specifically for managing devices on a network. Equipment commonly managed with SNMP includes switches, routers and host computers. SNMP is typically used to configure these devices for proper operation in a network environment, as well as to monitor them to evaluate performance or detect potential problems.

Managed devices supporting SNMP contain software, which runs locally on the device and is referred to as an agent. A defined set of variables, known as managed objects, is maintained by the SNMP agent and used to manage the device. These objects are defined in a Management Information Base (MIB) that provides a standard presentation of the information controlled by the agent. SNMP defines both the format of the MIB specifications and the protocol used to access this information over the network.

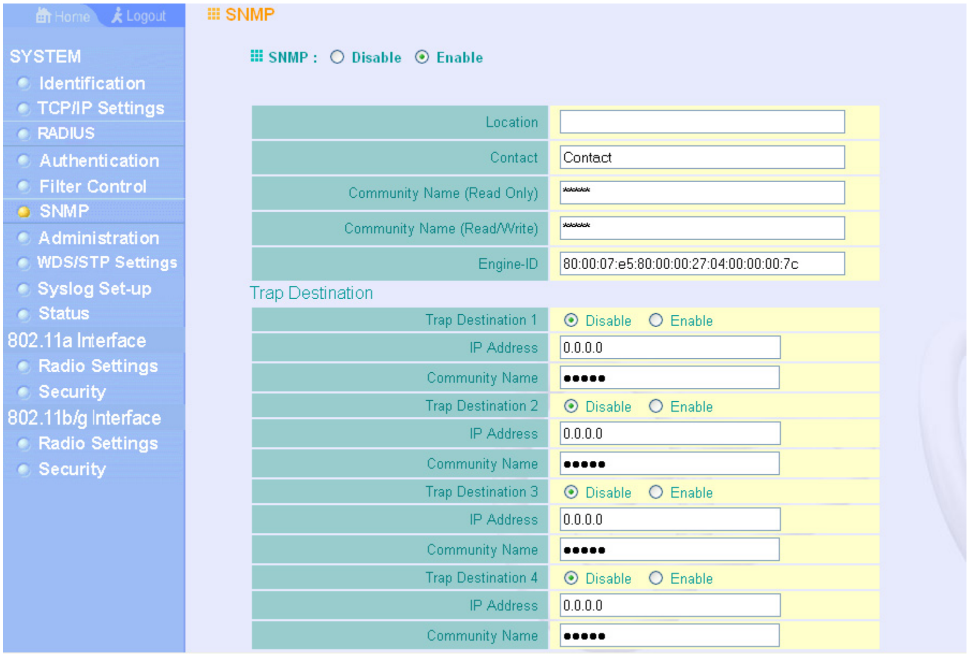
The access point includes an onboard agent that supports SNMP versions 1, 2c, and 3 clients. This agent continuously monitors the status of the access point, as well as the traffic passing to and from wireless clients. A network management station can access this information using SNMP management software that is compliant with MIB II. To implement SNMP management, the access point must first have an IP address and subnet mask, configured either manually or dynamically. Access to the onboard agent using SNMP v1 and v2c is controlled by community strings. To communicate with the access point, the management station must first submit a valid community string for authentication.

Access to the access point using SNMP v3 provides additional security features that cover message integrity, authentication, and encryption; as well as controlling notifications that are sent to specified user targets.

CONFIGURING SNMP AND TRAP MESSAGE PARAMETERS

The access point SNMP agent must be enabled to function (for versions 1, 2c, and 3 clients). Management access using SNMP v1 and v2c also requires community strings to be configured for authentication. Trap notifications can be enabled and sent to up to four management stations.

Figure 26 SNMP



SNMP

SNMP : ○ Disable ● Enable

Location	
Contact	Contact
Community Name (Read Only)	*****
Community Name (Read/Write)	*****
Engine-ID	80:00:07:e5:80:00:00:27:04:00:00:00:7c

Trap Destination

Trap Destination 1	● Disable ○ Enable
IP Address	0.0.0.0
Community Name	●●●●●
Trap Destination 2	● Disable ○ Enable
IP Address	0.0.0.0
Community Name	●●●●●
Trap Destination 3	● Disable ○ Enable
IP Address	0.0.0.0
Community Name	●●●●●
Trap Destination 4	● Disable ○ Enable
IP Address	0.0.0.0
Community Name	●●●●●

SNMP – Enables or disables SNMP management access and also enables the access point 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.

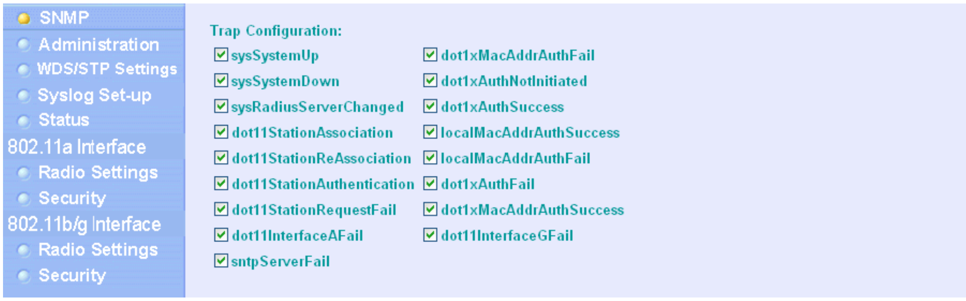
- *Trap Destination IP Address* – Specifies the recipient of SNMP notifications. Enter the IP address or the host name. (Host Name: 1 to 63 characters, case sensitive)

- *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 access point. 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 access point. (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. If you want to change the default engine ID, change it first before configuring other SNMP v3 parameters.*

Figure 27 Trap Confiiguration



Trap Configuration:

☑ sysSystemUp
☑ sysSystemDown
☑ sysRadiusServerChanged
☑ dot11StationAssociation
☑ dot11StationReAssociation
☑ dot11StationAuthentication
☑ dot11StationRequestFail
☑ dot11InterfaceAFail
☑ sntpServerFail
☑ dot1xMacAddrAuthFail
☑ dot1xAuthNotInitiated
☑ dot1xAuthSuccess
☑ localMacAddrAuthSuccess
☑ localMacAddrAuthFail
☑ dot1xAuthFail
☑ dot1xMacAddrAuthSuccess
☑ dot11InterfaceGFail

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

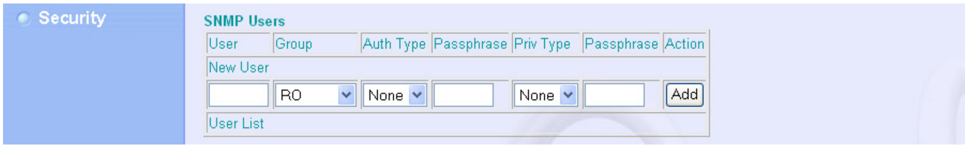
- sysSystemUp - The access point is up and running.
- sysSystemDown - The access point is about to shutdown and reboot.
- sysRadiusServerChanged - The access point has changed from the primary RADIUS server to the secondary, or from the secondary to the primary.
- dot11StationAssociation - A client station has successfully associated with the access point.
- dot11StationReAssociation - A client station has successfully re-associated with the access point.
- dot11StationAuthentication - A client station has been successfully authenticated.
- dot11StationRequestFail - A client station has failed association, re-association, or authentication.
- dot11InterfaceGFail - The 802.11b interface has failed.

- dot11InterfaceAFail - The 802.11a or 802.11g 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.
- localMacAddrAuthSuccess - A client station has successfully authenticated its MAC address with the local database on the access point.
- localMacAddrAuthFail - A client station has failed authentication with the local MAC address database on the access point.
- sntpServerFail - The access point has failed to set the time from the configured SNTP server.

CONFIGURING SNMPV3 USERS

The access point allows up to 10 SNMP v3 users to be configured. Each user must be defined by a unique name, assigned to one of three pre-defined security groups, and configured with specific authentication and encryption settings.

Figure 28 Configuring SNMPv3 Users



User	Group	Auth Type	Passphrase	Priv Type	Passphrase	Action
New User						
	RO	None		None		Add
User List						

User – The SNMPv3 user name. (32 characters maximum)

Group – The SNMPv3 group name. (Options: RO, RWAuth, or RWPriv; Default: RO)

- RO – Read-only access.
- RWAuth – Read/write access with user authentication.
- RWPriv – Read/write access with both user authentication and data encryption.

Auth Type – The authentication type used for the SNMP user; either MD5 or none. When MD5 is selected, enter a password in the corresponding Passphrase field.

Priv Type – The data encryption type used for the SNMP user; either DES or none. When DES is selected, enter a key in the corresponding Passphrase field.

Passphrase – The password or key associated with the authentication and privacy settings. A minimum of eight plain text characters is required.

Action – Click the Add button to add a new user to the list. Click the edit button to change details of an existing user. Click the Del button to remove a user from the list.

NOTE: *Users must be assigned to groups that have the same security levels. For example, a user who has "Auth Type" and "Priv Type" configured to MD5 and DES respectively (that it, uses both authentication and data encryption) must be assigned to the RWPriv group. If this same user were instead assigned to the read-only (RO) group, the user would not be able to access the database.*

ADMINISTRATION

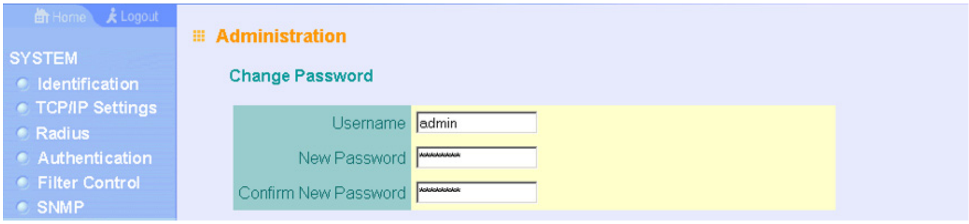
CHANGING THE PASSWORD

Management access to the web and CLI interface on the access point 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 4-14).

To protect access to the management interface, you need to configure an Administrator's user name and password as soon as possible. If the user name and password are not configured, then anyone having access to the access point may be able to compromise access point and network security. Once a new Administrator has been configured, you can delete the default "admin" user name from the system.

NOTE: *Pressing the Reset button on the back of the access point for more than 10 seconds resets the user name and password to the factory defaults. For this reason, we recommend that you protect the access point from physical access by unauthorized persons.*

Figure 29 Administration



Administration

Change Password

Username	admin
New Password	********
Confirm New Password	********

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.

TELNET AND SSH SETTINGS

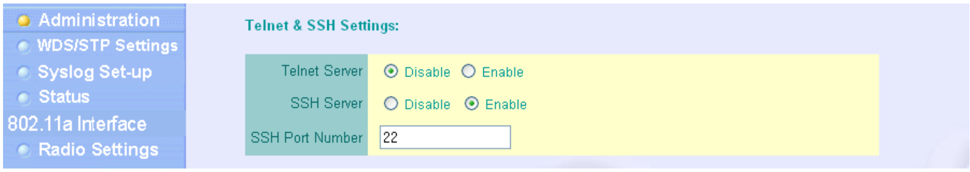
Telnet is a remote management tool that can be used to configure the access point from anywhere in the network. However, Telnet is not secure from hostile attacks. The Secure Shell (SSH) can act as a secure replacement for Telnet. The SSH protocol uses generated public keys to encrypt all data transfers passing between the access point 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.

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

NOTE: *The access point supports only SSH version 2.0.*

NOTE: *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 30 Telnet and SSH Settings



Telnet & SSH Settings:

Telnet Server	● Disable ○ Enable
SSH Server	○ Disable ● Enable
SSH Port Number	22

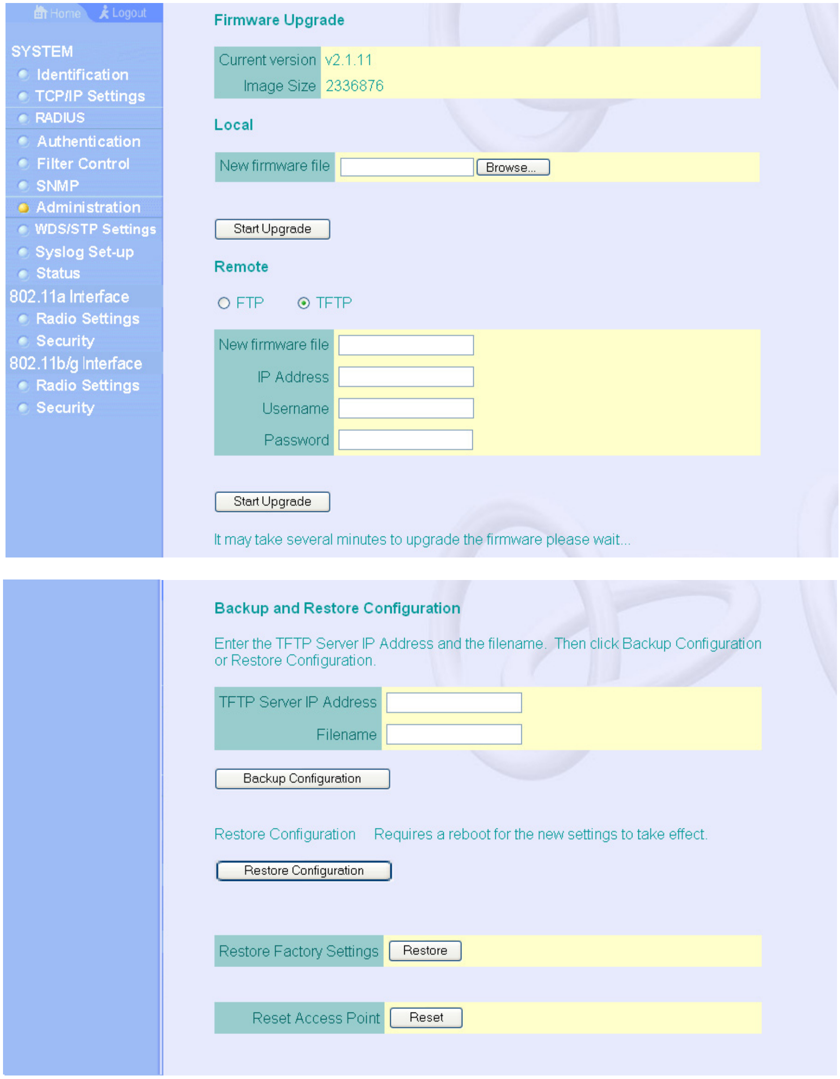
- *Telnet Server*: Enables or disables the Telnet server. (Default: Disabled)
- *SSH Server*: Enables or disables the SSH server. (Default: Enabled)
- *SSH Port* Number: Sets the UDP port for the SSH server. (Range: 1-65535; Default: 22)

UPGRADING FIRMWARE

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

After upgrading new software, you must reboot the access point to implement the new code. Until a reboot occurs, the access point 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 access point to the factory default settings when first activated after a reboot.

Figure 31 Firmware Upgrade



Firmware Upgrade

Current version	v2.1.11
Image Size	2336876

Local

New firmware file

Remote

○ FTP ● TFTP

New firmware file

IP Address

Username

Password

It may take several minutes to upgrade the firmware please wait...

Backup and Restore Configuration

Enter the TFTP Server IP Address and the filename. Then click Backup Configuration or Restore Configuration.

TFTP Server IP Address

Filename

Restore Configuration Requires a reboot for the new settings to take effect.

Restore Factory Settings

Reset Access Point

Before upgrading new software, verify that the access point 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 access point 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 access point, 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 access point 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 access point 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 device will only accept firmware files named "3Com-img.bin".

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 firmware file must be named "3com-img.bin".
- IP Address: IP address or host name of the TFTP server.

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

- Config file: Specifies the name of the configuration file. 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 TFTP server is 255 characters. (Valid characters: A-Z, a-z, 0-9, ".", "-", "_")
- IP Address: IP address or host name of the TFTP server.

Restore Factory Settings – Click the Restore button to reset the configuration settings for the access point 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.

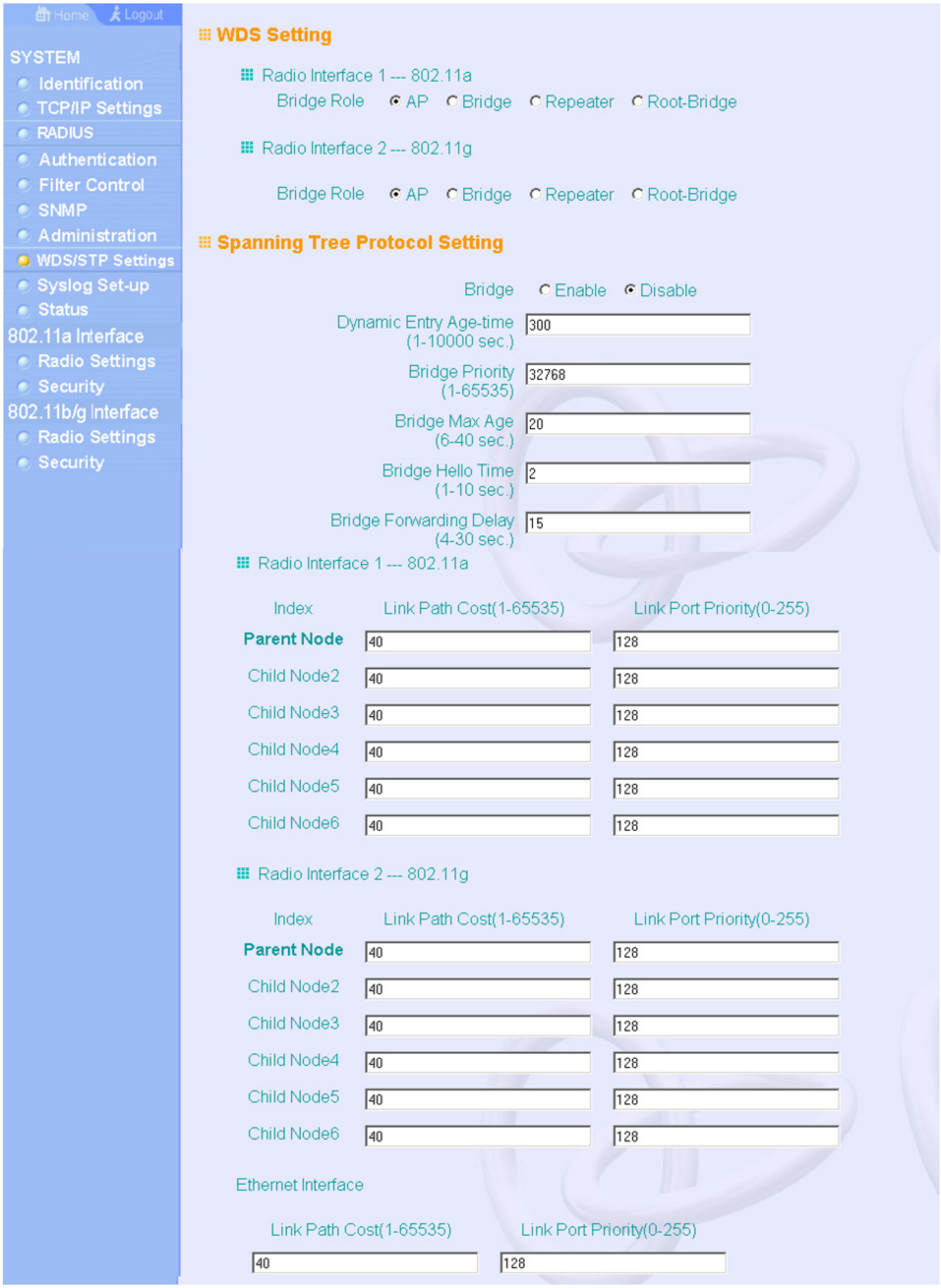
***NOTE:** If you have upgraded system software, then you must reboot the access point to implement the new operation code. New software that is incompatible with the current configuration automatically restores the access point to default values when first activated after a reboot.*

WDS and Spanning Tree Settings

Each access point radio interface can be configured to operate in a bridge or repeater mode, which allows it to forward traffic directly to other access point units. To set up bridge links between access point units, you must configure the wireless Distribution System (WDS) forwarding table by specifying the wireless MAC address of all units to which you want to forward traffic. Up to six WDS bridge or repeater links can be specified for each unit in the wireless bridge network.

The Spanning Tree Protocol (STP) can be used to detect and disable network loops, and to provide backup links between bridges. This allows a wireless bridge to interact with other bridging devices (that is, an STP-compliant switch, bridge or router) in your network to ensure that only one route exists between any two stations on the network, and provide backup links which automatically take over when a primary link goes down.

Figure 32 WDS and Spanning Tree Settings



WDS Setting

Radio Interface 1 --- 802.11a

Bridge Role ● AP ○ Bridge ○ Repeater ○ Root-Bridge

Radio Interface 2 --- 802.11g

Bridge Role ● AP ○ Bridge ○ Repeater ○ Root-Bridge

Spanning Tree Protocol Setting

Bridge ○ Enable ● Disable

Dynamic Entry Age-time (1-10000 sec.)	300
Bridge Priority (1-65535)	32768
Bridge Max Age (6-40 sec.)	20
Bridge Hello Time (1-10 sec.)	2
Bridge Forwarding Delay (4-30 sec.)	15

Radio Interface 1 --- 802.11a

Index	Link Path Cost(1-65535)	Link Port Priority(0-255)
Parent Node	40	128
Child Node2	40	128
Child Node3	40	128
Child Node4	40	128
Child Node5	40	128
Child Node6	40	128

Radio Interface 2 --- 802.11g

Index	Link Path Cost(1-65535)	Link Port Priority(0-255)
Parent Node	40	128
Child Node2	40	128
Child Node3	40	128
Child Node4	40	128
Child Node5	40	128
Child Node6	40	128

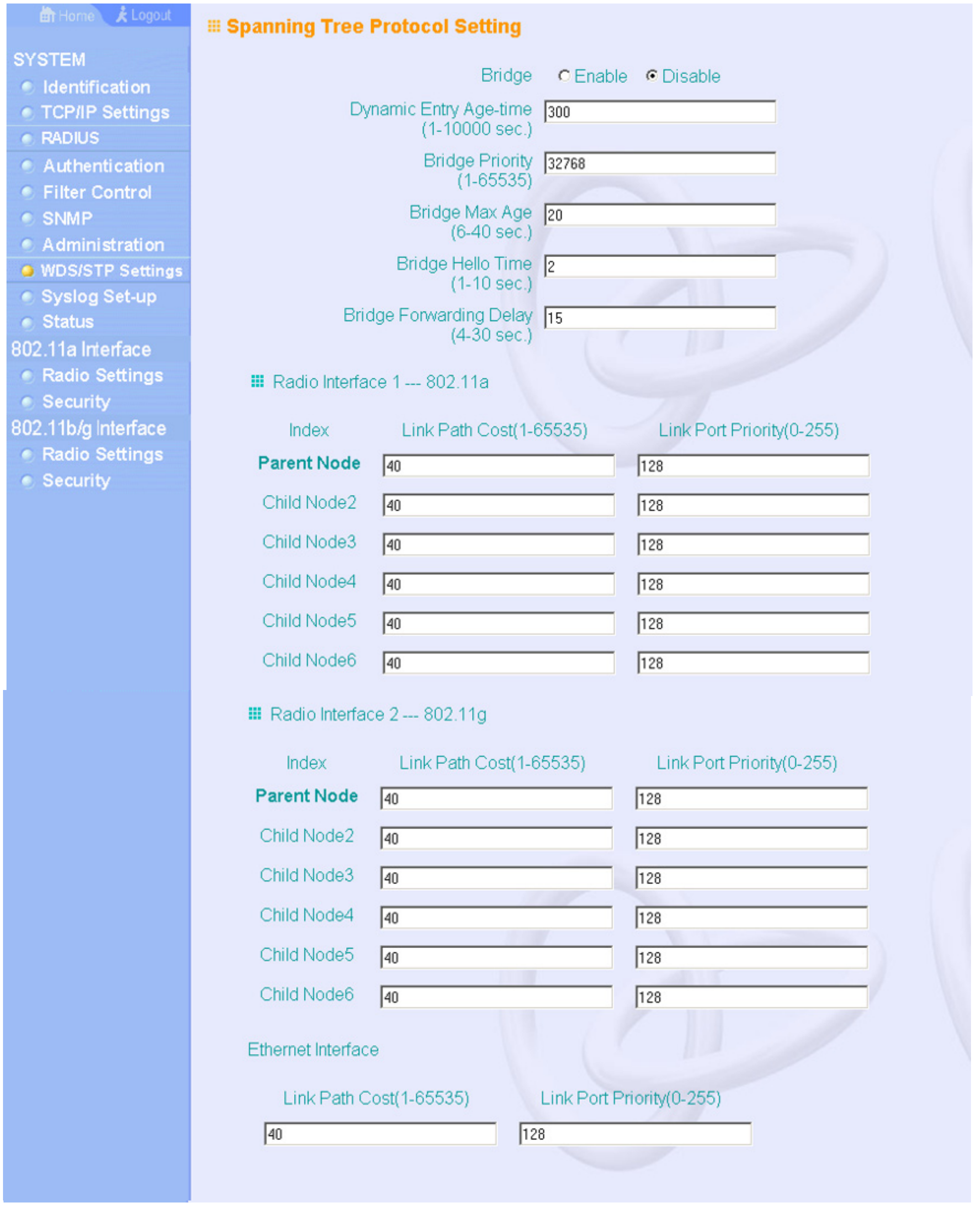
Ethernet Interface

Link Path Cost(1-65535)	Link Port Priority(0-255)
40	128

WDS Bridge – Up to six WDS bridge or repeater links (MAC addresses) per radio interface can be specified for each unit in the wireless bridge network. One unit only must be configured as the "root bridge" in the wireless network. The root bridge is the unit connected to the main core of the wired LAN. Other bridges need to specify one "Parent" link to the root bridge or to a bridge connected to the root bridge. The other five WDS links are available as "Child" links to other bridges.

- *Bridge Role* – Each radio interface can be set to operate in one of the following four modes: (Default: AP)
    - AP (Access Point): Operates as an access point for wireless clients, providing connectivity to a wired LAN.
    - Bridge: Operates as a bridge to other access points. The "Parent" link to the root bridge must be configured. Up to five other "Child" links are available to other bridges.
    - Repeater: Operates as a wireless repeater, extending the range for remote wireless clients and connecting them to the root bridge. The "Parent" link to the root bridge must be configured. In this mode, traffic is not forwarded to the Ethernet port from the radio interface.
    - Root Bridge: Operates as the root bridge in the wireless bridge network. Up to six "Child" links are available to other bridges in the network.
- *Bridge Parent* – The physical layer address of the root bridge unit or the bridge unit connected to the root bridge. (12 hexadecimal digits in the form "xx-xx-xx-xx-xx-xx")
- *Bridge Child* – The physical layer address of other bridge units for which this unit serves as the bridge parent or the root bridge. Note that the first entry under the list of child nodes is reserved for the root bridge, and can only be configured if the role is set to "Root Bridge." (12 hexadecimal digits in the form "xx-xx-xx-xx-xx-xx")

Figure 33 Spanning Tree Protocol



Spanning Tree Protocol Setting

Bridge ○ Enable ● Disable

Dynamic Entry Age-time (1-10000 sec.)	300
Bridge Priority (1-65535)	32768
Bridge Max Age (6-40 sec.)	20
Bridge Hello Time (1-10 sec.)	2
Bridge Forwarding Delay (4-30 sec.)	15

Radio Interface 1 --- 802.11a

Index	Link Path Cost(1-65535)	Link Port Priority(0-255)
Parent Node	40	128
Child Node2	40	128
Child Node3	40	128
Child Node4	40	128
Child Node5	40	128
Child Node6	40	128

Radio Interface 2 --- 802.11g

Index	Link Path Cost(1-65535)	Link Port Priority(0-255)
Parent Node	40	128
Child Node2	40	128
Child Node3	40	128
Child Node4	40	128
Child Node5	40	128
Child Node6	40	128

Ethernet Interface

Link Path Cost(1-65535)	Link Port Priority(0-255)
40	128

Spanning Tree Protocol – STP uses a distributed algorithm to select a bridging device (STP-compliant switch, bridge or router) that serves as the root of the spanning tree network. It selects a root port on each bridging device (except for the root device) which incurs the lowest path cost when forwarding a packet from that device to the root device. Then it selects a designated bridging device from each LAN which incurs the lowest path cost when forwarding a packet from that LAN to the root device. All ports connected to designated bridging devices are assigned as designated ports. After determining the lowest cost spanning tree, it enables all root ports and designated ports, and disables all other ports. Network packets are therefore only forwarded between root ports and designated ports, eliminating any possible network loops.

Once a stable network topology has been established, all bridges listen for Hello BPDUs (Bridge Protocol Data Units) transmitted from the root bridge. If a bridge does not get a Hello BPDU after a predefined interval (Maximum Age), the bridge assumes that the link to the root bridge is down. This bridge will then initiate negotiations with other bridges to reconfigure the network to reestablish a valid network topology.

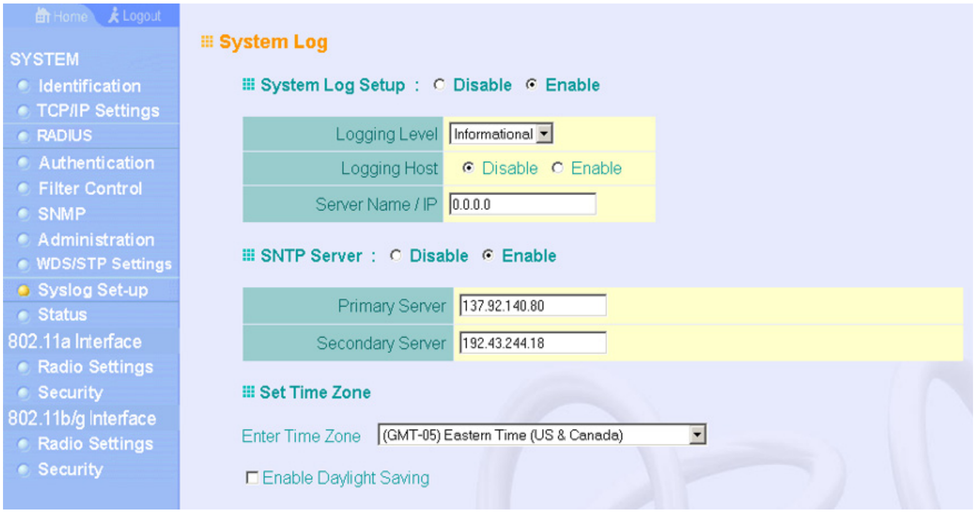
- *Bridge* – Enables/disables STP on the wireless bridge or repeater. (Default: Disabled)
- *Bridge Priority* – Used in selecting the root device, root port, and designated port. The device with the highest priority becomes the STP root device. However, if all devices have the same priority, the device with the lowest MAC address will then become the root device. (Note that lower numeric values indicate higher priority.)
  - Range: 0-65535
  - Default: 32768
- *Bridge Max Age* – The maximum time (in seconds) a device can wait without receiving a configuration message before attempting to reconfigure. All device ports (except for designated ports) should receive configuration messages at regular intervals. Any port that ages out STP information (provided in the last configuration message) becomes the designated port for the attached LAN. If it is a root port, a new root port is selected from among the device ports attached to the network. (Range: 6-40 seconds)
  - Default: 20
  - Minimum: The higher of 6 or [2 x (Hello Time + 1)].
  - Maximum: The lower of 40 or [2 x (Forward Delay - 1)]
- *Bridge Hello Time* – Interval (in seconds) at which the root device transmits a configuration message. (Range: 1-10 seconds)
  - Default: 2
  - Minimum: 1
  - Maximum: The lower of 10 or [(Max. Message Age / 2) -1]

- *Bridge Forwarding Delay* – The maximum time (in seconds) this device waits before changing states (i.e., discarding to learning to forwarding). This delay is required because every device must receive information about topology changes before it starts to forward frames. In addition, each port needs time to listen for conflicting information that would make it return to a discarding state; otherwise, temporary data loops might result. (Range: 4-30 seconds)
  - Default: 15
  - Minimum: The higher of 4 or [(Max. Message Age / 2) + 1]
  - Maximum: 30
- *Link Path Cost* – This parameter is used by the STP to determine the best path between devices. Therefore, lower values should be assigned to ports attached to faster media, and higher values assigned to ports with slower media. (Path cost takes precedence over port priority.)
  - Range: 1-65535
  - Default: Ethernet interface: 19; Wireless interface: 40
- *Link Port Priority* – Defines the priority used for this port in the Spanning Tree Protocol. If the path cost for all ports on a switch are the same, the port with the highest priority (i.e., lowest value) will be configured as an active link in the spanning tree. This makes a port with higher priority less likely to be blocked if the Spanning Tree Protocol is detecting network loops. Where more than one port is assigned the highest priority, the port with lowest numeric identifier will be enabled.
  - Default: 128
  - Range: 0-240, in steps of 16

SYSTEM LOG

The access point 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 34 System Log



System Log

System Log Setup : ○ Disable ● Enable

Logging Level: Informational

Logging Host: ● Disable ○ Enable

Server Name / IP: 0.0.0.0

SNTP Server : ○ Disable ● Enable

Primary Server: 137.92.140.80

Secondary Server: 192.43.244.18

Set Time Zone

Enter Time Zone: (GMT-05) Eastern Time (US & Canada)

□ Enable Daylight Saving

ENABLING SYSTEM LOGGING

The access point 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 access point and network problems.

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

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

Logging Host – Enables the sending of log messages to a Syslog server host. Up to four Syslog servers are supported on the access point. (Default: Disable)

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

SNTP Server – Enables the sending of log messages to a Syslog server host. (Default: Disable)

Primary Server – The IP address the primary Syslog server. (Default: 0.0.0.0)

Secondary Server – The IP address the secondary Syslog server. (Default: 0.0.0.0)

Enter Time Zone – Sets the desired time zone + or - GMT.

Enable Daylight Saving – Adjusts the clock for summertime and wintertime.

The system allows you to limit the messages that are logged by specifying a minimum severity level. The following table 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 3 Logging 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 access point error log can be viewed using the Event Logs window in the Status section (page 4-61). The Event Logs window displays the last 128 messages logged in chronological order, from the newest to the oldest. Log messages saved in the access point's memory are erased when the device is rebooted.*

CONFIGURING SNTP

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

The access point 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 access point will attempt to poll each server in the configured sequence.

SNTP Server – Configures the access point 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 access point attempts to poll for a time update.

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

***NOTE:** The access point 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 access point 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.

RADIO INTERFACE

The IEEE 802.11a and 802.11g interfaces include 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.

The access point can operate in three modes, IEEE 802.11a only, 802.11b/g only, or a mixed 802.11a/b/g mode. Also note that 802.11g is backward compatible with 802.11b. These interfaces are configured independently under the following web pages:

- 802.11a Interface
- 802.11b/g Interface

Each radio supports up to four virtual access point (VAP) interfaces numbered 1to 4. Each VAP functions as a separate access point, 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.

***NOTE:** The 8760 Access Point ships from the factory enabled only for channels allowed in the US/Canada. If you live in an area where additional channels are allowed, go to the 3Com web site (http://www.3com.com) and download the latest software that will allow additional channels in your country.*

802.11A INTERFACE

The IEEE 802.11a interface operates within the 5 GHz band, at up to 54 Mbps in normal mode or up to 108 Mbps in Turbo mode.

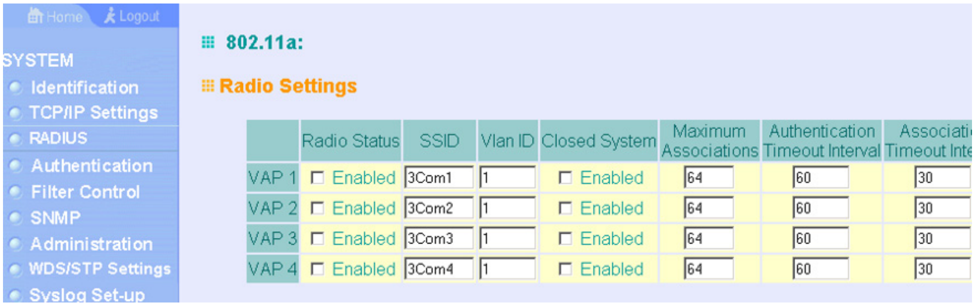
First configure the radio settings that apply to the individual VAPs (Virtual Access Point) and the common radio settings that apply to the overall system. After you have configured the radio settings, go to the Security page under the 802.11a Interface (See “Security” on page 49.), enable the radio 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 select a country before the wireless interfaces are enabled.*

Configuring Radio Settings

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

Figure 35 Radio Settings A



802.11a:

Radio Settings

	Radio Status	SSID	Vlan ID	Closed System	Maximum Associations	Authentication Timeout Interval	Associati Timeout Inte
VAP 1	□ Enabled	3Com1	1	□ Enabled	64	60	30
VAP 2	□ Enabled	3Com2	1	□ Enabled	64	60	30
VAP 3	□ Enabled	3Com3	1	□ Enabled	64	60	30
VAP 4	□ Enabled	3Com4	1	□ Enabled	64	60	30

Radio Status – Displays if the radio is enabled or disabled for this VAP.

***NOTE:** You must first enable VAP interface 1 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: 3Com1 to 3Com4 for 802.11a, 3Com5 to 3Com8 for 802.11b/g; Range: 1-32 characters)

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)

Maximum Associations – This command configures the maximum number of clients that can be associated with the access point at the same time.

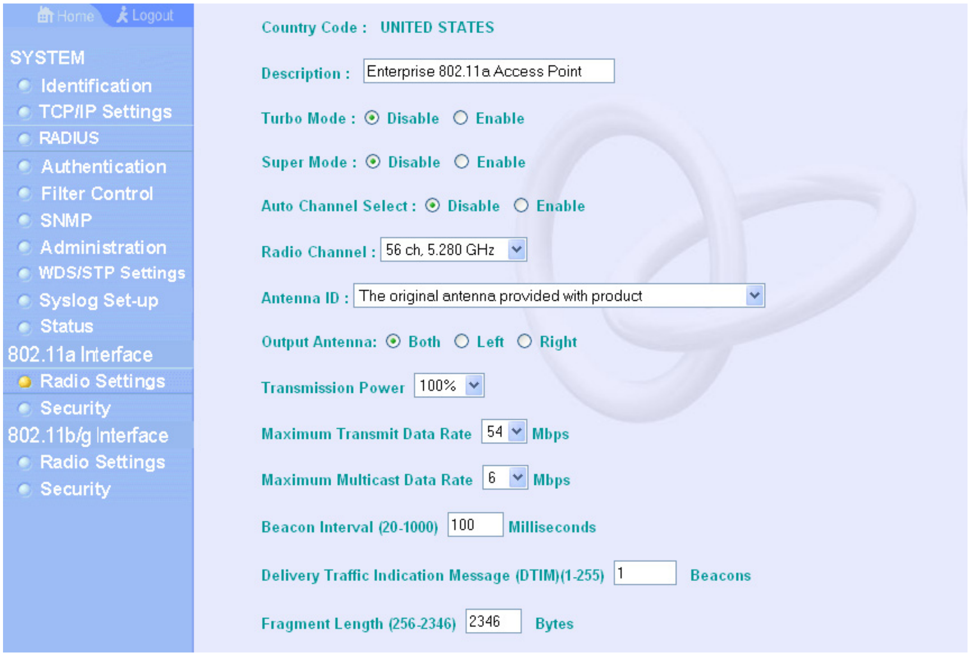
Authentication Timeout Interval – The time within which the client should finish authentication before authentication times out. (Range: 5-60 minutes; Default: 60 minutes)

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)

CONFIGURING COMMON RADIO SETTINGS

To configure common radio settings, select the Radio Settings page, and scroll down to below the VAP radio settings.

Figure 36 Radio Settings A



Country Code : UNITED STATES

Description : Enterprise 802.11a Access Point

Turbo Mode : ● Disable ○ Enable

Super Mode : ● Disable ○ Enable

Auto Channel Select : ● Disable ○ Enable

Radio Channel : 56 ch, 5.280 GHz

Antenna ID : The original antenna provided with product

Output Antenna: ● Both ○ Left ○ Right

Transmission Power 100%

Maximum Transmit Data Rate 54 Mbps

Maximum Multicast Data Rate 6 Mbps

Beacon Interval (20-1000) 100 Milliseconds

Delivery Traffic Indication Message (DTIM)(1-255) 1 Beacons

Fragment Length (256-2346) 2346 Bytes

Country Code – The current country code setting. This setting restricts operation of the access point to radio channels and transmit power levels permitted for wireless networks in the specified country.

Description – Adds a comment or description to the wireless interface. (Range: 1-80 characters)

Turbo Mode – The normal 802.11a wireless operation mode provides connections up to 54 Mbps. Turbo Mode is an enhanced mode (not regulated in IEEE 802.11a) that provides a higher data rate of up to 108 Mbps. Enabling Turbo Mode allows the access point to provide connections up to 108 Mbps. (Default: Disabled)

NOTE: *In normal mode, the access point provides a channel bandwidth of 20 MHz, and supports the maximum number of channels permitted by local regulations (e.g., 13 channels for the United States). In Turbo Mode, the channel bandwidth is increased to 40 MHz to support the increased data rate. However, this reduces the number of channels supported (e.g., 5 channels for the United States).*

NOTE: *.Check your country's regulations to see if Turbo Mode is allowed.*

Super Mode – The Atheros proprietary Super A 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)

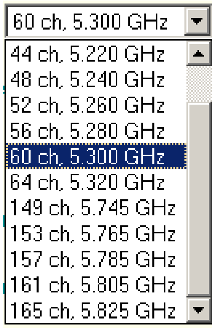
Auto Channel Select – Enables the access point to automatically select an unoccupied radio channel. (Default: Enabled)

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

Radio Channel – The radio channel that the access point uses to communicate with wireless clients. When multiple access points are deployed in the same area, set the channel on neighboring access points at least four channels apart to avoid interference with each other. For example, in the United States you can deploy up to four access points in the same area (e.g., channels 36, 56, 149, 165). 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. (Default: Channel 60 for normal mode, and channel 42 for Turbo mode)

Antenna ID – Selects the antenna to be used by the access point; either the included diversity antennas or an optional external antenna. 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 access point's radio transmissions are within regulatory power limits for the country of operation. (Default: 3Com Integrated Antenna)

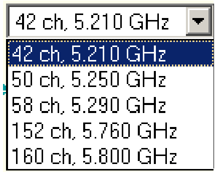
Normal Mode



60 ch, 5.300 GHz

44 ch, 5.220 GHz
48 ch, 5.240 GHz
52 ch, 5.260 GHz
56 ch, 5.280 GHz
60 ch, 5.300 GHz
64 ch, 5.320 GHz
149 ch, 5.745 GHz
153 ch, 5.765 GHz
157 ch, 5.785 GHz
161 ch, 5.805 GHz
165 ch, 5.825 GHz

Turbo Mode



42 ch, 5.210 GHz

42 ch, 5.210 GHz
50 ch, 5.250 GHz
58 ch, 5.290 GHz
152 ch, 5.760 GHz
160 ch, 5.800 GHz

ℹ **NOTE:** *The Antenna ID must be selected in conjunction with the Output Antenna to configure proper use of any of the antenna options.*

Output Antenna – Selects the use of both fixed antennas operating in diversity mode or a single antenna. (Default: Diversity)

- Both: The radio uses both antennas in a diversity system. Select this method when the Antenna ID is set to “3Com Integrated Antenna” to use the access point's integrated antennas.
- Right: The radio only uses the antenna on the right side (the side closest to the access point LEDs). Select this method when using an optional external antenna that is connected to the right antenna connector.
- Left: The radio only uses the antenna on the left side (the side farthest from the access point LEDs). Select this method when using an optional external antenna that is connected to the left antenna connector.

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%)

ℹ **NOTE:** *When operating the access point using 5 GHz channels in a European Community country, the end user and installer are obligated to operate the device in accordance with European regulatory requirements for Transmit Power Control (TPC).*

Maximum Transmit 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. (Options: 6, 9, 12, 18, 24, 36, 48, and 54 for 802.11a; 1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48, and 54 for 802.11b/g; Default: 54 Mbps)

Maximum 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 for 802.11a; 1, 2, 5.5, 11, Default 5.5 Mbps for 802.11b/g)

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)

Delivery Traffic Indication Message (DTIM) – The rate at which stations in sleep mode must wake up to receive broadcast/multicast transmissions.

The DTIM interval 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 1 indicates that the access point will save all broadcast/multicast frames for the Basic Service Set (BSS) and forward them after every 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)

Fragment Length (256~2346)– 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 access points 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)

802.11B/G INTERFACE

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, 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.

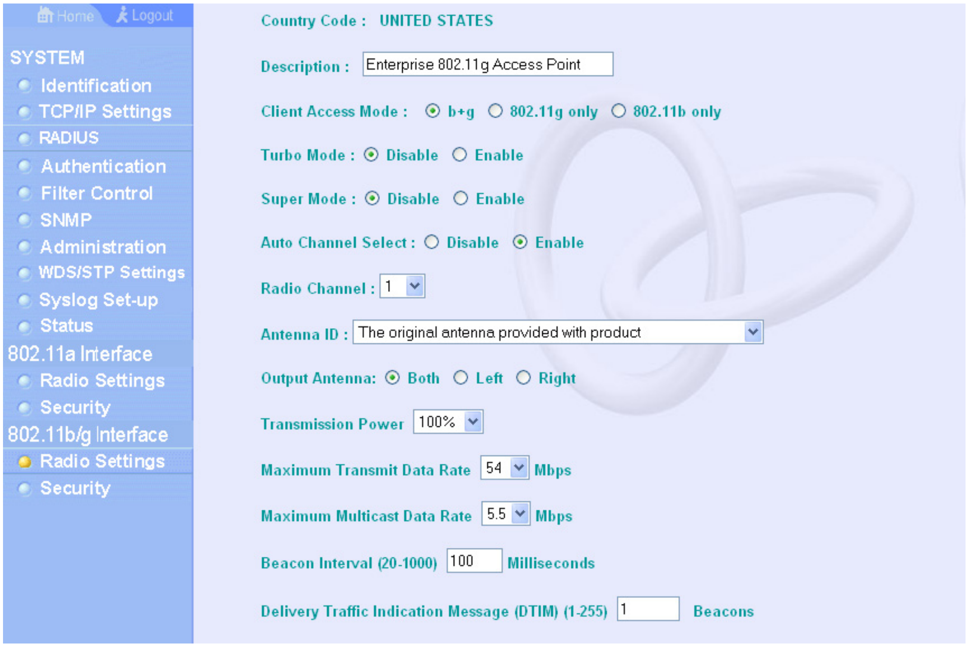
NOTE: *You must first select a country of operation before interfaces can be enabled.*

Most of the 802.11g commands are identical to those used by the 802.11a interface. For information on the these commands, refer to the following sections:

- "Configuring Radio Settings" on page 4-36
- "Configuring Common Radio Settings" on page 4-38
- "Configuring Wi-Fi Multimedia" on page 4-44

Only the radio settings specific to the 802.11g interface are included in this section. To configure the 802.11g radio settings, select the Radio Settings page.

Figure 37 Radio Settings B/G



Country Code : UNITED STATES

Description : Enterprise 802.11g Access Point

Client Access Mode : ● b+g ○ 802.11g only ○ 802.11b only

Turbo Mode : ● Disable ○ Enable

Super Mode : ● Disable ○ Enable

Auto Channel Select : ○ Disable ● Enable

Radio Channel : 1

Antenna ID : The original antenna provided with product

Output Antenna: ● Both ○ Left ○ Right

Transmission Power 100%

Maximum Transmit Data Rate 54 Mbps

Maximum Multicast Data Rate 5.5 Mbps

Beacon Interval (20-1000) 100 Milliseconds

Delivery Traffic Indication Message (DTIM) (1-255) 1 Beacons

Client Access 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).

Turbo Mode – The normal 802.11g wireless operation mode provides connections up to 54 Mbps. Turbo Mode is an enhanced proprietary mode (Atheros 802.11g Turbo) that provides a higher data rate of up to 108 Mbps. Enabling Turbo mode allows the access point to provide connections up to 108 Mbps to Atheros-compatible clients.

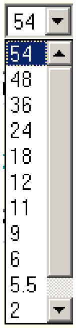
NOTE: *In normal mode, the access point supports the maximum number of channels permitted by local regulations (e.g., 11 channels for the United States). In Turbo mode, channel bonding is used to provide the increased data rate. However, this reduces the number of channels available to one (Channel 6).*

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

Radio Channel – The radio channel that the access point uses to communicate with wireless clients. When multiple access points are deployed in the same area, set the channel on neighboring access points at least five channels apart to avoid interference with each other. For example, in the United States you can deploy up to three access points in the same area (e.g., channels 1, 6, 11). 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. (Range: 1-11; Default: 1)

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

Maximum Transmit 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)



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

- Short: Sets the preamble to short (96 microseconds). Using a short preamble can increase data throughput.
- 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.
- Auto: Sets the preamble according to the capability of clients that are currently asscociated. 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.

CONFIGURING WI-FI 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 opportunityî wireless access method.

The access point implements QoS using the Wi-Fi 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 WMMenabled 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. 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 WMM Access Categories

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.

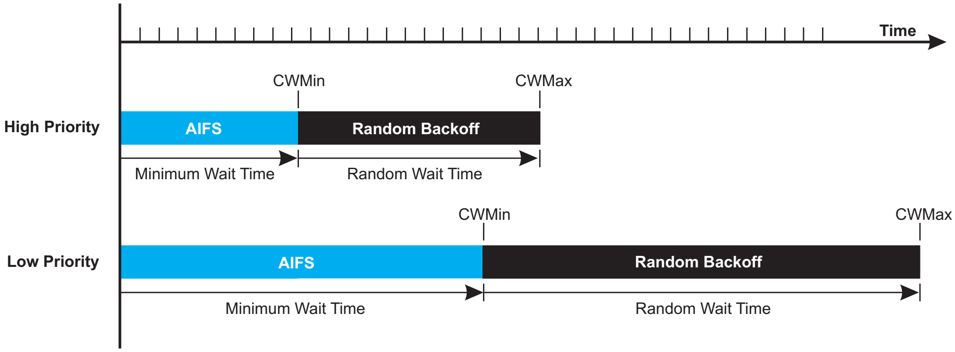
When the access point forwards traffic, WMM adds data packets to four independent transmit queues, one for each AC, depending on the 802.1D priority tag of the packet. Data packets without a priority tag are always added to the Best Effort AC queue. From the four queues, an internal “virtual” collision 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.

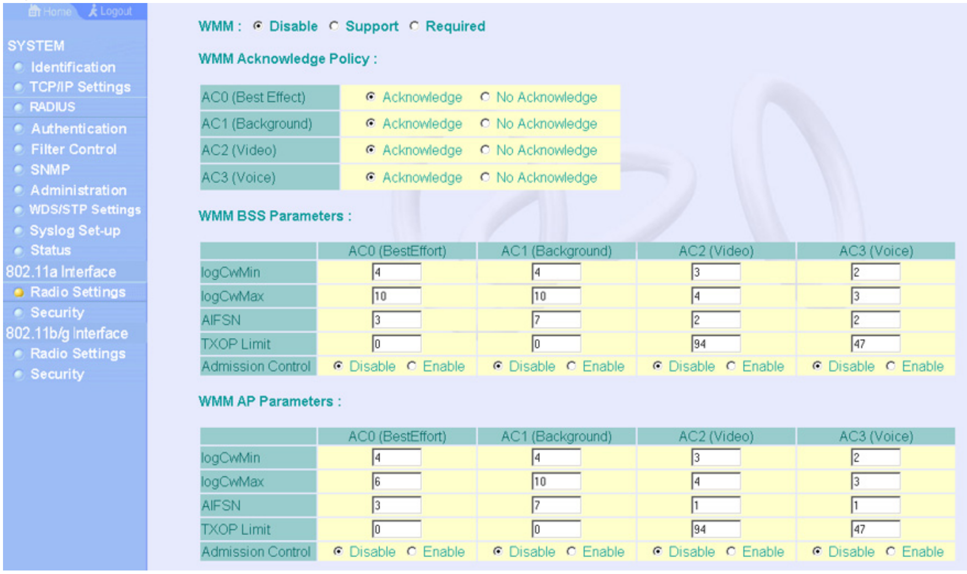
Figure 38 WMM Backoff Times



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 39 WMM Configuration



WMM : ● Disable ○ Support ○ Required

WMM Acknowledge Policy :

AC0 (Best Effect)	● Acknowledge	○ No Acknowledge
AC1 (Background)	● Acknowledge	○ No Acknowledge
AC2 (Video)	● Acknowledge	○ No Acknowledge
AC3 (Voice)	● Acknowledge	○ No Acknowledge

WMM BSS Parameters :

	AC0 (BestEffort)	AC1 (Background)	AC2 (Video)	AC3 (Voice)
logCwMin	4	4	3	2
logCwMax	10	10	4	3
AIFSN	3	7	2	2
TXOP Limit	0	0	94	47
Admission Control	● Disable ○ Enable	● Disable ○ Enable	● Disable ○ Enable	● Disable ○ Enable

WMM AP Parameters :

	AC0 (BestEffort)	AC1 (Background)	AC2 (Video)	AC3 (Voice)
logCwMin	4	4	3	2
logCwMax	6	10	4	3
AIFSN	3	7	1	1
TXOP Limit	0	0	94	47
Admission Control	● Disable ○ Enable	● Disable ○ Enable	● Disable ○ Enable	● Disable ○ Enable

WMM – Sets the WMM operational mode on the access point. 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).

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 access point can implement one or a combination of the following security mechanisms:

Wired Equivalent Privacy (WEP)	page 4-49
IEEE 802.1x	page 4-56
Wireless MAC address filtering	page 4-11
Wi-Fi Protected Access (WPA or WPA2)	page 4-56

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 the following table.

Table 5 Wireless Security Considerations

Security Mechanism	Client Support	Implementation Considerations
WEP	Built-in support on all 802.11a and 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

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 in order to enable all types of encryption (WEP, TKIP, or AES) in the access point.*

The access point 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 6 Security Considerations

Client Security Combination	Configuration Summary[a]	MAC Authentication[b]	RADIUS Server
No encryption and no authentication	Authentication: Open System Encryption: Disable 802.1x: Disable	Local, RADIUS, or Disabled	Yes[c]
Static WEP only (with or without shared key authentication)	Enter 1 to 4 WEP keys Select a WEP transmit key for the interface Authentication: Shared Key or Open System Encryption: Enable 802.1x: Disable	Local, RADIUS, or Disabled	Yes[c]

Client Security Combination	Configuration Summary[a]	MAC Authentication[b]	RADIUS Server
Dynamic WEP (802.1x) only	Authentication: Open System Encryption: Enable 802.1x: Required Set 802.1x key refresh and reauthentication rates	Local, RADIUS, or Disabled	Yes[c]
802.1x WPA only	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	Authentication: WPA-PSK Encryption: Enable WPA Configuration: Required Cipher Configuration: TKIP 802.1x: Disable WPA Pre-shared Key Type: Hexadecimal or Alphanumeric Enter a WPA Pre-shared key	Local only	No
Static and dynamic (802.1x) WEP keys	Enter 1 to 4 WEP keys Select a WEP transmit key 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	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 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	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
WPA2 Pre-Shared Key only	Authentication: WPA2-PSK Encryption: Enable WPA Configuration: Required Cipher Suite: AES-CCMP 802.1x: Disable WPA Pre-shared Key Type: Hexadecimal or Alphanumeric Enter a WPA Pre-shared key	Local or Disabled	No

Client Security Combination	Configuration Summary[a]	MAC Authentication[b]	RADIUS Server
802.1x WPA-WPA2 Mixed Mode	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	Authentication: WPA-WPA2-PSK-mixed Encryption: Enable WPA Configuration: Required Cipher Suite: TKIP 802.1x: Disable WPA Pre-shared Key Type: Hexadecimal 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 (see page 4-9) or RADIUS server (see page 4-8).

[b] The configuration of RADIUS MAC authentication together with 802.1x WPA or WPA Pre-shared Key is not supported.

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.*

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 Wi-Fi 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.

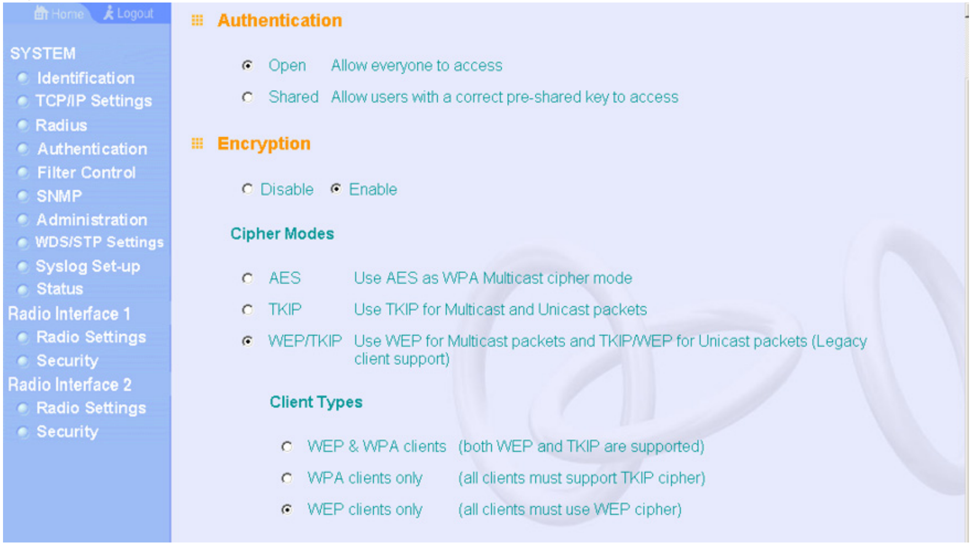
If you choose to use WEP shared keys instead of an open system, be sure to define at least one static WEP key for user authentication and data encryption. Also, be sure that the WEP shared keys are the same for each client in the wireless network.

Note that 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 under 802.11a or 802.11b/g, then select Authentication ‘Shared’. To use all other than WEP shared keys, select Authentication ‘Open.’

The following example presumes that you have selected to opt for other methods of encryption than WEP.

Figure 40 Authentication and Encryption



Authentication

● Open Allow everyone to access
○ Shared Allow users with a correct pre-shared key to access

Encryption

○ Disable ● Enable

Cipher Modes

○ AES Use AES as WPA Multicast cipher mode
○ TKIP Use TKIP for Multicast and Unicast packets
● WEP/TKIP Use WEP for Multicast packets and TKIP/WEP for Unicast packets (Legacy client support)

Client Types

○ WEP & WPA clients (both WEP and TKIP are supported)
○ WPA clients only (all clients must support TKIP cipher)
● WEP clients only (all clients must use WEP cipher)

Authentication – 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.*

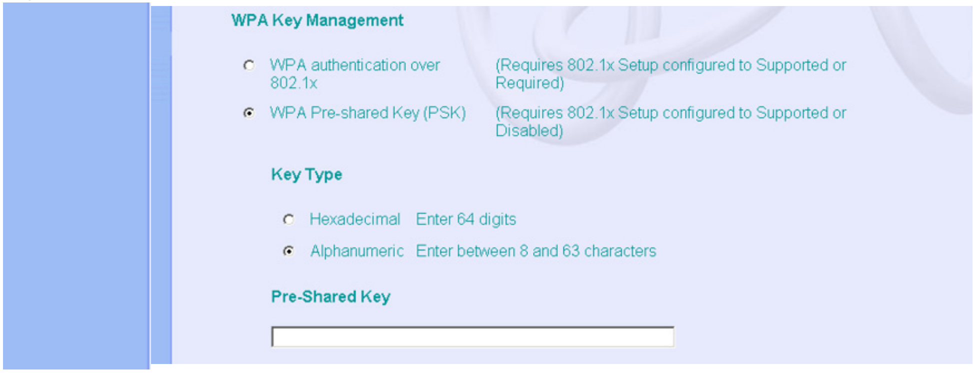
Encryption – Enable or disable the access point to use data encryption (WEP, TKIP, or AES). If this option is selected when using static WEP keys, you must configure at least one key on the access point and all clients. (Default: Disabled)

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 access point.*

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

- AES: AES-CCMP is used as the multicast encryption cipher. AES-CCMP is the standard encryption cipher required for WPA2.
- TKIP: TKIP is used as the multicast encryption cipher.
- WEP/TKIP: WEP is used as the multicast encryption cipher. You should select WEP only when both WPA and WEP clients are supported.

Figure 41 WPA Key Management



WPA Key Management

○ WPA authentication over 802.1x (Requires 802.1x Setup configured to Supported or Required)

● WPA Pre-shared Key (PSK) (Requires 802.1x Setup configured to Supported or Disabled)

Key Type

○ Hexadecimal Enter 64 digits

● Alphanumeric Enter between 8 and 63 characters

Pre-Shared Key

WPA Key Management – Specifies the type of WPA encryption to use:

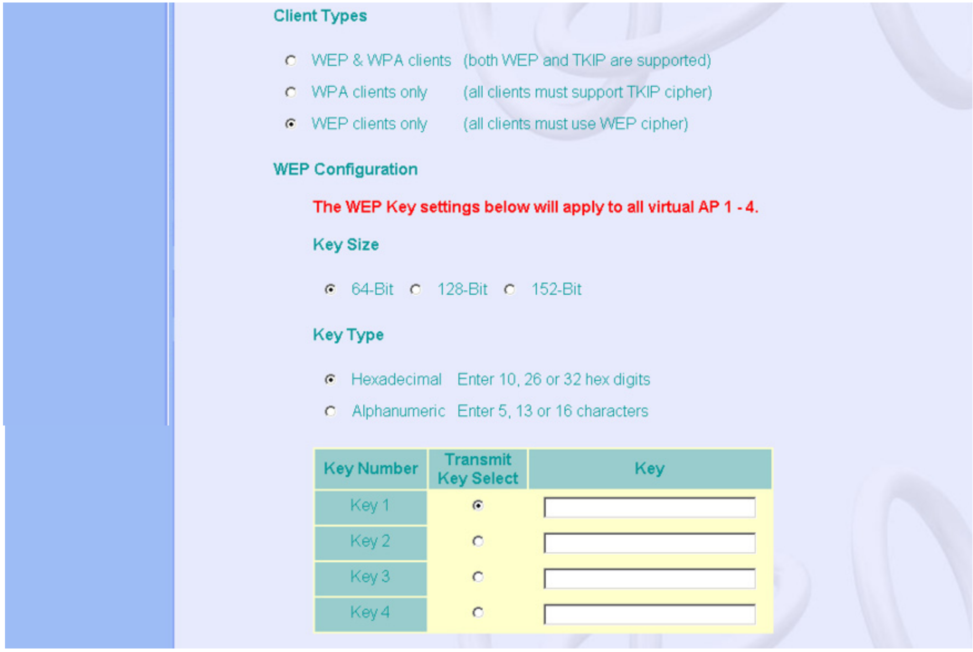
- *WPA authentication over 802.1x* – Requires the use of 802.1x authentication.
- *WPA Pre-shared Key (PSK)* – Requires that 802.1x authentication be disabled.

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 (802.11a 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 (802.11a radio only).
- *Key* – 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)

Figure 42 WEP Keys



Client Types

○ WEP & WPA clients (both WEP and TKIP are supported)
○ WPA clients only (all clients must support TKIP cipher)
● WEP clients only (all clients must use WEP cipher)

WEP Configuration

The WEP Key settings below will apply to all virtual AP 1 - 4.

Key Size

● 64-Bit ○ 128-Bit ○ 152-Bit

Key Type

● Hexadecimal Enter 10, 26 or 32 hex digits
○ Alphanumeric Enter 5, 13 or 16 characters

Key Number	Transmit Key Select	Key
Key 1	●	
Key 2	○	
Key 3	○	
Key 4	○	

Client Types – Specifies the type of client to encrypt:

- *WEP and WPA clients* – Both WEP and TKIP encryption are supported.
- *WPA clients only* – All clients must support TKIP.
- *WEP clients only* – All clients must support WEP.

WEP Configuration – Under open authentication it is still possible to configure WEP keys.

- *Key Size* – 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)
- *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 (802.11a 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 (802.11a radio only).

Key – 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)

NOTE: *Key index and type must match that configured on the clients.*

NOTE: *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.*

Wi-Fi 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.

The configuration settings for WPA are summarized below:

Table 7 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.

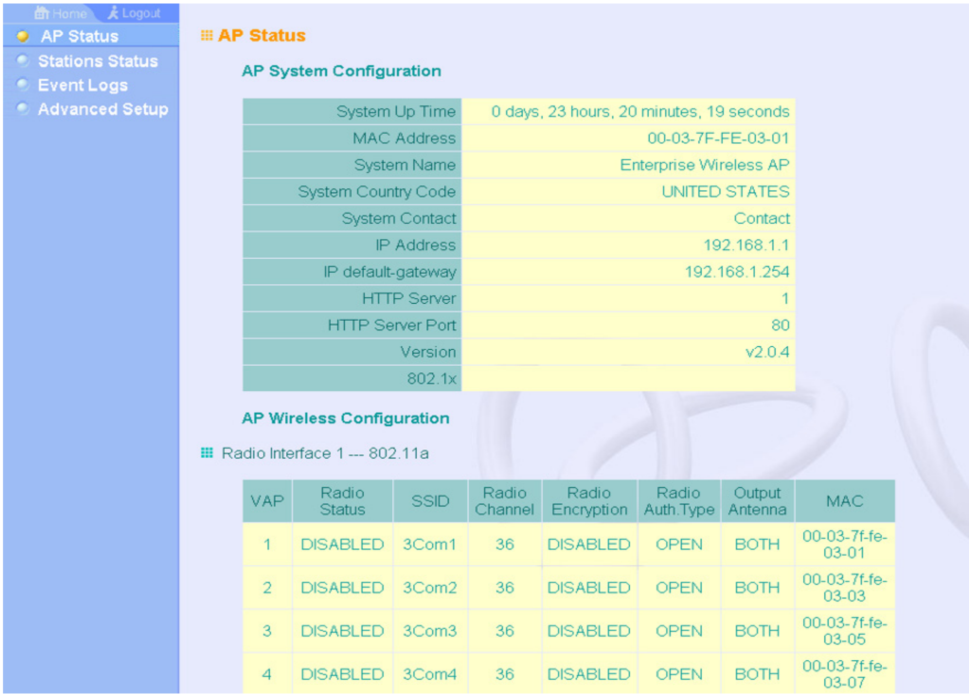
Status Information

The Status page includes information on the following items:

Access Point Status

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

Figure 43 AP Status



AP Status

AP System Configuration

System Up Time	0 days, 23 hours, 20 minutes, 19 seconds
MAC Address	00-03-7F-FE-03-01
System Name	Enterprise Wireless AP
System Country Code	UNITED STATES
System Contact	Contact
IP Address	192.168.1.1
IP default-gateway	192.168.1.254
HTTP Server	1
HTTP Server Port	80
Version	v2.0.4
802.1x	

AP Wireless Configuration

Radio Interface 1 --- 802.11a

VAP	Radio Status	SSID	Radio Channel	Radio Encryption	Radio Auth.Type	Output Antenna	MAC
1	DISABLED	3Com1	36	DISABLED	OPEN	BOTH	00-03-7f-fe-03-01
2	DISABLED	3Com2	36	DISABLED	OPEN	BOTH	00-03-7f-fe-03-03
3	DISABLED	3Com3	36	DISABLED	OPEN	BOTH	00-03-7f-fe-03-05
4	DISABLED	3Com4	36	DISABLED	OPEN	BOTH	00-03-7f-fe-03-07

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.
- MAC Address: The physical layer address for the Ethernet port.
- System Name: Name assigned to this system.
- System Country Code: The country for which the device has been set for use.
- 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.
- Version: Shows the software version number.
- 802.1X: Shows if IEEE 802.1X access control for wireless clients is enabled.

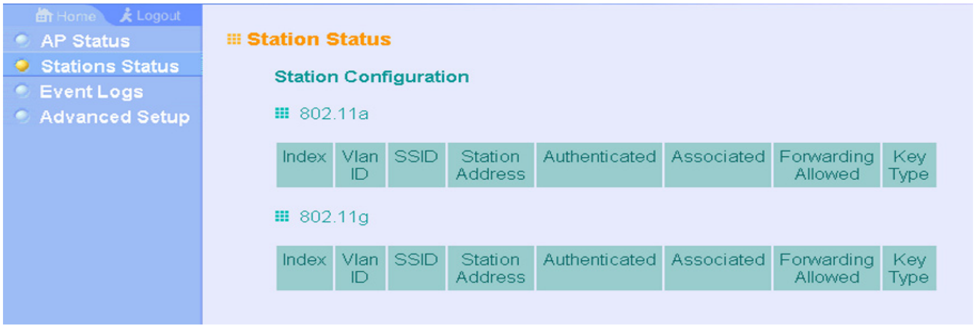
AP Wireless Configuration – The AP Wireless Configuration tables display the radio and VAP interface settings listed below. Note that Interface Wireless A refers to the 802.11a radio and Interface Wireless G refers the 802.11b/g radio.

- VAP: Displays the VAP number.
- Radio Status: Displays if the radio is enabled or disabled for this VAP.
- SSID: The service set identifier for the VAP interface.
- Radio Channel: The radio channel through which the access point communicates with wireless clients.
- Radio Encryption: The key size used for data encryption.
- Radio Auth. Type: Shows the type of authentication used.
- Output Antenna: Displays which antenna/e are in use by the VAP.
- MAC: The physical layer address of the radio interface.

Station Status

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

Figure 44 Station Status



Station Status

Station Configuration

802.11a

Index	Vlan ID	SSID	Station Address	Authenticated	Associated	Forwarding Allowed	Key Type

802.11g

Index	Vlan ID	SSID	Station Address	Authenticated	Associated	Forwarding Allowed	Key Type

The Station Configuration page displays basic connection information for all associated stations as described below. Note that 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

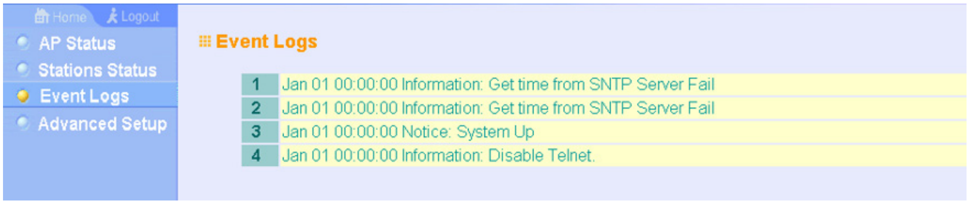
system" and "shared key." Open-system authentication accepts any client attempting to connect to the access point without verifying its identity. The shared-key approach uses Wired Equivalent Privacy (WEP) to verify client identity by distributing a shared key to stations before attempting authentication.

- 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 Wi-Fi 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.

Event Logs

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

Figure 45 Event Logs



1	Jan 01 00:00:00 Information: Get time from SNTP Server Fail
2	Jan 01 00:00:00 Information: Get time from SNTP Server Fail
3	Jan 01 00:00:00 Notice: System Up
4	Jan 01 00:00:00 Information: Disable Telnet.

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 4-33.
- 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:

- Access point was set to “Open Authentication”, but a client sent an authentication request frame with a “Shared key.”
- Access point was set to “Shared Key Authentication,” but a client sent an authentication frame for “Open System.”
- WEP keys do not match: When the access point 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.

5 COMMAND LINE INTERFACE

USING THE COMMAND LINE INTERFACE

ACCESSING THE CLI

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

CONSOLE CONNECTION

To access the access point through the console port, perform these steps:

1. At the console prompt, enter the user name and password. (The default user name is "admin" and the default password is "password") 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 displays:

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

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

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 access point cannot acquire an IP address from a DHCP server, the default IP address used by the access point, 168.254.2.1, consists of a network portion (168.254.2) and a host portion (1).

To access the access point through a Telnet session, you must first set the IP address for the access point, and set the default gateway if you are managing the access point 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 configure the access point with an IP address, you can open a Telnet session by performing these steps.

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 displays:

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

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

ENTERING COMMANDS

This section describes how to enter CLI commands.

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
  ```

Minimum Abbreviation

The CLI will accept 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.

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**."

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.

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
  bridge          Show bridge
  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
```

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
```

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.

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.

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 the following table:

Table 8 Command Modes

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

Exec Commands

When you open a new console session on an access point, 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#
```

Configuration Commands

Configuration commands are used to modify access point 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)#
```

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 9 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.

COMMAND GROUPS

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

Table 10 Command Groups

Command Group	Description	Page
General	Basic commands for entering configuration mode, restarting the system, or quitting the CLI	5-8
System Management	Controls user name, password, web browser management options, and a variety of other system information	5-13
System Logging	Configures system logging parameters	5-32
System Clock	Configures SNTP and system clock settings	5-37
DHCP Relay	Configures the access point to send DHCP requests from clients to specified servers	5-42
SNMP	Configures community access strings and trap managers	5-44
Flash/File	Manages code image or access point configuration files	5-60
RADIUS	Configures the RADIUS client used with 802.1X authentication	5-64
802.1X Authentication	Configures 802.1X authentication	5-70
MAC Address Authentication	Configures MAC address authentication	5-76
Filtering	Filters communications between wireless clients, controls access to the management interface from wireless clients, and filters traffic using specific Ethernet protocol types	5-79

Command Group	Description	Page
WDS Bridge	Configures WDS forwarding table settings	5-84
Spanning Tree	Configures spanning tree parameters	5-91
Ethernet Interface	Configures connection parameters for the Ethernet interface	5-97
Wireless Interface	Configures radio interface settings	5-103
Wireless Security	Configures radio interface security and encryption settings	5-125
Rogue AP Detection	Configures settings for the detection of rogue access points in the network	5-125
Link Integrity	Configures a link check to a host device on the wired network	5-141
IAPP	Enables roaming between multi-vendor access points	5-144
VLANs	Configures VLAN membership	5-145
WMM	Configures WMM quality of service parameters	5-148

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).

General Commands

Table 11 General Commands

Command	Function	Mode	Page
configure	Activates global configuration mode	Exec	5-8
end	Returns to previous configuration mode	GC, IC	5-9
exit	Returns to the previous configuration mode, or exits the CLI	any	5-10
ping	Sends ICMP echo request packets to another node on the network	Exec	5-10
reset	Restarts the system	Exec	5-11
show history	Shows the command history buffer	Exec	5-12
show line	Shows the configuration settings for the console port	Exec	5-12

configure

This command activates Global Configuration mode. You must enter this mode to modify most of the settings on the access point. You must also enter Global Configuration mode prior to enabling the context modes for Interface Configuration. See “Using the Command Line Interface” on page 5-1.

Default Setting

None

Command Mode

Exec

Example

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

Related Commands

end (5-9)

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)#
```

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:
```

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
192.254.2.19 is alive
Enterprise AP#
```

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
```

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#
```

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#
```

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 12 System Management Commands

Command	Function	Mode	Page
Country Setting			
country	Sets the access point country code	Exec	5--14
Device Designation			
prompt	Customizes the command line prompt	GC	5--15
system name	Specifies the host name for the access point	GC	5-16
snmp-server contact	Sets the system contact string	GC	5-45
snmp-server location	Sets the system location string	GC	5-46
Management Access			
username	Configures the user name for management access	GC	5-16
password	Specifies the password for management access	GC	5-17
ip ssh-server enable	Enables the Secure Shell server	IC-E	5-17
ip ssh-server port	Sets the Secure Shell port	IC-E	5-18
ip telnet-server enable	Enables the Telnet server	IC-E	5-18
APmgmtIP	Specifies an IP address or range of addresses allowed access to the management interface	GC	5-23
APmgmtUI	Enables or disables SNMP, Telnet or web management access	GC	5-24
show APmanagement	Shows the AP management configuration	Exec	5-25
Web Server			
ip http port	Specifies the port to be used by the web browser interface	GC	5-19
ip http server	Allows the access point to be monitored or configured from a browser	GC	5-19
ip https port	Specifies the UDP port number used for a secure HTTP connection to the access point’s Web interface	GC	5-20
ip https server	Enables the secure HTTP server on the access point	GC	5-21
web-redirect	Enables web authentication of clients using a public access Internet service	GC	5-22
System Status			
show system	Displays system information	Exec	5-26
show version	Displays version information for the system	Exec	5-27
show config	Displays detailed configuration information for the system	Exec	5-27
show hardware	Displays the access point’s hardware version	Exec	5-32

country

This command configures the access point’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 13 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
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

Country	Code	Country	Code	Country	Code	Country	Code
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 access point 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#
```

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)#
```

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)#
```

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)#
```

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

null

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#password
Enterprise AP(config)#
```

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

Disabled

Command Mode

Interface Configuration (Ethernet)

Command Usage

- The access point 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)#
```

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)#
```

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)#
```

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 (5-19)

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

[**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 (5-19)

ip https port

Use this command to specify the UDP port number used for HTTPS/SSL connection to the access point'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)#
```

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 access point’s Web interface. Use the **no** form to disable this function.

Syntax

[**no**] **ip https server**

Default Setting

Disabled

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)#
```

web-redirect

Use this command to enable web-based authentication of clients. Use the **no** form to disable this function.

Syntax

[**no**] **web-redirect**

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

- The web redirect feature is used to support billing for a public access wireless network. After successful association to an access point, a client is "redirected" to an access point login web page as soon as Internet access is attempted. The client is then authenticated by entering a user name and password on the web page. This process allows controlled access for clients without requiring 802.1X or MAC authentication.
- Web redirect requires a RADIUS server on the wired network with configured user names and passwords for authentication. The RADIUS server details must also be configured on the access point. (See "show bootfile" on page 5-64.)
- Use the **show system** command to display the current web redirect status.

Example

```
Enterprise AP(config)#web-redirect
Enterprise AP(config)#
```

APmgmtIP

This command specifies the client IP addresses that are allowed management access to the access point through various protocols.

NOTE: *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 access point 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 access point will not accept overlapping address ranges. When entering addresses for different groups, the access point 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 192.254.1.50 255.255.255.0
Enterprise AP(config)#
```

APmgmtUI

This command enables and disables management access to the access point through SNMP, Telnet and web interfaces.

NOTE: *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)#
```

show apmanagement

This command shows the AP management configuration, including the IP addresses of management stations allowed to access the access point, 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#
```

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 AP
System Location       :
System Contact        :
System Country Code   : US - UNITED STATES
MAC Address           : 00-30-F1-F0-9A-9C
IP Address            : 192.254.2.1
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           : Dual band(a/g)
Boot Rom Version      : v3.0.3
Software Version      : v4.3.1.9
SSH Server            : ENABLED
SSH Server Port       : 22
Telnet Server         : ENABLED
WEB Redirect          : DISABLED
DHCP Relay            : DISABLED
Proxy ARP             : DISABLED
==========================================================
Enterprise AP#
```

show version

This command displays the software version for the system.

Command Mode

Exec

Example

```
Enterprise AP#show version

Version Information
=========================================
Version: v4.3.2.2
Date   : Dec 20 2005, 18:38:12
=========================================
Enterprise AP#
```

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 Bridge         :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          : 192.254.0.151
Subnet Mask         : 255.255.255.0
Default Gateway     : 192.254.0.1
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 802.11a Information
===========================================================
----------------Identification-----------------------------
Description                : 802.11a Access Point
SSID                       : A 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
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
              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 A VAP [0]   :
802.11a Channel : Auto

No 802.11a Channel Stations.
.
.
.
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 AP
System Location       :
System Contact        : Contact
System Country Code   : 99 - NO_COUNTRY_SET
MAC Address           : 00-12-CF-05-B7-84
IP Address            : 192.254.0.151
Subnet Mask           : 255.255.255.0
Default Gateway       : 192.254.0.1
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           : Dual band(a/g)
Boot Rom Version      : v3.0.7
Software Version      : v4.3.2.2
```

```
SSH Server            : ENABLED
SSH Server Port       : 22
Telnet Server         : ENABLED
WEB Redirect          : DISABLED
DHCP Relay            : DISABLED
==============================================================

Version Information
=========================================
Version: v4.3.2.2
Date   : Dec 20 2005, 18:38:12
=========================================
Enterprise AP#
```

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#
```

System Logging Commands

These commands are used to configure system logging on the access point.

Table 14 System Loggign Commands

Command	Function	Mode	Page
logging on	Controls logging of error messages	GC	5-33
logging host	Adds a syslog server host IP address that will receive logging messages	GC	5-33
logging console	Initiates logging of error messages to the console	GC	5-34
logging level	Defines the minimum severity level for event logging	GC	5-34
logging facility-type	Sets the facility type for remote logging of syslog messages	GC	5-35
logging clear	Clears all log entries in access point memory	GC	5-36
show logging	Displays the state of logging	Exec	5-36
show event-log	Displays all log entries in access point memory	Exec	5-37

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)#
```

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)#
```

logging console

This command initiates logging of error messages to the console. Use the **no** form to disable logging to the console.

Syntax

[**no**] **logging console**

Default Setting

Disabled

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#logging console
Enterprise AP(config)#
```

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)#
```

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 access point. 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)#
```

logging clear

This command clears all log messages stored in the access point’s memory.

Syntax

logging clear

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#logging clear
Enterprise AP(config)#
```

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: 192.254.2.19, 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#
```

show event-log

This command displays log messages stored in the access point'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 11:56:35  Information: 802.11a:11a 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.
Mar 09 11:55:40  Information: 802.11a:11a Radio Interface Disabled
Mar 09 11:55:40  Information: 802.11a:Transmit Power set to QUARTER
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
```

System Clock Commands

These commands are used to configure SNTP and system clock settings on the access point.

Table 15 System Clock Commands

Command	Function	Mode	Page
sntp-server ip	Specifies one or more time servers	GC	5-38
sntp-server enable	Accepts time from the specified time servers	GC	5-38
sntp-server date-time	Manually sets the system date and time	GC	5-39
sntp-server daylight-saving	Sets the start and end dates for daylight savings time	GC	5-40
sntp-server timezone	Sets the time zone for the access point's internal clock	GC	5-40
show sntp	Shows current SNTP configuration settings	Exec	5-41

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 access point polls for time updates. The access point 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 (5-38)
show sntp (5-41)

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

[**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 access point 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 (5-38)
show sntp (5-41)

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 (5-38)

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

[**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)#
```

sntp-server timezone

This command sets the time zone for the access point'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)#
```

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#
```

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 access point's DHCP relay agent is enabled, received client requests can be forwarded directly by the access point to a known DHCP server on another subnet. Responses from the DHCP server are returned to the access point, which then broadcasts them back to clients.

Table 16 DHCP Relay Commands

Command	Function	Mode	Page
dhcp-relay enable	Enables the DHCP relay agent	GC	5-42
dhcp-relay	Sets the primary and secondary DHCP server address	GC	5-43
show dhcp-relay	Shows current DHCP relay configuration settings	Exec	5-43

dhcp-relay enable

This command enables the access point'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)#
```

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 192.254.2.10
Enterprise AP(config)#
```

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   : 192.254.2.10
Secondary DHCP Server : 0.0.0.0
Enterprise AP#
```

SNMP Commands

Controls access to this access point from management stations using the Simple Network Management Protocol (SNMP), as well as the hosts that will receive trap messages.

Table 17 SNMP Commands

Command	Function	Mode	Page
snmp-server community	Sets up the community access string to permit access to SNMP commands	GC	5-45
snmp-server contact	Sets the system contact string	GC	5-45
snmp-server location	Sets the system location string	GC	5-46
snmp-server enable server	Enables SNMP service and traps	GC	5-47
snmp-server host	Specifies the recipient of an SNMP notification operation	GC	5-47
snmp-server trap	Enables specific SNMP notifications	GC	5-48
snmp-server engine id	Sets the engine ID for SNMP v3	GC	5-50
snmp-server user	Sets the name of the SNMP v3 user	GC	5-51
snmp-server targets	Configures SNMP v3 notification targets	GC	5-52
snmp-server filter	Configures SNMP v3 notification filters	GC	5-53
snmp-server filter-assignments	Assigns SNMP v3 notification filters to targets	GC	5-54
show snmp groups	Displays the pre-defined SNMP v3 groups	Exec	5-55
show snmp users	Displays SNMP v3 user settings	Exec	5-56
show snmp group-assignments	Displays the assignment of users to SNMP v3 groups	Exec	5-56
show snmp target	Displays the SNMP v3 notification targets	Exec	5-57
show snmp filter	Displays the SNMP v3 notification filters	Exec	5-57
show snmp filter-assignments	Displays the SNMP v3 notification filter assignments	Exec	5-58
show snmp	Displays the status of SNMP communications	Exec	5-59

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)#
```

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 (5-46)

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 (5-45)

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 (5-47)

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 (5-47)

snmp-server trap

This command enables the access point 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:
  - **dot11InterfaceAFail** - The 802.11a or 802.11g interface has failed.
  - **dot11InterfaceGFail** - The 802.11b/g interface has failed.
  - **dot11StationAssociation** - A client station has successfully associated with the access point.
  - **dot11StationAuthentication** - A client station has been successfully authenticated.
  - **dot11StationReAssociation** - A client station has successfully re-associated with the access point.

- **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 access point with which the station has associated.
- **iappStationRoamedFrom** - A client station has roamed from another access point (identified by its IP address).
- **iappStationRoamedTo** - A client station has roamed to another access point (identified by its IP address).
- **localMacAddrAuthFail** - A client station has failed authentication with the local MAC address database on the access point.
- **localMacAddrAuthSuccess** - A client station has successfully authenticated its MAC address with the local database on the access point.
- **pppLogonFail** - The access point has failed to log onto the PPPoE server using the configured user name and password.
- **sntpServerFail** - The access point has failed to set the time from the configured SNTP server.
- **sysConfigFileVersionChanged** - The access point's configuration file has been changed.
- **sysRadiusServerChanged** - The access point has changed from the primary RADIUS server to the secondary, or from the secondary to the primary.
- **sysSystemDown** - The access point is about to shutdown and reboot.
- **sysSystemUp** - The access point 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)#
```

snmp-server engine-id

This command is used for SNMP v3. It is used to uniquely identify the access point among all access points 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 engineID 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)#
```

snmp-server user

This command configures the SNMP v3 users that are allowed to manage the access point. 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 access point.
- 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 access point 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.
  - *auth-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)#
```

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 access point 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 192.254.2.33 chris
Enterprise AP(config)#
```

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 access point 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
```

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   : 192.254.2.33
UDP Port     : 162
=============================
Enterprise AP#show snmp filter-assignments

                             HostID  FilterID

                            mytraps  trapfilter

Enterprise AP(config)#
```

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#
```

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#
```

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#
```

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   : 192.254.2.33
UDP Port     : 162
=============================
Enterprise AP#
```

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#
```

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#
```

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:      192.254.2.9, 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
    pppLogonFail  Enabled             sntpServerFail  Enabled
  configFileVersionChanged  Enabled        radiusServerChanged
    Enabled
  systemDown  Enabled                   systemUp  Enabled

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

Flash/File Commands

These commands are used to manage the system code or configuration files.

Table 18 Flash/File Commands

Command	Function	Mode	Page
bootfile	Specifies the file or image used to start up the system	GC	5-60
copy	Copies a code image or configuration between flash memory and a FTP/TFTP server	Exec	5-61
delete	Deletes a file or code image	Exec	5-62
dir	Displays a list of files in flash memory	Exec	5-63
show bootfile	Displays the name of the current operation code file that booted the system	Exec	5-64

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#
```

copy

This command copies a boot file, code image, or configuration file between the access point’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 access point 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 access point.
- 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 access point. (Valid characters: A-Z, a-z, 0-9, “.”, “-”, “_”)
- Due to the size limit of the flash memory, the access point 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:192.254.2.19
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:192.254.2.19
Enterprise AP#
```

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

NOTE: *Beware of deleting application images from flash memory. At least one application image is required in order to boot the access point. If there are multiple image files in flash memory, and the one used to boot the access point is deleted, be sure you first use the* ***bootfile*** *command to update the application image file booted at startup before you reboot the access point.*

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 (5-60)
dir (5-63)

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#
```

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#
```

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 access point.

Table 19 RADIUS Client

Command	Function	Mode	Page
radius-server address	Specifies the RADIUS server	GC	5-65
radius-server port	Sets the RADIUS server network port	GC	5-65
radius-server key	Sets the RADIUS encryption key	GC	5-66
radius-server retransmit	Sets the number of retries	GC	5-66
radius-server timeout	Sets the interval between sending authentication requests	GC	5-67
radius-server port-accounting	Sets the RADIUS Accounting server network port	GC	5-67
radius-server timeout-interim	Sets the interval between transmitting accounting updates to the RADIUS server	GC	5-68
radius-server radius-mac-format	Sets the format for specifying MAC addresses on the RADIUS server	GC	5-68

Command	Function	Mode	Page
radius-server vlan-format	Sets the format for specifying VLAN IDs on the RADIUS server	GC	5-69
show radius	Shows the current RADIUS settings	Exec	5-69

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 192.254.2.25
Enterprise AP(config)#
```

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)#
```

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)#
```

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 access point 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)#
```

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 access point 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)#
```

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 access point 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 access point.

Example

```
Enterprise AP(config)#radius-server port-accounting 1813
Enterprise AP(config)#
```

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 access point waits between transmitting accounting updates. (Range: 60-86400)

Default Setting

3600

Command Mode

Global Configuration

Command Usage

- The access point 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)#
```

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)#
```

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)#
```

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#
```

802.1X Authentication

The access point 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 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.

Table 20 802.1X Authentication

Command	Function	Mode	Page
802.1x	Configures 802.1X as disabled, supported, or required	IC-W-VAP	5-71
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	5-72
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	5-73
802.1x session-timeout	Sets the timeout after which a connected client must be re-authenticated	IC-W-VAP	5-73

Command	Function	Mode	Page
802.1x-supplicant enable	Enables the access point to operate as a 802.1X supplicant	GC	5-74
802.1x-supplicant user	Sets the supplicant user name and password for the access point	GC	5-74
show authentication	Shows all 802.1X authentication settings, as well as the address filter table	Exec	5-74

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 access point 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 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 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 access point enforces 802.1X authentication for all 802.11 associated stations. If 802.1X authentication is not initiated by the station, the access point 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)#
```

802.1x broadcast-key-refresh-rate

This command sets the interval at which the broadcast keys are refreshed for stations using 802.1X dynamic keying.

Syntax

802.1x broadcast-key-refresh-rate <*rate*>

rate - The interval at which the access point rotates broadcast keys. (Range: 0 - 1440 minutes)

Default Setting

0 (Disabled)

Command Mode

Global Configuration

Command Usage

- The access point uses Enterprise APOL (Extensible Authentication Protocol Over LANs) packets to pass dynamic unicast session and broadcast keys to wireless clients. The **802.1x broadcast-key-refresh-rate** command specifies the interval after which the broadcast keys are changed. The **802.1x session-key-refresh-rate** command specifies the interval after which unicast session keys are changed.
- Dynamic broadcast key rotation allows the access point to generate a random group key and periodically update all key-management capable wireless clients.

Example

```
Enterprise AP(config)#802.1X broadcast-key-refresh-rate 5
Enterprise AP(config)#
```

802.1x session-key-refresh-rate

This command sets the interval at which unicast session keys are refreshed for associated stations using dynamic keying.

Syntax

802.1x session-key-refresh-rate <*rate*>

rate - The interval at which the access point refreshes a session key. (Range: 0 - 1440 minutes)

Default Setting

0 (Disabled)

Command Mode

Global Configuration

Command Usage

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 access point.

Example

```
Enterprise AP(config)#802.1x session-key-refresh-rate 5
Enterprise AP(config)#
```

802.1x session-timeout

This command sets the time period after which a connected client must be re-authenticated. Use the **no** form to disable 802.1X re-authentication.

Syntax

802.1x session-timeout <*seconds*>
no 802.1x session-timeout

seconds - The number of seconds. (Range: 0-65535)

Default

0 (Disabled)

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#802.1x session-timeout 300
Enterprise AP(config)#
```

802.1x-supplicant enable

This command enables the access point to operate as an 802.1X supplicant for authentication. Use the **no** form to disable 802.1X authentication of the access point.

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)#
```

802.1x-supplicant user

This command sets the user name and password used for authentication of the access point 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 access point name used for authentication to the network. (Range: 1-32 alphanumeric characters)
- *password* - The MD5 password used for access point authentication. (Range: 1-32 alphanumeric characters)

Default

None

Command Mode

Global Configuration

Command Usage

The access point currently only supports EAP-MD5 CHAP for 802.1X supplicant authentication.

Example

```
Enterprise AP(config)#802.1x-supplicant user AP8760 dot1xpass
Enterprise AP(config)#
```

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)#
```

MAC Address Authentication

Use these commands to define MAC authentication on the access point. 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 21 MAC Address Authentication

Command	Function	Mode	Page
address filter default	Sets filtering to allow or deny listed addresses	GC	5-76
address filter entry	Enters a MAC address in the filter table	GC	5-77
address filter delete	Removes a MAC address from the filter table	GC	5-78
mac- authentication server	Sets address filtering to be performed with local or remote options	GC	5-78
mac- authentication session-timeout	Sets the interval at which associated clients will be re-authenticated with the RADIUS server authentication database	GC	5-79
show authentication	Shows all 802.1X authentication settings, as well as the address filter table	Exec	5-74

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 (5-77)
802.1x-supplicant user (5-74)

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 access point 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 (5-76)
802.1x-supplicant user (5-74)

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

802.1x-supplicant user (5-74)

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

address filter entry (5-77)
radius-server address (5-65)
802.1x-supplicant user (5-74)

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)#
```

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 22 Filtering Commands

Command	Function	Mode	Page
filter local-bridge	Disables communication between wireless clients	GC	5-80
filter ap-manage	Prevents wireless clients from accessing the management interface	GC	5-81
filter uplink enable	Ethernet port MAC address filtering	GC	5-81
filter uplink	Adds or deletes a MAC address from the filtering table	GC	5-81
filter ethernet-type enable	Checks the Ethernet type for all incoming and outgoing Ethernet packets against the protocol filtering table	GC	5-82

Command	Function	Mode	Page
filter ethernet-type protocol	Sets a filter for a specific Ethernet type	GC	5-83
show filters	Shows the filter configuration	Exec	5-83

filter local-bridge

This command disables communication between wireless clients. Use the **no** form to disable this filtering.

Syntax

filter local-bridge <all-VAP | intra-VAP>
no filter local-bridge

all-VAP - When enabled, clients cannot establish wireless communications with any other client, either those associated to the same VAP interface or any other VAP interface.
intra-VAP - 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.

Default

Disabled

Command Mode

Global Configuration

Command Usage

This command can disable wireless-to-wireless communications between clients via the access point. However, it does not affect communications between wireless clients and the wired network.

Example

```
Enterprise AP(config)#filter local-bridge
Enterprise AP(config)#
```

filter ap-manage

This command prevents wireless clients from accessing the management interface on the access point. Use the **no** form to disable this filtering.

Syntax

[**no**] **filter ap-manage**

Default

Enabled

Command Mode

Global Configuration

Example

```
Enterprise AP(config)#filter AP-manage
Enterprise AP(config)#
```

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)#
```

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 eight 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)#
```

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

[**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 (5-83)

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 (5-82)

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 Bridge         :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#
```

WDS Bridge Commands

The commands described in this section are used to set the operation mode for each access point interface and configure WIreless Distribution System (WDS) forwarding table settings.

Table 23 WDS Bridge Commands

Command	Function	Mode	Page
bridge role	Selects the bridge operation mode for a radio interface	IC-W	5-85
bridge-link parent	Configures the MAC addresses of the parent bridge node	IC-W	5-86
bridge-link child	Configures MAC addresses of connected child bridge nodes	IC-W	5-86
bridge dynamic-entry age-time	Sets the aging time for dynamic entries in the WDS forwarding table	GC	5-87
show bridge aging-time	Displays the current WDS forwarding table aging time	Exec	5-88
show bridge filter-entry	Displays current entries in the bridge MAC address table	Exec	5-89
show bridge link	Displays current bridge settings for specified interfaces	Exec	5-90

bridge role (WDS)

This command selects the bridge operation mode for the radio interface.

Syntax

bridge role <**ap** | **repeater** | **bridge** | **root-bridge** >

- **ap** - Operates only as an access point for wireless clients.
- **repeater** - Operates as a wireless repeater, extending the range for remote wireless clients and connecting them to the root bridge. The "Parent" link to the root bridge must be configured. In this mode, traffic is not forwarded to the Ethernet port from the radio interface.
- **bridge** - Operates as a bridge to other access points also in bridge mode.
- **root-bridge** - Operates as the root bridge in the wireless bridge network.

Default Setting

AP

Command Mode

Interface Configuration (Wireless)

Command Usage

- When the bridge role is set to "repeater," the "Parent" link to the root bridge must be configured (see "bridge-link parent" on page 5-86). When the access point is operating in this mode, traffic is not forwarded to the Ethernet port from the radio interface.
- Up to four WDS bridge links (MAC addresses) per radio interface can be specified for each unit in the wireless bridge network. One unit only must be configured as the "root bridge" in the wireless network. The root bridge is the unit connected to the main core of the wired LAN. Other bridges need to specify one "Parent" link to the root bridge or to a bridge connected to the root bridge. The other seven WDS links are available as "Child" links to other bridges.
- The bridge link on the radio interface always uses the default VAP interface. In any bridge mode, VAP interfaces 1 to 7 are not available for use.

Example

```
Enterprise AP(if-wireless a)#bridge role root-bridge
Enterprise AP(if-wireless a)#
```

bridge-link parent

This command configures the MAC address of the parent bridge node.

Syntax

bridge-link parent <*mac-address*>

mac-address - The wireless MAC address of the parent bridge unit. (12 hexadecimal digits in the form “xx-xx-xx-xx-xx-xx”).

Default Setting

None

Command Mode

Interface Configuration (Wireless)

Command Usage

Every bridge (except the root bridge) in the wireless bridge network must specify the MAC address of the parent bridge that is linked to the root bridge, or the root bridge itself.

Example

```
Enterprise AP(if-wireless a)#bridge-link parent 00-08-2d-69-3a-51
Enterprise AP(if-wireless a)#
```

bridge-link child

This command configures the MAC addresses of child bridge nodes.

Syntax

bridge-link child <*index*> <*mac-address*>

- *index* - The link index number of the child node. (Range: 1 - 6)
- *mac-address* - The wireless MAC address of a child bridge unit. (12 hexadecimal digits in the form “xx-xx-xx-xx-xx-xx”).

Default Setting

None

Command Mode

Interface Configuration (Wireless)

Command Usage

- In root bridge mode, up to six child bridge links can be specified using link index numbers 1 to 6.

- In bridge mode, up to five child links can be specified using link index numbers 2 to 6. Index number 1 is reserved for the parent link, which must be set using the **bridge parent** command.

Example

```
Enterprise AP(if-wireless a)#bridge-link child 2 00-08-3e-84-bc-6d
Enterprise AP(if-wireless a)#bridge-link child 3 00-08-3e-85-13-f2
Enterprise AP(if-wireless a)#bridge-link child 4 00-08-3e-84-79-31
Enterprise AP(if-wireless a)#
```

bridge dynamic-entry age-time

This command sets the time for aging out dynamic entries in the WDS forwarding table.

Syntax

bridge dynamic-entry age-time <*seconds*>

seconds - The time to age out an address entry. (Range: 10-10000 seconds).

Default Setting

300 seconds

Command Mode

Global Configuration

Command Usage

If the MAC address of an entry in the address table is not seen on the associated interface for longer than the aging time, the entry is discarded.

Example

```
Enterprise AP(config)#bridge dynamic-entry age-time 100
Enterprise AP(config)#
```

show bridge aging-time

This command displays the current WDS forwarding table aging time setting.

Command Mode

Exec

Example

```
Enterprise AP#show bridge aging-time
Aging time:  300
Enterprise AP#
```

show bridge filter-entry

This command displays current entries in the WDS forwarding table.

Command Mode

Exec

Example

```
Enterprise AP#show bridge filter-entry
max entry numbers =512
current entry nums =13
****************************************************************
********************** Bridge MAC Addr Table ***********
****************************************************************
|      MAC       |  Port  |Fwd_type| VlanID|origin life|remain Life|  Type
 |
 01 80 c2 00 00 00        0        5    4095         300         300
 Static
 01 80 c2 00 00 03        0        5    4095         300         300
 Static
 00 30 f1 f0 9b 20        1        0       1         300         300
 Static
 00 30 f1 f0 9b 21        1        0       1         300         300
 Static
 00 30 f1 f0 9b 22        1        0       1         300         300
 Static
 00 30 f1 f0 9b 23        1        0       1         300         300
 Static
 00 30 f1 f0 9b 24        1        0       1         300         300
 Static
 00 30 f1 f0 9b 25        1        0       1         300         300
 Static
 00 30 f1 f0 9b 26        1        0       1         300         300
 Static
 00 30 f1 f0 9b 27        1        0       1         300         300
 Static
 00 30 f1 2f be 30        1        3       0         300         175
 Dynamic
 00 30 f1 f0 9a 9c        1        0       1         300         300
 Static
 ff ff ff ff ff ff        0        4    4095         300         300
 Static
Enterprise AP#
```

show bridge link

This command displays WDS bridge link and spanning tree settings for specified interfaces.

Syntax

show bridge link <**ethernet** | **wireless** <**a** | **g**> [*index*]>

- **ethernet** - Specifies the Ethernet interface.
- **wireless** - Specifies a wireless interface.
  - **a** - The 802.11a radio interface.
  - **g** - The 802.11g radio interface.
  - *index* - The index number of a bridge link. (Range: 1 - 6)

Command Mode

Exec

Example

```
Enterprise AP#show bridge link wireless a

Interface Wireless A WDS Information
====================================
AP Role:   Bridge
Parent:    00-12-34-56-78-9a
Child:
      Child 2:    00-08-12-34-56-de
      Child 3:    00-00-00-00-00-00
      Child 4:    00-00-00-00-00-00
      Child 5:    00-00-00-00-00-00
      Child 6:    00-00-00-00-00-00
STAs:
      No WDS Stations.
Enterprise AP#
Enterprise AP#show bridge link wireless a 2

Port-No              : 11
status               : Enabled
state                : Disabled
priority             : 0
path cost            : 19
message age Timer    : Inactive
message age          : 4469
designated-root     : priority = 32768, MAC = 00:30:F1:F0:9A:9C
designated-cost     : 0
designated-bridge   : priority = 32768, MAC = 00:30:F1:F0:9A:9C
designated-port     : priority = 0, port No = 11
forward-transitions : 0
Enterprise AP#
```

```
Enterprise AP#show bridge link ethernet

status               : Enabled
state                : Forwarding
priority             : 0
path cost            : 19
message age Timer    : Inactive
message age          : 4346
designated-root     : priority = 32768, MAC = 00:30:F1:F0:9A:9C
designated-cost     : 0
designated-bridge   : priority = 32768, MAC = 00:30:F1:F0:9A:9C
designated-port     : priority = 0, port No = 1
forward-transitions : 1
Enterprise AP#
```

Spanning Tree Commands

The commands described in this section are used to set the MAC address table aging time and spanning tree parameters for both the Ethernet and wireless interfaces.

Table 24 Bridge Commands

Command	Function	Mode	Page
bridge stp enable	Enables the Spanning Tree feature	GC	5-92
bridge stp forwarding-delay	Configures the spanning tree bridge forward time	GC	5-92
bridge stp hello-time	Configures the spanning tree bridge hello time	GC	5-93
bridge stp max-age	Configures the spanning tree bridge maximum age	GC	5-94
bridge stp priority	Configures the spanning tree bridge priority	GC	5-94
bridge-link path-cost	Configures the spanning tree path cost of a port	IC	5-95
bridge-link port-priority	Configures the spanning tree priority of a port	IC	5-96

Command	Function	Mode	Page
show bridge stp	Displays the global spanning tree settings	Exec	5-96
show bridge link	Displays current bridge settings for specified interfaces	Exec	5-90

bridge stp enable

This command enables the Spanning Tree Protocol. Use the **no** form to disable the Spanning Tree Protocol.

Syntax

[**no**] **bridge stp enable**

Default Setting

Enabled

Command Mode

Global Configuration

Example

This example globally enables the Spanning Tree Protocol.

```
Enterprise AP(config)bridge stp enable
Enterprise AP(config)
```

bridge stp forwarding-delay

Use this command to configure the spanning tree bridge forward time globally for the wireless bridge. Use the **no** form to restore the default.

Syntax

bridge stp forwarding-delay <*seconds*>

no bridge stp forwarding-delay

seconds - Time in seconds. (Range: 4 - 30 seconds)

The minimum value is the higher of 4 or [(max-age / 2) + 1].

Default Setting

15 seconds

Command Mode

Global Configuration

Command Usage

This command sets the maximum time (in seconds) the root device will wait before changing states (i.e., discarding to learning to forwarding). This delay is required because every device must receive information about topology changes before it starts to forward frames. In addition, each port needs time to listen for conflicting information that would make it return to the discarding state; otherwise, temporary data loops might result.

Example

```
Enterprise AP(config)#bridge stp forwarding-delay 20
Enterprise AP(config)#
```

bridge stp hello-time

Use this command to configure the spanning tree bridge hello time globally for the wireless bridge. Use the **no** form to restore the default.

Syntax

bridge stp hello-time <*time*>

no bridge stp hello-time

time - Time in seconds. (Range: 1-10 seconds).
The maximum value is the lower of 10 or [(max-age / 2) -1].

Default Setting

2 seconds

Command Mode

Global Configuration

Command Usage

This command sets the time interval (in seconds) at which the root device transmits a configuration message.

Example

```
Enterprise AP(config)#bridge stp hello-time 5
Enterprise AP(config)#
```

bridge stp max-age

Use this command to configure the spanning tree bridge maximum age globally for the wireless bridge. Use the **no** form to restore the default.

Syntax

bridge stp max-age <*seconds*>

no bridge stp max-age

seconds - Time in seconds. (Range: 6-40 seconds)

The minimum value is the higher of 6 or [2 x (hello-time + 1)].

The maximum value is the lower of 40 or [2 x (forward-time - 1)].

Default Setting

20 seconds

Command Mode

Global Configuration

Command Usage

This command sets the maximum time (in seconds) a device can wait without receiving a configuration message before attempting to reconfigure. All device ports (except for designated ports) should receive configuration messages at regular intervals. Any port that ages out STP information (provided in the last configuration message) becomes the designated port for the attached LAN. If it is a root port, a new root port is selected from among the device ports attached to the network.

Example

```
Enterprise AP(config)#bridge stp max-age 40
Enterprise AP(config)#
```

bridge stp priority

Use this command to configure the spanning tree priority globally for the wireless bridge. Use the **no** form to restore the default.

Syntax

bridge stp priority<*priority*>

no bridge stp priority

priority - Priority of the bridge. (Range: 0 - 65535)

Default Setting

32768

Command Mode

Global Configuration

Command Usage

Bridge priority is used in selecting the root device, root port, and designated port. The device with the highest priority becomes the STP root device. However, if all devices have the same priority, the device with the lowest MAC address will then become the root device.

Example

```
Enterprise AP(config)#bridge stp-bridge priority 40000
Enterprise AP(config)#
```

bridge-link path-cost

Use this command to configure the spanning tree path cost for the specified port.

Syntax

bridge-link path-cost <*index*> <*cost*>

- *index* - Specifies the bridge link number on the wireless bridge. (Range: 1-6 required on wireless interface only)
- *cost* - The path cost for the port. (Range: 1-65535)

Default Setting

19

Command Mode

Interface Configuration

Command Usage

- This command is used by the Spanning Tree Protocol to determine the best path between devices. Therefore, lower values should be assigned to ports attached to faster media, and higher values assigned to ports with slower media.
- Path cost takes precedence over port priority.

Example

```
Enterprise AP(if-wireless a)#bridge-link path-cost 1 50
Enterprise AP(if-wireless a)#
```

bridge-link port-priority

Use this command to configure the priority for the specified port.

Syntax

bridge-link port-priority *<index> <priority>*

- *index* - Specifies the bridge link number on the wireless bridge. (Range: 1-6 required on wireless interface only)
- *priority* - The priority for a port. (Range: 1-255)

Default Setting

128

Command Mode

Interface Configuration

Command Usage

- This command defines the priority for the use of a port in the Spanning Tree Protocol. If the path cost for all ports on a wireless bridge are the same, the port with the highest priority (that is, lowest value) will be configured as an active link in the spanning tree.
- Where more than one port is assigned the highest priority, the port with lowest numeric identifier will be enabled.

Example

```
Enterprise AP(if-wireless a)#bridge-link port-priority 1 64
Enterprise AP(if-wireless a)#
```

Related Commands

bridge-link path-cost (5-95)

show bridge stp

This command displays aging time and spanning tree settings for the Ethernet and wireless interfaces.

Syntax

show bridge stp

Command Mode

Exec

Example

```
Enterprise AP#show bridge stp

Bridge MAC           : 00:12:CF:05:B7:84
Status               : Disabled
priority             : 0
designated-root     : priority = 0, MAC = 00:00:00:00:00:00
root-path-cost       : 0
root-Port-no         : 0
Hold Time            :      1 Seconds
Hello Time           :      2 Seconds
Maximum Age          :     20 Seconds
Forward Delay        :     15 Seconds
bridge Hello Time    :      2 Seconds
bridge Maximum Age   :     20 Seconds
bridge Forward Delay :     15 Seconds
time-since-top-change: 89185 Seconds
topology-change-count: 0
Enterprise AP#
```

Ethernet Interface Commands

The commands described in this section configure connection parameters for the Ethernet port and wireless interface.

Table 25 Ehternet Interface Commands

Command	Function	Mode	Page
interface ethernet	Enters Ethernet interface configuration mode	GC	5-98
dns primary- server	Specifies the primary name server	IC-E	5-98
dns secondary- server	Specifies the secondary name server	IC-E	5-98
ip address	Sets the IP address for the Ethernet interface	IC-E	5-99
ip dhcp	Submits a DHCP request for an IP address	IC-E	5-100
speed-duplex	Configures speed and duplex operation on the Ethernet interface	IC-E	5-101
shutdown	Disables the Ethernet interface	IC-E	5-101
show interface ethernet	Shows the status for the Ethernet interface	Exec	5-102

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)#
```

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 192.254.2.55
Enterprise AP(if-ethernet)#dns secondary-server 10.1.0.55
Enterprise AP(if-ethernet)#
```

Related Commands

show interface ethernet (5-102)

ip address

This command sets the IP address for the access point. 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: 192.254.2.1
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 access point 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 192.254.2.1 255.255.255.0
 192.254.2.253
Enterprise AP(if-ethernet)#
```

Related Commands

ip dhcp (5-100)

ip dhcp

This command enables the access point to obtain an IP address from a DHCP server. Use the **no** form to restore the default IP address.

Syntax

[**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 access point 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 access point 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 (5-99)

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)#
```

shutdown

This command disables the Ethernet interface. To restart a disabled interface, use the **no** form.

Syntax

[**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)#
```

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          : 192.254.2.1
Subnet Mask         : 255.255.255.0
Default Gateway     : 192.254.2.253
Primary DNS         : 192.254.2.55
Secondary DNS       : 10.1.0.55
Speed-duplex        : 100Base-TX Half Duplex
Admin status        : Up
Operational status  : Up
========================================
Enterprise AP#
```

Wireless Interface Commands

The commands described in this section configure connection parameters for the wireless interfaces.

Table 26 Wireless Interface Commands

Command	Function	Mode	Page
interface wireless	Enters wireless interface configuration mode	GC	5-104
vap	Provides access to the VAP interface configuration mode	IC-W	5-105
speed	Configures the maximum data rate at which the access point transmits unicast packets	IC-W	5-105
turbo	Configures turbo mode to use a faster data rate	IC-W (a)	5-106
multicast-data-rate	Configures the maximum rate for transmitting multicast packets on the wireless interface	IC-W	5-107
channel	Configures the radio channel	IC-W	5-108
transmit-power	Adjusts the power of the radio signals transmitted from the access point	IC-W	5-109
radio-mode	Forces the operating mode of the 802.11g radio	IC-W (b/g)	5-109
preamble	Sets the length of the 802.11g signal preamble	IC-W (b/g)	5-110
antenna control	Selects the antenna control method to use for the radio	IC-W	5-111
antenna id	Selects the antenna ID to use for the radio	IC-W	5-112
antenna location	Selects the location of the antenna	IC-W	5-112
beacon-interval	Configures the rate at which beacon signals are transmitted from the access point	IC-W	5-113
dtim-period	Configures the rate at which stations in sleep mode must wake up to receive broadcast/multicast transmissions	IC-W	5-114
fragmentation- length	Configures the minimum packet size that can be fragmented	IC-W	5-115
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	5-115
super-a	Enables Atheros proprietary Super A performance enhancements	IC-W (a)	5-116
super-g	Enables Atheros proprietary Super G performance enhancements	IC-W (b/g)	5-117
description	Adds a description to the wireless interface	IC-W-VAP	5-117

Command	Function	Mode	Page
ssid	Configures the service set identifier	IC-W-VAP	5-118
closed system	Opens access to clients without a pre-configured SSID	IC-W-VAP	5-118
max-association	Configures the maximum number of clients that can be associated with the access point at the same time	IC-W-VAP	5-119
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	5-119
auth- timeout-value	Configures the time interval after which clients must be re-authenticated	IC-W-VAP	5-120
shutdown	Disables the wireless interface	IC-W-VAP	5-120
show interface wireless	Shows the status for the wireless interface	Exec	5-121
show station	Shows the wireless clients associated with the access point	Exec	5-125

interface wireless

This command enters wireless interface configuration mode.

Syntax

interface wireless <**a** | **g**>

- **a** - 802.11a radio interface.
- **g** - 802.11g radio interface.

Default Setting

None

Command Mode

Global Configuration

Example

To specify the 802.11a interface, enter the following command:

```
Enterprise AP(config)#interface wireless a
Enterprise AP(if-wireless a)#
```

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])#
```

speed

This command configures the maximum data rate at which the access point transmits unicast packets.

Syntax

speed <*speed*>

speed - Maximum access speed allowed for wireless clients.
(Options for 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps)
(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.
- When turbo mode is enabled (page 5-106) for 802.11a, 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)#
```

turbo

This command sets the access point to an enhanced proprietary modulation mode (not regulated in IEEE 802.11a) that provides a higher data rate of up to 108 Mbps.

Syntax

turbo <**static** | **dynamic**>
no turbo

static - Always uses turbo mode.
dynamic - Will use turbo mode when no other nearby access points are detected or active.

Default Setting

Disabled

Command Mode

Interface Configuration (Wireless - 802.11a)

Command Usage

- The normal 802.11a wireless operation mode provides connections up to 54 Mbps. Turbo Mode is an enhanced mode (not regulated in IEEE 802.11a) that provides a higher data rate of up to 108 Mbps. Enabling Turbo Mode allows the access point to provide connections up to 108 Mbps.
- In normal mode, the access point provides a channel bandwidth of 20 MHz, and supports the maximum number of channels permitted by local regulations (e.g., 11 channels for the United States). In Turbo Mode, the channel bandwidth is increased to 40 MHz to support the increased data rate. However, this reduces the number of channels supported (e.g., 5 channels for the United States).

Example

```
Enterprise AP(if-wireless a)#turbo
Enterprise AP(if-wireless a)#
```

multicast-data-rate

This command configures the maximum data rate at which the access point 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 802.11a: 6, 12, 24 Mbps)
(Options for 802.11b/g; 1, 2, 5.5, 11 Mbps)

Default Setting

1 Mbps for 802.11b/g
6 Mbps for 802.11a

Command Mode

Interface Configuration (Wireless)

Example

```
Enterprise AP(if-wireless g)#multicast-data-rate 5.5
Enterprise AP(if-wireless g)#
```

channel

This command configures the radio channel through which the access point communicates with wireless clients.

Syntax

channel <*channel* | **auto**>

- *channel* - Manually sets the radio channel used for communications with wireless clients. (Range for 802.11a: 36, 40, 44, 48, 52, 56, 60, 64, 149, 153, 157, 161, 165 for normal mode, and 42, 50, 58, 152, 160 for turbo mode; 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 access points are deployed in the same area, be sure to choose a channel separated by at least two channels for 802.11a to avoid having the channels interfere with each other, and at least five channels for 802.11b/g. You can deploy up to four access points in the same area for 802.11a (e.g., channels 36, 56, 149, 165) and three access points for 802.11b/g (e.g., channels 1, 6, 11).
- For most wireless adapters, the channel for wireless clients is automatically set to the same as that used by the access point to which it is linked.

Example

```
Enterprise AP(if-wireless g)#channel 1
Enterprise AP(if-wireless g)#
```

transmit-power

This command adjusts the power of the radio signals transmitted from the access point.

Syntax

transmit-power <*signal-strength*>

signal-strength - Signal strength transmitted from the access point. (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)#
```

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 access point, 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 access point (up to 54 Mbps).
- **b+g** - b & g mixed mode: Both 802.11b and 802.11g clients can communicate with the access point (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)#
```

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 access point, but requires that all clients can support a short preamble.
- Set the preamble to long to ensure the access point can support all 802.11b and 802.11g clients.

Example

```
Enterprise AP(if-wireless g)#preamble short
Enterprise AP(if-wireless g)#
```

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 both antennas in a diversity system. Select this method when the Antenna ID is set to “Default Antenna” to use the access point's integrated antennas. The access point does not support external diversity antennas.
- **left** - The radio only uses the antenna on the left side (the side farthest from the access point LEDs). The access point does not support an external antenna connection on its left antenna. Therefore, this method is not valid for the access point.
- **right** - The radio only uses the antenna on the right side (the side closest to the access point LEDs). Select this method when using an optional external antenna that is connected to the right antenna connector.

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)#
```

antenna id

This command specifies the antenna type connected to the access point represented by a four-digit hexadecimal ID number, either the integrated diversity antennas (the "Default Antenna") or an optional external antenna.

Syntax

antenna id <*antenna-id*>

- *antenna-id* - Specifies the ID number of an approved antenna that is connected to the access point
  (Range: 0x0000 - 0xFFFF)

Default Setting

0x0000 (built-in antennas)

Command Mode

Interface Configuration (Wireless)

Command Usage

- The optional external antennas (if any) that are certified for use with the access point are listed by typing **antenna control id ?**. Selecting the correct antenna ID ensures that the access point'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.

Example

```
Enterprise AP(if-wireless g)#antenna id 0000
Enterprise AP(if-wireless g)#
```

antenna location

This command selects the antenna mounting location for the radio interface.

Syntax

antenna location <**indoor** | **outdoor**>

- **indoor** - The antenna is mounted indoors.
- **outdoor** - The antenna is mounted outdoors.

Default Setting

Indoor

Command Mode

Interface Configuration (Wireless)

Command Usage

- When an external antenna is selected, the antenna control must be set to “right.”
- Selecting the correct location ensures that the access point only uses radio channels that are permitted in the country of operation.

Example

```
Enterprise AP(if-wireless g)#antenna location indoor
Enterprise AP(if-wireless g)#
```

beacon-interval

This command configures the rate at which beacon signals are transmitted from the access point.

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 access point. They may also carry power-management information.

Example

```
Enterprise AP(if-wireless g)#beacon-interval 150
Enterprise AP(if-wireless g)#
```

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 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.

Example

```
Enterprise AP(if-wireless g)#dtim-period 100
Enterprise AP(if-wireless g)#
```

fragmentation-length

This command configures the minimum packet size that can be fragmented when passing through the access point.

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)#
```

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 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 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 frame to notify the sending station that it can start sending data.
- Access points 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)#
```

super-a

This command enables Atheros proprietary Super A performance enhancements. Use the **no** form to disable this function.

Syntax

[**no**] **super-a**

Default Setting

Disabled

Command Mode

Interface Configuration (Wireless - 802.11a)

Command Usage

Super A enhancements include bursting, compression, and fast frames. Maximum throughput ranges between 40 to 60 Mbps for connections to Atheros-compatible clients.

Example

```
Enterprise AP(if-wireless a)#super a
Enterprise AP(if-wireless a)#
```

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 a)#super g
Enterprise AP(if-wireless a)#
```

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

None

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])#
```

ssid

This command configures the service set identifier (SSID).

Syntax

ssid <*string*>

string - The name of a basic service set supported by the access point. (Range: 1 - 32 characters)

Default Setting

802.11a Radio: VAP_TEST_11A (0 to 3)
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 access point must set their SSIDs to the same as that of the access point.

Example

```
Enterprise AP(if-wireless g: VAP[0])#ssid RD-AP#3
Enterprise AP(if-wireless g)#
```

closed-system

This command prohibits access to clients without a pre-configured SSID. Use the **no** form to disable this feature.

Syntax

[**no**] **closed-system**

Default Setting

Disabled

Command Mode

Interface Configuration (Wireless-VAP)

Command Usage

When closed system is enabled, the access point 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)#
```

max-association

This command configures the maximum number of clients that can be associated with the access point 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)#
```

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])#
```

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])#
```

shutdown

This command disables the wireless interface. Use the **no** form to restart the interface.

Syntax

[**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)#
```

show interface wireless

This command displays the status for the wireless interface.

Syntax

show interface wireless <**a** | **g**> *vap-id*

- **a** - 802.11a radio interface.
- **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_G 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                : Indoor
----------------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#
```

show station

This command shows the wireless clients associated with the access point.

Command Mode

Exec

Example

```
Enterprise AP#show station

Station Table Information
========================================================
if-wireless A VAP [0]   :
802.11a Channel : 60

No 802.11a 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#
```

Rogue AP Detection Commands

A “rogue AP” is either an access point that is not authorized to participate in the wireless network, or an access point 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 access point can be configured to periodically scan all radio channels and find other access points within range. A database of nearby access points is maintained where any rogue APs can be identified.

Table 27 Rogue AP Commands

Command	Function	Mode	Page
rogue-ap enable	Enables the periodic detection of other nearby access points	GC	5-126
rogue-ap authenticate	Enables identification of all access points	GC	5-127
rogue-ap duration	Sets the duration that all channels are scanned	GC	5-128
rogue-ap interval	Sets the time between each scan	GC	5-128
rogue-ap scan	Forces an immediate scan of all radio channels	GC	5-129
show rogue-ap	Shows the current database of detected access points	Exec	5-130

rogue-ap enable

This command enables the periodic detection of nearby access points. 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 access point 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.
- A “rogue AP” is either an access point that is not authorized to participate in the wireless network, or an access point that does not have the correct security configuration. Rogue access points can be identified by unknown BSSID (MAC address) or SSID configuration. A database of nearby access points should therefore be maintained on a RADIUS server, allowing any rogue APs to be identified (see “rogue-ap authenticate” on page 5-127).

The rogue AP database can be viewed using the **show rogue-ap** command.

- The access point sends Syslog messages for each detected access point 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)#
```

rogue-ap authenticate

This command forces the unit to authenticate all access points 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 access points stored on a RADIUS server allows the access point to discover rogue APs. With authentication enabled and a configure RADIUS server, 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 authentication disabled, the access point can identify its neighboring access points only; it cannot identify whether the access points are allowed or are rogues. If you enable authentication, you should also configure a RADIUS server for this access point (see “RADIUS” on page 4-8).

Example

```
Enterprise AP(if-wireless g)#rogue-ap authenticate
Enterprise AP(if-wireless g)#
```

rogue-ap duration

This command sets the scan duration for detecting access points.

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 access point. If clients experience severe disruption, reduce the scan duration time.
- A long scan duration time will detect more access points 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 (5-128)

rogue-ap interval

This command sets the interval at which to scan for access points.

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 access points, 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 (5-128)

rogue-ap scan

This command starts an immediate scan for access points on the radio interface.

Default Setting

Disabled

Command Mode

Interface Configuration (Wireless)

Command Usage

While the access point 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.

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)#
```

show rogue-ap

This command displays the current rogue AP database.

Command Mode

Exec

Example

```
Enterprise AP#show rogue-ap

802.11a Channel : Rogue AP Status
AP Address(BSSID)            SSID   Channel(MHz) RSSI Type Privacy RSN
======================================================================

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#
```

Wireless Security Commands

The commands described in this section configure parameters for wireless security on the 802.11a and 802.11g interfaces.

Table 28 Wireless Security Commands

Command	Function	Mode	Page
auth	Defines the 802.11 authentication type allowed by the access point	IC-W-VAP	5-134
encryption	Defines whether or not WEP encryption is used to provide privacy for wireless communications	IC-W-VAP	5-133
key	Sets the keys used for WEP encryption	IC-W	5-134
transmit-key	Sets the index of the key to be used for encrypting data frames sent between the access point and wireless clients	IC-W-VAP	5-135
cipher-suite	Selects an encryption method for the global key used for multicast and broadcast traffic	IC-W-VAP	5-136
mic_mode	Specifies how to calculate the Message Integrity Check (MIC)	IC-W	5-137
wpa-pre-shared- key	Defines a WPA preshared-key value	IC-W-VAP	5-138

Command	Function	Mode	Page
pmksa-lifetime	Sets the lifetime PMK security associations	IC-W-VAP	5-139
pre-authentication	Enables WPA2 pre-authentication for fast roaming	IC-W-VAP	5-139

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 5-70) and RADIUS server details (see "RADIUS Client" on page 5-64) must be configured on the access point. 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 5-70) and RADIUS server details (see "RADIUS Client" on page 5-64) 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 access point. Use the wpa-preshared-key command to configure the key (see "key" on page 5-134 and "transmit-key" on page 5-135).
- 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 access point 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 access point. 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 (5-133)
key (5-134)

encryption

This command enables data encryption for wireless communications. Use the **no** form to disable data encryption.

Syntax

[**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 access point.

Example

```
Enterprise AP(if-wireless g: VAP[0])#encryption
Enterprise AP(if-wireless g)#
```

Related Commands

key (5-134)

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 access point.
- The encryption index, length and type configured in the access point 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 (5-134)
encryption (5-133)
transmit-key (5-135)

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 access point 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 access point uses a dynamic key to encrypt unicast and broadcast messages to 802.1X-enabled clients. However, because the access point 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 access point 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)#
```

cipher-suite

This command defines the cipher algorithm used to encrypt the global key for broadcast and multicast traffic when using Wi-Fi Protected Access (WPA) security.

Syntax

cipher-suite <**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 access point 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 access point are not WPA enabled, the cipher-suite 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])#cipher-suite TKIP
Enterprise AP(if-wireless g)#
```

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 Wi-Fi 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 access point supports a choice of hardware or software for MIC calculation. The performance of the access point 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 both 802.11a and 802.11g interfaces are supporting a high number of clients simultaneously.

Example

```
Enterprise AP(if-wireless a)#mic_mode hardware
Enterprise AP(if-wireless g)#
```

wpa-pre-shared-key

This command defines a Wi-Fi 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 access point'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 (5-131)

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 access point 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 access point 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 access point, it requires full reauthentication.
- The access point 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])#
```

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 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 support pre-authentication, both clients and access points in the network must be WPA2 enabled.
- Pre-authentication requires all access points 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])#
```

Link Integrity Commands

The access point provides a link integrity feature that can be used to ensure that wireless clients are connected to resources on the wired network. The access point does this by periodically sending Ping messages to a host device in the wired Ethernet network. If the access point detects that the connection to the host has failed, it disables the radio interfaces, forcing clients to find and associate with another access point. When the connection to the host is restored, the access point re-enables the radio interfaces.

Table 29 Link Integrity Commands

Command	Function	Mode	Page
link-integrity ping-detect	Enables link integrity detection	GC	5-141
link-integrity ping-host	Specifies the IP address of a host device in the wired network	GC	5-142
link-integrity ping-interval	Specifies the time between each Ping sent to the link host	GC	5-142
link-integrity ping-fail-retry	Specifies the number of consecutive failed Ping counts before the link is determined as lost	GC	5-143
link-integrity ethernet-detect	Enables integrity check for Ethernet link	GC	5-143
show link-integrity	Displays the current link integrity configuration	Exec	5-144

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 access point 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)#
```

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 192.254.2.10
Enterprise AP(config)#
```

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)#
```

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)#
```

link-integrity ethernet-detect

This command enables an integrity check to determine whether or not the access point 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)#
```

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  : 192.254.0.140
 Ping Fail Retry : 6
 Ping Interval   : 30
===========================================================
Enterprise AP#
```

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 access points. In other words, the 802.11f protocol can ensure successful roaming between access points in a multi-vendor environment.

iapp

This command enables the protocol signaling required to hand over wireless clients roaming between different 802.11f-compliant access points. 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 access points in order to support clients roaming from one access point to another. In particular, this can create a problem for clients roaming between access points from different vendors. This command is used to enable or disable 802.11f handover signaling between different access points, especially in a multi-vendor environment.

Example

```
Enterprise AP(config)#iapp
Enterprise AP(config)#
```

VLAN Commands

The access point 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 access point, 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 access point assigns the user to its own configured native VLAN ID.

***NOTE:** When VLANs are enabled, the access point's Ethernet port drops all received traffic that does not include a VLAN tag. To maintain network connectivity to the access point and wireless clients, be sure that the access point is connected to a device port on a wired network that supports IEEE 802.1Q VLAN tags.*

The VLAN commands supported by the access point are listed below.

Table 30 VLAN Commands

Command	Function	Mode	Page
vlan	Enables a single VLAN for all traffic	GC	5-146
management-vlanid	Configures the management VLAN for the access point	GC	5-146
vlan-id	Configures the default VLAN for the VAP interface	IC-W-VAP	5-147

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 access point 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 access point’s native VLAN ID.
- Traffic entering the Ethernet port must be tagged with a VLAN ID that matches the access point’s native VLAN ID, or with a VLAN tag that matches one of the wireless clients currently associated with the access point.

Example

```
Enterprise AP(config)#vlan enable
Reboot system now? <y/n>: y
```

Related Commands

management-vlanid (5-146)

management-vlanid

This command configures the management VLAN ID for the access point.

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 access point. For example, the access point allows traffic that is tagged with the specified VLAN to manage the access point via remote management, SSH, SNMP, Telnet, etc.

Example

```
Enterprise AP(config)#management-vlanid 3
Enterprise AP(config)#
```

Related Commands

vlan (5-146)

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 access point must enable VLAN support using the **vlan** command.
- When VLANs are enabled, the access point 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])#
```

WMM Commands

The access point implements QoS using the Wi-Fi 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.

The WMM commands supported by the access point are listed below.

Table 31 WMM Commands

Command	Function	Mode	Page
wmm	Sets the WMM operational mode on the access point	IC-W	5-148
wmm-acknowledge-policy	Allows the acknowledgement wait time to be enabled or disabled for each Access Category (AC)	IC-W	5-149
wmmparam	Configures detailed WMM parameters that apply to the access point (AP) or the wireless clients (BSS)	IC-W	5-150

wmm

This command sets the WMM operational mode on the access point. 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 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.

Default

supported

Command Mode

Interface Configuration (Wireless)

Example

```
Enterprise AP(if-wireless a)#wmm required
Enterprise AP(if-wireless a)#
```

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. 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 access points 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 a)#wmm-acknowledge-policy 0 noack
Enterprise AP(if-wireless a)#
```

wmmparam

This command configures detailed WMM parameters that apply to the access point (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 . (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

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

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 a)#wmmparams ap 0 4 6 3 1 1
Enterprise AP(if-wireless a)#
```

6 TROUBLESHOOTING

If you have difficulty with the 3Com Wireless LAN access point, first check the following items in the configuration:

- Radio Settings page: Ensure that the SSID is the same on clients and the access point.
- Security page: Ensure that Encryption is the same on clients and the access point.
- Authentication page: Ensure that the Local MAC Authentication System Default is set to Allow. Ensure that 802.1x Authentication Settings are correct.
- TCP/IP Settings page: If the DHCP Client is set to Disabled, then ensure that the access point IP Address is within the same subnet as the wired LAN.

If necessary, reset the access point to the factory defaults.

Try the solutions in the following table. If you need further assistance, contact 3Com Technical Support through the following Web page: http://www.3com.com/products/en_US/supportedindex.jsp

Symptom	**Solutions**
Access point does not power up.	Make sure the Ethernet cable is plugged into the port labeled *To Access Point* on the power brick. Check for a faulty access point power supply. Check for a failed AC power supply
Access point powers up, but has no connection to the wired network.	Make sure that the Ethernet cable is plugged into the port labeled To Hub/Switch on the power brick. Verify the network wiring and topology for proper configuration. Check that the cables used are the proper type.

Symptom	Solutions
No operation.	Verify the access point configuration. Review access point firmware revisions and update firmware if necessary. Make sure that there are no duplicate IP addresses on the network. Unplug the access point and ping the assigned address to make sure that no other device responds to that address.
Access point powers up, but does not associate with wireless clients.	Confirm that the service area on the access point matches that on the clients. Verify that the clients are operating correctly. Make sure that security settings on the access point match those on the clients. Make sure that the access point antennas are positioned properly. Check the range and move clients closer if necessary.
Mobile users do not have roaming access to the access point.	Make sure that all access points and wireless devices in the ESS in which mobile users can roam are configured to the same WEP setting, SSID, and authentication settings.
Slow or erratic performance.	Try changing the wireless channel on the access point. Check the access point antennas, connectors, and cabling for loose connections. Check the wired network topology and configuration for malfunctions.
Running on a computer connected to the wired LAN, the 3Com Device Manager cannot find an access point.	The 3Com Device Manager cannot discover devices across routers. Make sure that the computer is connected on the same segment as the access point.
After you specify an IP address for an access point, the 3Com Device Manager continues to point to the old IP address when you select the access point in the Wireless Network Tree.	In the 3Com Device Manager window click the *Refresh* button to refresh the Wireless Network Tree. Then click the access point in the Wireless Network Tree and click *Properties*. The IP address you specified is now listed. If you want to continue configuring the access point, click *Configure*.

Symptom	Solutions
While you are configuring the access point, the Configuration Management System stops responding.	To maintain wireless association, the service area and the security settings on the client and the access point must match exactly. Therefore, if you are associated with the access point that you are configuring and you change the access point service area or security, make sure to change the client service area to match. If you change the IP address and save the change, you cannot continue to configure the access point using the old IP address. Therefore, if you want to continue configuring this access point after you save this change, you must do the following: **1** Close your browser. **2** Return to the 3Com Device Manager Wireless Network Tree and click *Refresh*. **3** Select the access point and click *Configure* to start a new configuration session.
The access point cannot be configured using the Web browser.	Reset the access point (push the reset button located near the access point LEDs).

INDEX