



# **Installation and User Guide**

## **Airgo Access Point**

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# Preface

This guide explains how to install and configure the Airgo Access Point (Airgo AP), which is used with Wi-Fi certified clients to provide PC laptop and desktop users with wireless network access.

The Airgo Access Point provides the following features:

- High throughput and range through dual-band radio transceivers
- Easy installation
- Wireless networking features that include bridging, VLAN, Quality of Service (QoS), IP routing, and network backhaul capabilities
- Comprehensive security that includes support for WEP, TKIP, AES, EAP-PEAP, EAP-TLS, RADIUS, WPA, and IEEE 802.1x
- Automated radio resource management, including controls for operating channels, capacity, and range
- Policy-based management

## Audience

This guide is designed to help you install and configure the Airgo Access Point successfully even if you are unfamiliar with wireless networking technology. Some familiarity with local area networking technology is assumed. If you encounter a term or acronym with which you are unfamiliar, refer to the glossary at the end of the guide, just before the index.

## Organization of this Guide

This guide consists of the following chapters:

- **Chapter 1, “Overview,”** provides a high-level overview of the Airgo Access Point products.
- **Chapter 2, “Planning Your Installation,”** describes various deployment scenarios and helps determine how many Airgo Access Points will be needed and the appropriate network management scheme.
- **Chapter 3, “Installing the Access Point Using the Configuration Interfaces,”** describes how to install the Airgo Access Point and how to use the Quick Start panels for fast and easy configuration. Also explains how to use the Airgo AP web interface.
- **Chapter 4, “Configuring Radio Settings,”** explains how to configure the Airgo Access Point radios.
- **Chapter 5, “Configuring Networking Settings,”** explains how to configure the advanced networking features of the Airgo Access Point.
- **Chapter 6, “Configuring a Wireless Backhaul,”** explains how to use the wireless backhaul feature to configure a wireless distribution system that can cover a large area with limited wired network connectivity.
- **Chapter 7, “Managing Security,”** describes the encryption and authentication features of the Airgo Access Point and explains how to configure the security options.
- **Chapter 8, “Configuring Guest Access,”** describes how to configure guest access for the network.

- **Chapter 9, “Managing the Network,”** explains how to use the NM Portal features of the Airgo Access Point to manage multiple APs across your network.
- **Chapter 10, “Maintaining the Access Point,”** describes the tools available to maintain the Airgo Access Point.
- **Appendix A, “Using the Command Line Interface,”** describes how to use the console and command line interface (CLI) to configure the Airgo Access Point, with cross-references to the Airgo Command Line Interface Reference Manual.
- **Appendix B, “Regulatory and License Information,”** provides regulatory specifications. for the Airgo Access Point.
- **Appendix C, “External Landing Page API,”** describes how guest authentication is performed when an external authentication web server is configured and supplements the information in **Chapter 8, “Configuring Guest Access.”**
- **Appendix D, “Alarms,”** provides a description of the alarms generated by the Airgo Access Point.
- **Glossary**— Provides definitions for acronyms, networking terminology, and Airgo-specific terms.

### Conventions Used in this Guide

This guide uses the following conventions for instructions and information.

### Notes, Cautions, and Warnings

Notes, cautions, and time-saving tips use the following conventions and symbols.



**NOTE:** Contains helpful suggestions or information important to the task at hand.



**CAUTION:** Indicates a risk of equipment damage or loss of data when certain actions are performed.



**WARNING:** Alerts you to situations that could result in injury (such as exposure to electric current, for example).

### Command Conventions

Table 1 describes the command syntax used in this document.

**Table 1:Command Conventions**

| Convention                         | Description                                                                                                                                                      |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>boldface</b>                    | Commands and keywords.                                                                                                                                           |
| <i>italic</i>                      | Command input that is supplied by you.                                                                                                                           |
| [   ]                              | Optional keywords and default responses to system prompts appear within square brackets.                                                                         |
| { <b>x</b>   <b>x</b>   <b>x</b> } | A choice of keywords (represented by <b>x</b> ) appears in braces separated by vertical bars. You must select one.                                               |
| Ctrl                               | Represents the key labeled <i>Ctrl</i> . For example, when you read <i>^D</i> or <i>Ctrl-D</i> , you should hold down the Control key while you press the D key. |
| panel font                         | Examples of information displayed on a panel.                                                                                                                    |
| <b>boldface panel font</b>         | Examples of information the user must enter.                                                                                                                     |

**Related Documentation**

The following documentation related to the Airgo Networks wireless networking product line is available on CD-ROM:

- **Airgo Networks Client Installation and User Guide** — Explains how to install and configure the Airgo Networks Wireless LAN Client Adapter, which provides PC laptop and desktop users with access to the Airgo Networks Access Point products.
- **Airgo Networks NMS Pro Installation and Configuration Guide** — Explains how to use Airgo Networks NMS Pro to manage an enterprise wireless network.
- **Airgo Networks Command Line Interface (CLI) Reference Manual** — Provides a listing of all the commands available for the Airgo Access Point through serial console access and the command line interface. Intended for advanced users and system administrators.



# 1 Overview

This chapter introduces the features and capabilities of the Airgo Access Point and presents the following topics:

- [Product Overview](#)
- [Features Overview](#)
- [Standards and Data Rates](#)
- [Radio Resource Management](#)
- [Mobility Management](#)
- [Portal Architecture](#)
- [Security](#)
- [Integration with the Existing Wired Network](#)
- [Management Interface Options](#)

## Product Overview

The Airgo Access Point is part of an innovative suite of wireless technology products designed to dramatically improve the quality and convenience of wireless networking. By greatly increasing the range, speed, reliability, security, and ease-of-use of wireless LAN (WLAN) systems, Airgo Networks products help to promote the mainstream adoption of wireless technology and foster new wireless applications.

## Product Suite

The Airgo Networks product suite comprises these wireless networking products:

- Airgo Access Point
- Airgo Wireless LAN Client Adapter
- NMS Pro

### Airgo Access Points

Airgo Access Points (Airgo AP) provide network connectivity for wireless client stations. Incorporating the latest technological advances in radio design and implementation, the dual or single radio Airgo Access Point offers very high wireless performance, financial-grade security, and extended wireless coverage.

### Airgo Wireless LAN Client Adapter

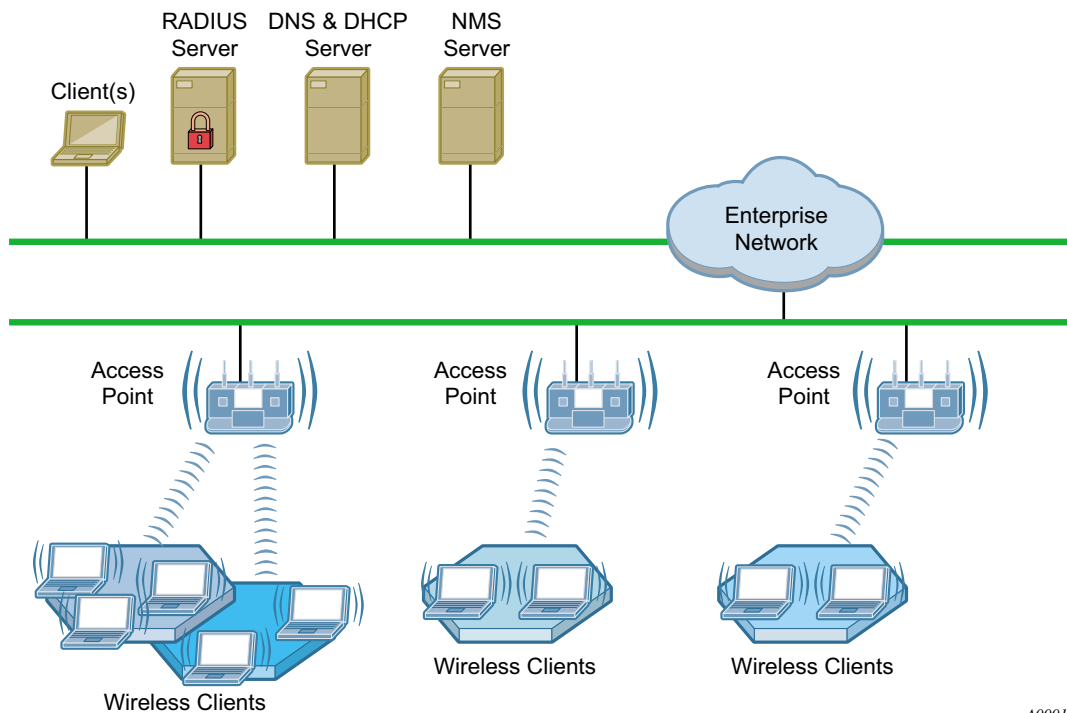
The Airgo Wireless LAN Client Adapter provides the communications link between laptop or desktop PC users and a wireless network. Available in PC Card and Mini PCI Card form factors, the Airgo Wireless LAN Client Adapter is designed to take full advantage of the performance, range, security, and management capabilities of the Airgo Access Point. For more information, refer to the *Airgo Wireless LAN Client Adapter Installation and User Guide*.

### Airgo Networks NMS Pro

NMS Pro provides enterprise-class management for the wireless network, including complete configuration and image control, security, and performance and fault monitoring. For more information, refer to the *NMS Pro Installation and Configuration Guide*.

Figure 1 shows how Airgo Networks products operate in concert to create a wireless network.

**Figure 1: Airgo Wireless Network**



A0001D

## Features Overview

Airgo Access Points extend the range, coverage, and bandwidth of traditional wireless equipment, while supporting the latest network security and management features. The following are key features of the Airgo Access Point:

- Standards - Supports IEEE 802.11 and RFC standards
  - Supports IEEE 802.11a, b, g, d, e, f, and i standards (or draft standards).
  - Supports numerous IETF RFC networking and security standards
  - Dual radio or single radio operating in 802.11b/g or 802.11a mode
  - Optional enhanced, True MIMI™ data rates up to 108 Mbps
  - Requires fewer access-points due to extended coverage and high performance

- Security - Financial Grade Security
  - Four-layers of security: AP security, Admin User Security, Wireless User Security, and Guest User security support
    - AP Security with a built-in unique X.509 AP certificate for constructing a secure wireless network.
    - Admin User Security with management access through SSH, HTTPs and SNMPv3.
    - Wireless User Security supports IEEE 802.1X security with WPA-PSK, WPA-EAP, WEP-64, WEP-128, EAP-TLS, EAP-PEAP, EAP-TTLS, MAC-ACL, Guest Authentication and Open authentication
    - Guest User Security with secure web browser based security
  - Wire-speed AES-CCM encryption (supported in hardware)
  - Rogue AP detection and monitoring to protect against unauthorized wireless networks
- Wireless Services - Self-Healing and High-Performance Wireless Access
  - Each radio is dual-band and multi-mode with 802.11a, b or g operations.
  - Dynamic channel assignment
  - Support for low, medium or high network density for varying cell size
  - World-mode support for compliance for channel and transmit-power constraints in different countries
  - Multiple SSID with Virtual AP feature set
  - WMM QOS, or IEEE 802.11e QOS support
  - Wireless backhaul to extend secure wireless network without need to wire every access-point to Ethernet backbone.
- Layer-2 and Layer-3 Mobility - Seamless Mobility
  - Supports seamless Layer-2 or intra-IP subnet roaming using IAPP
  - Supports seamless Layer-3 or inter-IP subnet roaming using VLANs or Tunneling methods
- Zero-Configuration - Rapid Secure Network Deployment
  - Built-in network management and security portal services to enable centralized configuration, security and management of wireless network.
  - Built-in RADIUS server to provide WPA-EAP with certificate based security for wireless users
  - Support RADIUS-proxy to simplify configuration of external RADIUS servers
  - Support for legacy station authentication using MAC-address based Access Control List (ACL).
  - Support for password-based Guest-Access authentication
  - Policy based configuration of network from NM-Portal AP
  - One click software distribution to entire network from NM-Portal AP
  - Configuration backup and restore
  - Centralized fault-monitoring using Alarms and SYSLOG
  - Configuration using CLI, SNMP and Web User-Interface
- Networking - High Performance QOS & VLAN Support
  - High-performance bridging, VLANs and static IP routing support
  - Extensive QOS support using WMM, IP DSCP, IP Precedence, and IP Protocol with ingress and egress QOS rules
  - Layer-2 Filtering on ingress and egress interfaces.

## Radio Resource Management

The Airgo AP supports management of radio channels, cell size, and range.

Channel management features include automatic channel selection, support for international channel sets, dynamic channel changes in response to network conditions, and the ability to assign channels manually to fine tune channel quality. Cell size and range capabilities enable you to optimize equipment placement, eliminate dead spots, and reduce interference.

## Mobility Management

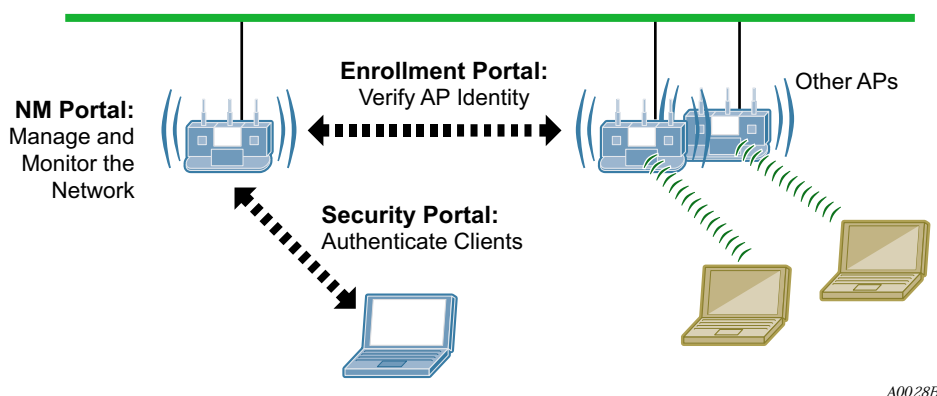
Mobility management features include Layer-2 and Layer-3 roaming, as users move from one access point coverage area to another or are switched for load balancing purposes. Layer-2 roaming occurs by default when a wireless client roams between APs on the same subnet, if 802.11f-based Inter-Access Point Protocol (IAPP) is enabled. The Layer-3 Mobility feature provides seamless roaming for wireless clients across multiple subnets in proximity to each other.

## Portal Architecture

To support the range of network sizes and configurations served by Airgo Networks products, Airgo has designed a built-in, flexible, portal services architecture for management and security. An AP can be configured as an *NM Portal AP* to support the following services:

| Service    | Description                                                                                                                                                                                                                                                                                                                                                                              |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Management | NM Portal services provide network management functionality for small to mid-size wireless networks. Each Airgo AP configured as an NM Portal can operate in stand-alone mode to provide network management for the entire network or as a location or branch manager working in conjunction with NMS Pro, the Airgo Networks Professional Network Management System.                    |
| Security   | Security portal services include support for secure user authentication by way of a RADIUS server internal to the Airgo AP. Security portal services are part of NM Portal, but can also be configured independently for backup authentication in the event that the primary internal RADIUS server becomes unavailable.                                                                 |
| Enrollment | Each Airgo Networks wireless network requires an enrollment server to verify the identity other of Airgo APs and authorize them for operation in the network. The enrollment portal feature is automatically enabled in the access point as part of NM Portal. NM Portal should be used for enrollment unless NMS Pro has been implemented as an enterprise network management solution. |

Figure 2 illustrates portal services within the Airgo Networks network. NM Portal provides overall network management functionality and monitoring. The enrollment portal feature enables verification of additional APs and authorization for operation in the network. The security portal feature verifies the identity of individual users wanting access to the network.

**Figure 2: Portal Services**

Regardless of network size, configuring one or more Airgo APs as NM Portals yields the following benefits:

- Even with as few as two APs in a network, NM Portal offers a single point of focus for monitoring the network and managing security. Configuring the first installed AP as an NM Portal makes it easy to enroll additional APs.
- The configuration of the NM Portal AP is easily distributed to the other APs in the network, assuring consistent application of configuration parameters.
- NM Portal can provide user authentication services for an entire small to mid-size network or serve as a backup security server if an external RADIUS authentication service is used.

## Security

Airgo Networks offers a comprehensive security solution that adheres to the following industry standards and draft standards:

- Data encryption — WEP, Wi-Fi Protected Access (WPA) with TKIP or AES encryption
- User authentication — IEEE 802.1x authentication, including EAP-PEAP or EAP-TLS, WPA-PSK
- Key management — Microsoft-IAS, FUNK-RADIUS, Airgo Networks NMS Pro, Airgo Networks integrated security portal, and manual key management capabilities

These features are part of a security architecture that provides the wireless network a greater degree of security than most traditional wired networks. The following security features are included in all Airgo Access Points:

- Built-in maximum industry-standard security
- Auto-detection of the security capability of clients and APs
- Policy-based configuration of security settings
- Hardware support for high-performance encryption
- Support for installations ranging from the small-office/home-office (SOHO) to multi-site enterprises
- Zone privacy to protect users in public hot spots by isolating client stations from each other
- Command-line access using SSH (secure shell)
- Web-based management interface and policy-based management using HTTPS (SSL)

- SNMP management interface through SNMPv3
- IEEE 802.11i standards
- User-authentication using EAP-TLS, EAP-PEAP, WPA-PSK, WEP
- Rogue AP detection
- Rogue client detection

### VLANs

By decoupling traffic flow and network services from the physical network topology, virtual LANs (VLANs) enable enterprises to improve network traffic flow, increase load, and deliver varying levels of service and access to different groups of users. The Airgo AP VLAN feature readily extends an existing wired VLAN structure to the wireless network. It can also be used to implement new network privileges and services; for example, user VLANs are integral to the Airgo Networks guest access feature (see “Guest Access” on page 7).

Airgo supports interface-based VLANs and user-based VLANs. Interface VLANs separate traffic according to the Ethernet and radio interfaces on the Airgo AP. Packets destined for a specific interface VLAN are directed to the port with that VLAN assigned. By contrast, user VLANs separate traffic according to user groups. Users can be assigned to the same VLAN even if they are in different physical LANs and at geographically dispersed locations. User VLANs are useful for managing enterprise work groups and differentiating among categories of users. The Airgo Access Point supports up to 16 VLANs, including a default VLAN.

### Quality of Service

Quality of Service (QoS) features enable differential treatment of network traffic types to support special applications or extend priority access to designated groups of users. For example, applications such as streaming media and voice over IP (VoIP) suffer serious quality degradation if data transmission is interrupted or bandwidth fluctuates excessively. You can assign higher service quality to applications of this type, while maintaining adequate service for less intensive applications such as print and file sharing. Network utilization is increased with little to no negative effect on user productivity. QoS can also be used to lower the priority for non-critical applications. For example, FTP transfers, which are generally not time critical but can consume significant network bandwidth, can be assigned lower priority than streaming media applications or database transactions.

QoS can also be assigned on a user group basis. For example, network administrators can be assigned a higher service quality than other employees, thereby enhancing their ability to manage and troubleshoot a heavily loaded network.

Airgo Networks implements QoS features using classes of service (COS). Eight COS levels are available for assignment according to user, group, or application based rules. The COS approach does not guarantee bandwidth, but it does give “best effort” priority according to the assigned level. A flexible approach to service quality, it scales easily and accommodates a variety of mapping rules. MAC layer mappings for COS levels and COS-to-IP layer mappings are supported, and priority settings can be assigned for different COS mapping rules.

### IP Routing

IP routing adds flexibility to AP management and expands the addressing capability of the AP. You can specify static IP addresses outside the local subnet along with routing information to reach those addresses.

## Multiple SSIDs

The Airgo AP supports multiple SSIDs within each individual AP. Using the multiple SSID feature, users can access separate networks through a single physical infrastructure. For example, if you want to create different levels of resource access for employees and visitors, you can create two SSIDs, one with high security and one with open security.

## Guest Access

The Airgo AP supports flexible, secure management of guest access at corporate and hot spot locations. By contrast with most other guest access solutions, the Airgo AP supports guest access without necessarily requiring changes to the physical network topology. VLAN tags on the existing access points segregate users into non-guest and guest VLANs, and guests are automatically directed to an internal or external web landing page. Guest passwords can be assigned statically or change dynamically according to a pre-set schedule. An open access option is available to provide unauthenticated guests with access to an open subnet.

## Rogue AP Detection and Classification

Maintaining a secure wireless network requires ongoing monitoring of potential rogue access points and the ability to classify them as known to the local or neighboring network, or as true rogues. The network management functions of NM Portal include automatic network scanning and display of detected APs that potentially qualify as rogues. Using the information included in the display, network administrators can identify and classify the known APs. The remaining APs are classified as rogues. By examining the information available for each rogue AP, it is generally possible to pinpoint the location of the rogue and take action to remove it from the network.

## Standards and Data Rates

Airgo Networks supports the wireless networking standards shown in Table 2.

**Table 2: Supported Wireless Networking Standards**

| Standard           | Area                                      | Status            |
|--------------------|-------------------------------------------|-------------------|
| IEEE 802.11b       | Wireless LAN                              | Approved Standard |
| IEEE 802.11a       | Wireless LAN                              | Approved Standard |
| IEEE 802.11g       | Wireless LAN                              | Approved Standard |
| IEEE 802.11d       | World Mode Support                        | Approved Standard |
| IEEE 802.11e       | HCF & eDCF                                | Draft Standard    |
| IEEE 802.11f       | Inter-AP Protocol (IAPP)                  | Draft Standard    |
| IEEE 802.11h       | TPC and DFS additional regulatory domains | Approved Standard |
| IEEE 802.11i       | Wireless Security                         | Approved Standard |
| IETF Standards     | Security EAP-TLS                          | Draft Standard    |
| Microsoft Standard | Security EAP-PEAP                         | Draft Standard    |
| IETF SNMP MIBs     | Numerous RFC MIBs                         | Standard          |
| IETF Protocols     | Bridging, Routing                         | Standard          |

**Table 2: Supported Wireless Networking Standards**

| Standard       | Area                      | Status        |
|----------------|---------------------------|---------------|
| WPA            | Security Standard         | Standard      |
| Wi-Fi Alliance | Wireless Interoperability | Certification |

The 802.11 standard specifies the following data rates:

- 802.11b: DSSS (1, 2, 5.5 and 11 Mbps)
- 802.11a: OFDM (6, 9, 12, 18, 24, 36, 48, 54 Mbps)
- 802.11g: OFDM (6, 9, 12, 18, 24, 36, 48, 54 Mbps)

Airgo Networks also offers enhanced, True MIMO™ data rates of 72, 96, and 108 Mbps for enhanced performance.

## Integration with the Existing Wired Network

Airgo Networks wireless networking solutions are standards-compliant to ensure seamless integration with existing wired network infrastructures. The following integration features are included with all Airgo APs:

- 10/100 Ethernet connectivity
- 802.1Q VLAN support
- 802.1p QoS support
- Layer-2 and Layer-3 QoS
- 802.3af Power-over-Ethernet support
- DHCP server and client support
- NTP for time-synchronization

## Management Interface Options

Management support for the Airgo AP is available through four different interfaces:

| Interface                    | Description                                                                                                                                                                                                                           |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Web Browser Interface        | This is the primary user interface for basic and advanced AP configuration support for a single AP. This guide presents all configuration tasks using the web browser interface.                                                      |
| NM Explorer                  | A built-in NM Portal web interface is available to manage multiple APs. For details on using NM Portal, see Chapter 9, “Managing the Network.”                                                                                        |
| Command Line Interface (CLI) | The command line interface (CLI) for the Airgo AP is accessible through a local 9-pin serial console port or over SSH. For more information on using the CLI to configure the AP, see Appendix A, “Using the Command Line Interface.” |
| NMS Pro                      | The NMS Pro user interface provides access to AP configuration functions and is designed to manage very large numbers of access points and networks. For more information, see the <i>NMS Pro Installation and User Guide</i> .       |

# 2 Planning Your Installation

This chapter provides guidelines on planning a wireless network. It includes example network configurations and explains how to plan for coverage, capacity, security, and network management. The chapter includes the following topics:

- [Introduction](#)
- [Assessing Coverage and Capacity Requirements](#)
- [Assessing Security Needs and Architecture](#)
- [Planning Network Features](#)
- [Sample Deployment Scenarios](#)

## Introduction

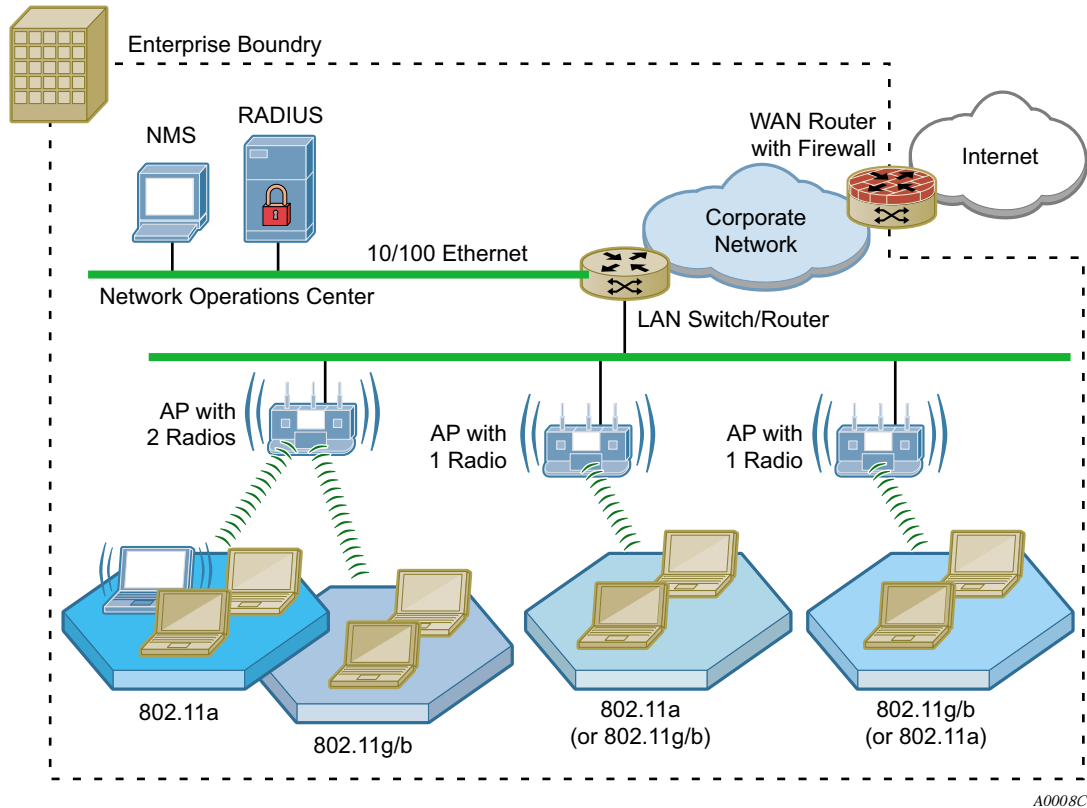
Careful planning of a new wireless network can greatly enhance your ability to install, maintain, manage, and expand the network. There are several dimensions to installation planning:

- Coverage and capacity requirements — Identify the number and types of access points to install and determine optimal placement.
- Security needs — Choose a security architecture and features.
- Network management — Choose a method to manage the network and monitor its health.
- Network features — Determine VLAN assignment, user groups, services, and privileges.

If planned properly, a wireless network can be easily expanded and adjusted to changing conditions and requirements while preserving effective security and enabling network-wide management support.

## Example Wireless Network Installation

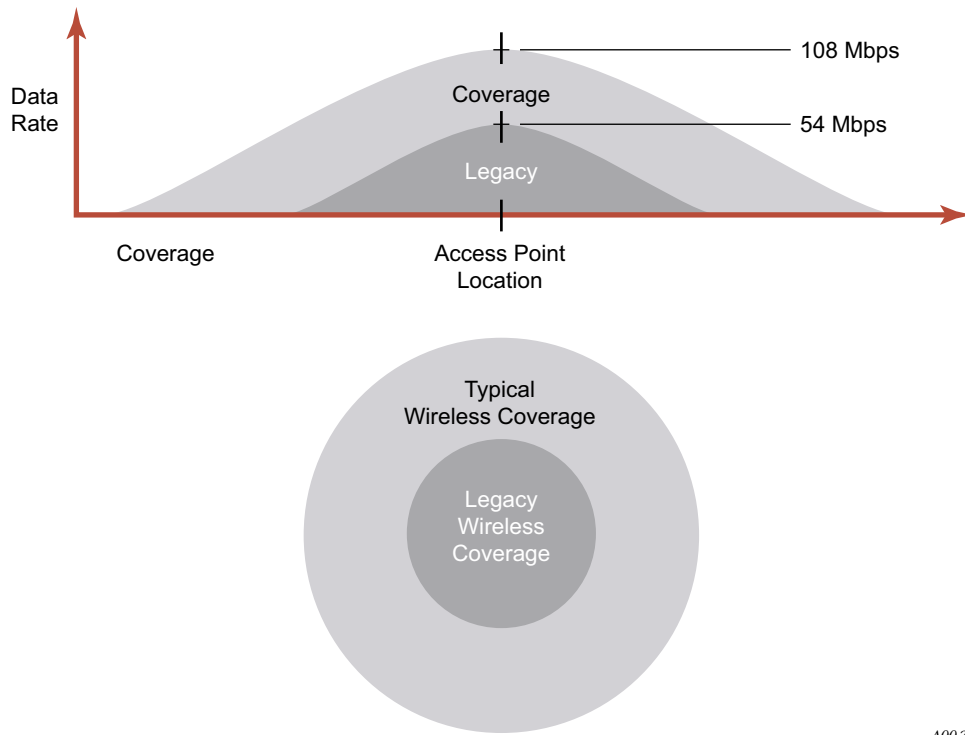
Figure 3 shows the elements of a typical Airgo wireless network. Airgo Access Points provide wireless connectivity to client stations (laptop or desktop computers) and connect in turn to the existing wired network infrastructure and beyond to the Internet. Network size and complexity may also dictate the need for an external RADIUS server for user authentication, as well as installation of Airgo Networks NMS Pro for enterprise network management.

**Figure 3: Typical Wireless Network**

## Assessing Coverage and Capacity Requirements

Airgo Networks wireless technology significantly increases wireless coverage or capacity in comparison to other wireless LAN products. This wireless advantage allows an access point to service a large area or provide higher data rates, depending upon the conditions at your location. Figure 4 illustrates the contrast between typical wireless coverage and Airgo wireless coverage. Each Airgo AP can service a wider area or provide higher data rates than alternative solutions.

Precise coverage and capacity vary considerably depending on factors such as the specific 802.11 protocol being used, antenna placement and location, building construction materials, and local obstructions.

**Figure 4: Airgo AP Coverage Compared with Other Access Points**

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## Site Surveys

Site surveys are used to measure the wireless characteristics of the physical environment and thereby determine cost-efficient placement of equipment in the network. They are useful because physical attributes of a location may have a significant impact on realized coverage and data rates. The site survey involves a detailed assessment of the radio signal environment of the site based on experiments and testing. After the wireless network equipment is installed, radio signals are sent between the AP and a mobile client (laptop) to effectively tune the placement of APs.

A professional site survey is highly recommended for large installations, but can be an expensive and time-consuming process, especially for installations with a variety of buildings and building materials, radio signal conditions, and restrictions on equipment placement. Thanks to the dramatic improvements in capacity and coverage provided by Airgo APs, many small to mid-size companies can forgo the traditional site survey process and rely instead on general guidelines.

## Assessing Security Needs and Architecture

The latest security innovations and standards make it possible to provide complete and effective security for wireless networks. The specifics of an optimal security solution will vary according to the type and size of organization. For each environment, Airgo offers a selection of features to satisfy all your security needs.

Three aspects of security require planning and decisions:

- Enrollment — Specifying the Airgo AP or NMS Pro server used to verify which access points are authorized to be part of the wireless network.

- **Data encryption** — Specifying the method of security for wireless data communications between client stations and the AP.
- **Authentication** — Specifying the method to verify the identity of users who want to access the wireless network, and assign access restrictions and services to them.

### **Enrollment**

Enrollment is the process of verifying the identity of APs and confirming that they are authorized to be a legitimate part of the wireless network. It is recommended that you designate a single enrollment server for the entire network. For small and mid-size networks, this should be an AP configured as an NM Portal (see “Selecting a Network Management Method” on page 12). For large offices and campuses, it is recommended that you use the enrollment module within NMS Pro as the enrollment server. The process of enrollment is discussed in “Enrolling APs” on page 181.

### **Data Encryption**

Data encryption is the process whereby data packets are encoded to prevent intruders from deciphering the content. The first wave of IEEE 802.11 products introduced encryption based on the Wired Equivalent Privacy (WEP) standard. The WEP algorithm uses keys configured on the AP and in the user client software to encrypt wireless data. Unfortunately, WEP is vulnerable to compromise and difficult to manage and configure. Temporal Key Integrity Protocol (TKIP) is the secure successor to WEP.

The current state of the art for data encryption is the Advanced Encryption Standard (AES), adopted by the Wi-Fi Alliance as part of the IEEE 802.11i working group under the heading Wi-Fi Protected Access (WPA). The new IEEE 802.11i standard provides financial-grade security with extremely strong AES over-the-air encryption. The keys used for every user session are unique and are established automatically using the IEEE 802.1x protocol.

Unless your wireless network must support WEP encryption, using WPA with AES for data encryption, regardless of your network size or complexity, is recommended.

### **User Authentication**

User authentication is the process of verifying user identity and assigning access rights based on predetermined rules.

- For small to mid-size networks, the internal RADIUS server within the Airgo AP security portal provides authentication services across the network. A second AP can also be configured as a backup security portal.
- For large office and campus installations, one or more external RADIUS authentication servers may already be in place to provide authentication services for the wired network based on the IEEE 802.1x RADIUS standard. It is a straightforward exercise to extend that infrastructure to the wireless network, thereby creating an integrated user authentication process for the entire enterprise network.

The security portal feature of the Airgo AP plays a special role in wireless backhaul authentication. For more information, see Chapter 6, “Configuring a Wireless Backhaul.”

### **Selecting a Network Management Method**

As with user authentication, appropriate network management solutions depend upon the size and complexity of the network, and Airgo products and features are available to support a wide range of possibilities.

- For small and mid-sized networks, configure one of the APs on the network as a portal AP to provide NM Portal, security portal, and enrollment services, and designate another AP as a backup for the security portal.
- For large offices and campuses, enterprise-wide control and advanced network management features become essential to reliable network operations. For these networks, the Airgo NMS Pro network management application is recommended as a comprehensive network management solution. Install the NMS server on any suitably configured network computer, and permit network administrators to obtain access from any designated client station. For more information, see the *Airgo Networks NMS Pro Installation and Configuration Guide*.

NMS can be installed as a stand-alone network management solution, or it can be used in conjunction with NM Portal APs to create an efficient distribution system for network management data and policies across multiple locations. In enterprises with multiple locations, assign an AP in each location as the NM Portal. The NM Portal serves an auxiliary function, executing commands for AP management updates and distributing them to all the APs at the remote location or collecting data from all the APs at the location and sending the data back to NMS Pro. This model can significantly reduce the time and network load associated with performing network management functions such as policy distribution and software updates.

## Planning Network Features

The Airgo AP offers an extensive set of configuration parameters and network service features. Automated and default options are available for most of these, making it necessary to configure only a few of the AP parameters to set up a basic network. As needs change, additional features can be configured to support new network services.

Network feature planning involves the following decisions:

| Feature            | Planning Issues                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Physical Network   | Estimate how many APs are expected initially and with growth. Determine whether wireless backhaul will be required.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Network Management | <p>Determine the network management structure.</p> <ul style="list-style-type: none"><li>• A network management solution such as NM Portal or NMS Pro is strongly recommended for all multiple AP installations.</li><li>• NM Portal is recommended for small to mid-size networks.</li><li>• NMS Pro is recommended for large enterprise networks. NMS Pro can be used in conjunction with NM Portal for an efficient, hierarchical network management solution.</li><li>• If wireless backhaul is selected, then network management must include NM Portal.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Authentication     | <p>Determine how to verify the identity of users requesting access to the network. An authentication scheme is required for all except open access.</p> <ul style="list-style-type: none"><li>• <b>Pre-shared key (PSK) authentication</b> uses matching keys assigned prior to the authentication session and stored on the AP and in the client. With PSK, no external authentication server is required. This approach is useful for small to mid-size networks in which keys can be easily configured and modified, as needed.</li><li>• <b>RADIUS user authentication</b> relies upon individual login and password. This approach is preferred for medium-large and enterprise networks that must accommodate sizable, changing user populations. RADIUS is the most common protocol used in authentication servers.</li></ul> <p>The Airgo AP can take advantage of the authentication services provided by an external third party RADIUS server or the internal RADIUS security portal on the Airgo AP. In conjunction with an external RADIUS server, the security portal provides wireless backhaul authentication services and can serve as a backup authentication server if the external RADIUS server is not available.</p> <p>An authentication zone is a group of one or more RADIUS servers providing user authentication services within an SSID. If multiple SSIDs are configured, then you can create an authentication zone for each.</p> <p>The chosen authentication method influences how services can be configured in the network.</p> |
| Security Modes     | <p>Choose WPA, WEP, or open security modes.</p> <ul style="list-style-type: none"><li>• WPA is recommended, unless WEP is required for communication with legacy systems.</li><li>• WPA security is compatible with WEP and with open security. WEP is not compatible with open security.</li><li>• Guest access requires the open security mode.</li><li>• The preferred encryption method is AES, unless TKIP or WEP are required for compatibility with legacy systems.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

| Feature            | Planning Issues                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| VLAN               | <p>VLANs permit the network to be segmented according to functional needs without the restrictions of the physical topology.</p> <ul style="list-style-type: none"> <li>• If your enterprise uses multiple VLANs, they can be supported in the wireless network.</li> <li>• Multiple VLANs are required for guest access.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| SSID               | <p>Decide whether one or multiple SSIDs will be supported.</p> <ul style="list-style-type: none"> <li>• Multiple SSIDs are desirable for applications such as wireless Internet service (WISP), in which a single physical access point supports multiple user populations in distinct networks.</li> <li>• Multiple SSIDs permit support of multiple service levels in networks that rely on PSK rather than user-based authentication. Services are bound to the SSID rather than to specific user groups.</li> </ul>                                                                                                                                                                                                                                                                                             |
| Quality of Service | <p>Quality of Service (QoS) allows you to set priorities for user traffic, thereby increasing the likelihood that critical data will obtain the needed priority.</p> <ul style="list-style-type: none"> <li>• QoS is implemented by way of class of service (COS) mappings. Accept the default mappings or define custom mappings to create special high or low priority classes of service.</li> <li>• Default and custom mappings are compatible with other feature selections.</li> </ul>                                                                                                                                                                                                                                                                                                                        |
| Service Profile    | <p>Service profiles specify the services available for an SSID or for designated user groups within an SSID.</p> <ul style="list-style-type: none"> <li>• Accept the default service profile or create custom service profiles to provide varying levels of service.</li> <li>• The service profile includes VLAN assignment, COS, and minimum security.</li> </ul> <p>Once created, a service profile can be bound to an SSID with or without a specified user group.</p> <ul style="list-style-type: none"> <li>• If a user group is included in the binding of a service profile to an SSID, then members of the user group are automatically assigned that profile when authenticated.</li> <li>• If no user groups are specified, then all users who access the SSID are assigned the same profile.</li> </ul> |
| Guest Access       | <p>Guest access refers to special treatment of users who are not authorized to access the main corporate network. The guest access feature allows non-authorized users to gain network access in a controlled way.</p> <p>Decide whether the network will support guest users and if so, how guest access will be managed.</p> <ul style="list-style-type: none"> <li>• Guest access requires open access security and is not compatible with WEP.</li> <li>• Guest users can be authenticated by way of an internal or external web landing page, or can be given open access to a restricted portion of the corporate network.</li> </ul>                                                                                                                                                                         |

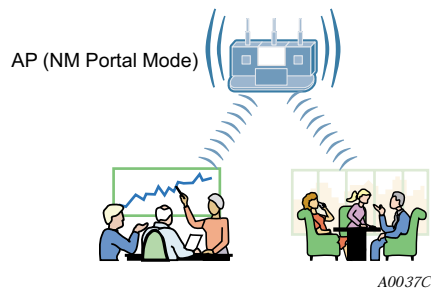
## Sample Deployment Scenarios

This section describes sample feature decisions for companies as a function of network size, management structure, and network services.

### Example 1: Small office, single AP, possible future growth

Acme Works begins as a small company with 20 users. The office is at a single location served by one access point connected to the wired backbone. The elements of the network are shown in Figure 5.

**Figure 5: Example 1 Network**



One AP is able to meet current coverage and capacity needs. The AP is configured as an NM Portal to assure that the appropriate network management structure will be in place in the event that the business expands and additional APs are required. Since the user base is small, there is no need for a RADIUS authentication infrastructure. The security mode is WPA with pre-shared keys (PSK) and AES encryption. A single SSID is in place, and the default VLAN, QoS, and service profiles are used.

**Figure 6: Example 1 Feature Decisions**

|                                             |                                                             |                                                  |                                            |
|---------------------------------------------|-------------------------------------------------------------|--------------------------------------------------|--------------------------------------------|
| Physical Network                            | <input checked="" type="checkbox"/> One AP                  | <input type="checkbox"/> Multiple APs            | <input type="checkbox"/> Wireless Backhaul |
| Network Management                          | <input checked="" type="checkbox"/> NM Portal               | <input type="checkbox"/> NMS PRO                 |                                            |
| User Authentication                         | <input type="checkbox"/> Built-In Security Portal           | <input type="checkbox"/> External RADIUS Server  |                                            |
| Security Modes                              | <input checked="" type="checkbox"/> WPA (default)           | <input type="checkbox"/> Open                    | <input type="checkbox"/> WEP               |
| VLAN                                        | <input checked="" type="checkbox"/> Default VLAN            | <input type="checkbox"/> Multiple VLANs          |                                            |
| SSID                                        | <input checked="" type="checkbox"/> Single SSID (default)   | <input type="checkbox"/> Multiple SSIDs          |                                            |
| Quality of Service (Class of Service - COS) | <input checked="" type="checkbox"/> Default COS Mappings    | <input type="checkbox"/> Custom COS Mappings     |                                            |
| Service Profile                             | <input checked="" type="checkbox"/> Default Service Profile | <input type="checkbox"/> Custom Service Profiles |                                            |
| Guest Access                                | <input checked="" type="checkbox"/> Disabled (default)      | <input type="checkbox"/> Enabled                 |                                            |

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The following table lists the tasks required for configuration and provides pointers to the detailed instructions in this guide.

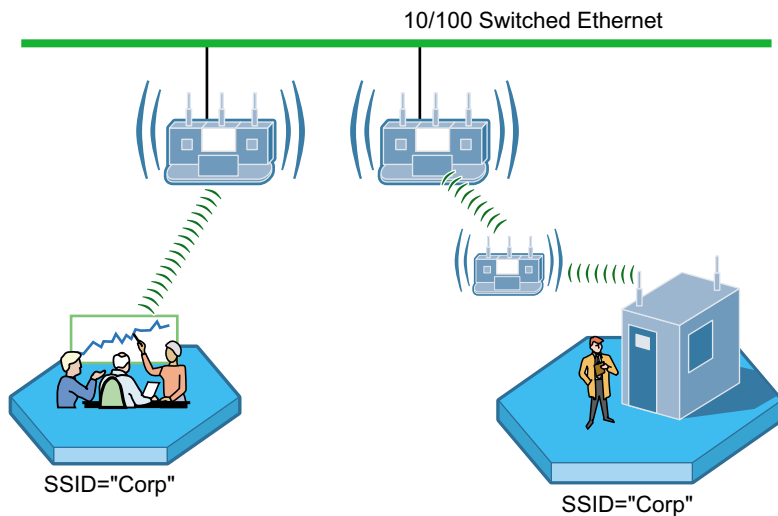
**Table 3: Example 1 Configuration Tasks**

| <b>Task</b>                           | <b>Process</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bring up the first (or only) Airgo AP | <ol style="list-style-type: none"> <li>1 Make sure a DHCP server is available on the network, and create a DHCP reservation for the MAC address of this AP.</li> <li>2 Have the information sheet that was shipped with the AP available.</li> <li>3 Bootstrap the AP as an NM Portal. Defaults are acceptable for most settings.</li> <li>4 Choose an SSID (wireless network name).</li> <li>5 Choose an administrative password and WPA pre-shared key.</li> <li>6 Configure clients with compatible WPA security using the same pre-shared key.</li> </ol> <p>References: “Initializing a Normal AP” on page 35 and “Initializing the Portal AP” on page 38</p> |
| Confirm that the network is up        | <ol style="list-style-type: none"> <li>1 Open the AP Enrollment panel under the Network Topology menu in NM Portal to confirm that the AP is listed as enrolled.</li> <li>2 Open the Station Management panel at any time to view a list of client stations associated to the AP.</li> </ol> <p>References: “Enrolled APs” on page 183 and “Managing Client Stations” on page 91.</p>                                                                                                                                                                                                                                                                              |

### Example 2: Small to mid-size business with wireless backhaul

Acme Works has now grown to 70 users. The site is the same as in Example 1; however Acme wants to provide coverage to a temporary building that has no wired connection. An additional AP is added to provide user access by way of wireless backhaul (Figure 7).

**Figure 7: Example 2 Network**



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Figure 8 summarizes the feature decisions for this example. The security portal capability within NM Portal provides authentication for the backhaul AP. The security mode is WPA with pre-shared keys (PSK). A single SSID is in place, and the default VLAN, QoS, and service profiles are used.

**Figure 8: Example 2 Feature Decisions**

|                                             |                                                             |                                                  |                                                       |
|---------------------------------------------|-------------------------------------------------------------|--------------------------------------------------|-------------------------------------------------------|
| Physical Network                            | <input type="checkbox"/> One AP                             | <input checked="" type="checkbox"/> Multiple APs | <input checked="" type="checkbox"/> Wireless Backhaul |
| Network Management                          | <input checked="" type="checkbox"/> NM Portal               | <input type="checkbox"/> NMS PRO                 |                                                       |
| User Authentication                         | <input type="checkbox"/> Built-In Security Portal           | <input type="checkbox"/> External RADIUS Server  |                                                       |
| Security Modes                              | <input checked="" type="checkbox"/> WPA (default)           | <input type="checkbox"/> Open                    | <input type="checkbox"/> WEP                          |
| VLAN                                        | <input checked="" type="checkbox"/> Default VLAN            | <input type="checkbox"/> Multiple VLANs          |                                                       |
| SSID                                        | <input checked="" type="checkbox"/> Single SSID (default)   | <input type="checkbox"/> Multiple SSIDs          |                                                       |
| Quality of Service (Class of Service - COS) | <input checked="" type="checkbox"/> Default COS Mappings    | <input type="checkbox"/> Custom COS Mappings     |                                                       |
| Service Profile                             | <input checked="" type="checkbox"/> Default Service Profile | <input type="checkbox"/> Custom Service Profiles |                                                       |
| Guest Access                                | <input checked="" type="checkbox"/> Disabled (default)      | <input type="checkbox"/> Enabled                 |                                                       |

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**Table 4: Example 2 Configuration Tasks**

| <b>Task</b>                      | <b>Explanation</b>                                                                                                                                                                                                                              |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Enroll APs                       | <ol style="list-style-type: none"><li>1 Connect the additional AP to the wired network.</li><li>2 Enroll the AP to support wireless backhaul</li></ol> Reference: “Enrolling APs” on page 181                                                   |
| Distribute policies to other APs | <ol style="list-style-type: none"><li>1 Generate the default policy based on the configuration of the NM Portal AP.</li><li>2 Distribute the policy to the other AP(s) in the network.</li></ol> Reference: “Working with Policies” on page 197 |
| Distribute configuration updates | <ol style="list-style-type: none"><li>1 Make any configuration changes in the NM Portal AP.</li><li>2 Regenerate the default policy and redistribute to the enrolled AP(s).</li></ol> Reference: “Working with Policies” on page 197            |
| Install wireless backhaul AP     | <ol style="list-style-type: none"><li>1 Disconnect the wireless backhaul AP from the wired network.</li><li>2 Place the AP where needed, within radio range of the wired AP.</li></ol>                                                          |

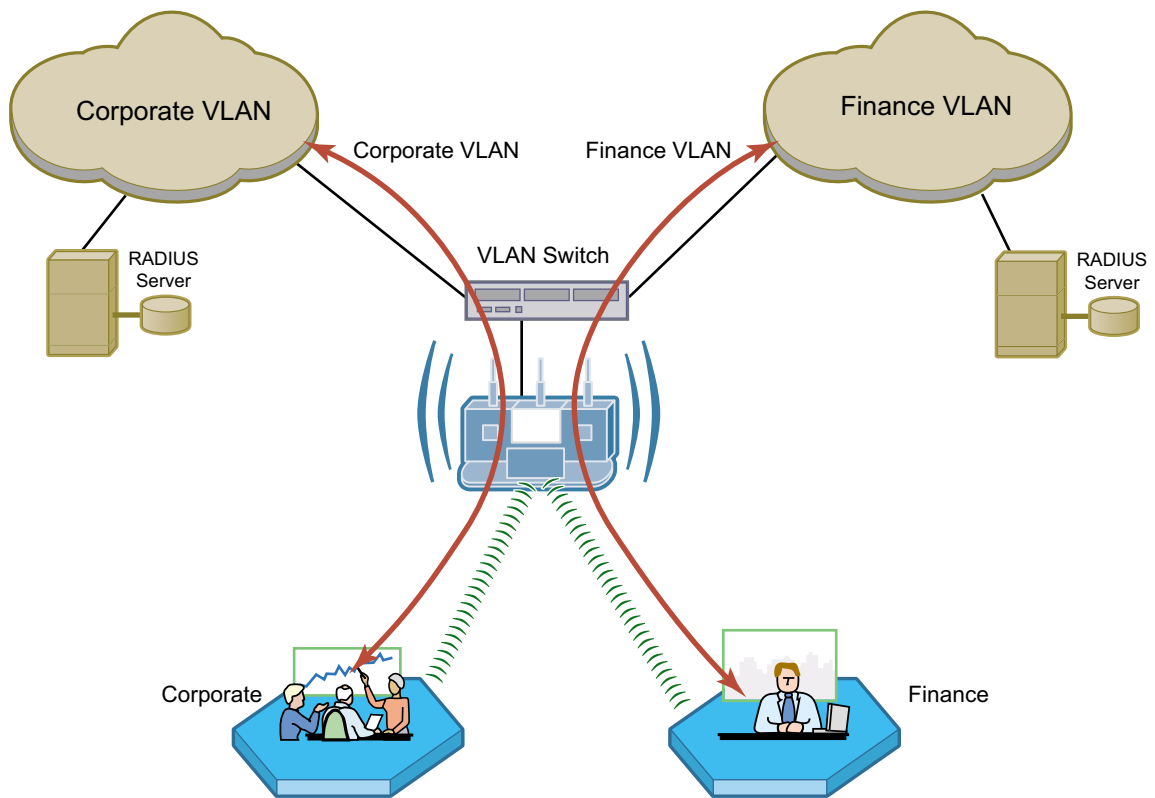
### Example 3: Mid-size business, multiple SSIDs, multiple VLANs

Now a successful business, the management at Acme Works wants to position the company for continued growth. Management decides to deploy an external RADIUS server to manage user authentication centrally for the entire company. The RADIUS authentication infrastructure works well for a changing user population (employees joining, leaving, or moving to new departments) and readily supports further network service enhancements.

The company creates two SSIDs as a way to separate the Finance department network traffic from the main corporate network traffic. Two RADIUS servers are configured, each in its own authentication zone. To separate Finance department traffic from the overall network traffic, a Finance VLAN is created. A Finance service profile is also created and bound to the Finance SSID. The service profile is configured to include the Finance VLAN, high security, and higher-than-normal COS. Once this structure is in place and a member of the Finance group is authenticated by way of the RADIUS server, the Finance group tag is passed to the Airgo AP, and the Finance service profile is applied to the user.

The network configuration for this example is shown in Figure 9, and the feature decisions are shown in Figure 10.

**Figure 9: Example 3 Network**



**Figure 10: Example 3 Feature Decisions**

|                                                |                                                        |                                                             |                                                       |
|------------------------------------------------|--------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------|
| Physical Network                               | <input type="checkbox"/> One AP                        | <input checked="" type="checkbox"/> Multiple APs            | <input checked="" type="checkbox"/> Wireless Backhaul |
| Network Management                             | <input checked="" type="checkbox"/> NM Portal          | <input type="checkbox"/> NMS PRO                            |                                                       |
| User Authentication                            | <input type="checkbox"/> Built-In Security Portal      | <input checked="" type="checkbox"/> External RADIUS Server  |                                                       |
| Security Modes                                 | <input checked="" type="checkbox"/> WPA (default)      | <input type="checkbox"/> Open                               | <input type="checkbox"/> WEP                          |
| VLAN                                           | <input type="checkbox"/> Default VLAN                  | <input checked="" type="checkbox"/> Multiple VLANs          |                                                       |
| SSID                                           | <input type="checkbox"/> Single SSID (default)         | <input checked="" type="checkbox"/> Multiple SSIDs          |                                                       |
| Quality of Service<br>(Class of Service - COS) | <input type="checkbox"/> Default COS Mappings          | <input checked="" type="checkbox"/> Custom COS Mappings     |                                                       |
| Service Profile                                | <input type="checkbox"/> Default Service Profile       | <input checked="" type="checkbox"/> Custom Service Profiles |                                                       |
| Guest Access                                   | <input checked="" type="checkbox"/> Disabled (default) | <input type="checkbox"/> Enabled                            |                                                       |

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The following table lists the tasks required to link to an external RADIUS server and add multiple VLANs, and provides pointers to the detailed instructions in this guide.

**Table 5: Example 3 Configuration Tasks**

| Task                                 | Explanation                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Add authentication servers and zones | <ol style="list-style-type: none"> <li>1 Identify the RADIUS server for each authentication zone.</li> <li>2 Select the authentication option for the SSID, with reference to the defined authentication zone.</li> </ol> <p>References: “Configuring SSID Parameters” on page 83 and “Configuring Authentication Zones” on page 155</p> |
| Set up VLANs                         | <ol style="list-style-type: none"> <li>1 Choose the VLAN structure for the network.</li> <li>2 Configure the VLANs.</li> </ol> <p>Reference: “Configuring VLANs” on page 111</p>                                                                                                                                                         |
| Add VLANs to the service profiles    | <ol style="list-style-type: none"> <li>1 Define or modify service profiles to include VLAN selection.</li> <li>2 Bind each profile to an SSID with an existing or new user group.</li> </ol> <p>Reference: “Profile Table” on page 89 and “SSID Details” on page 87</p>                                                                  |
| Distribute configuration updates     | <ol style="list-style-type: none"> <li>1 Make any configuration changes in the NM Portal AP.</li> <li>2 Regenerate the default policy and redistribute to the enrolled AP(s).</li> </ol> <p>Reference: “Working with Policies” on page 197</p>                                                                                           |

**Example 4: Large business, guest access, extended network services**

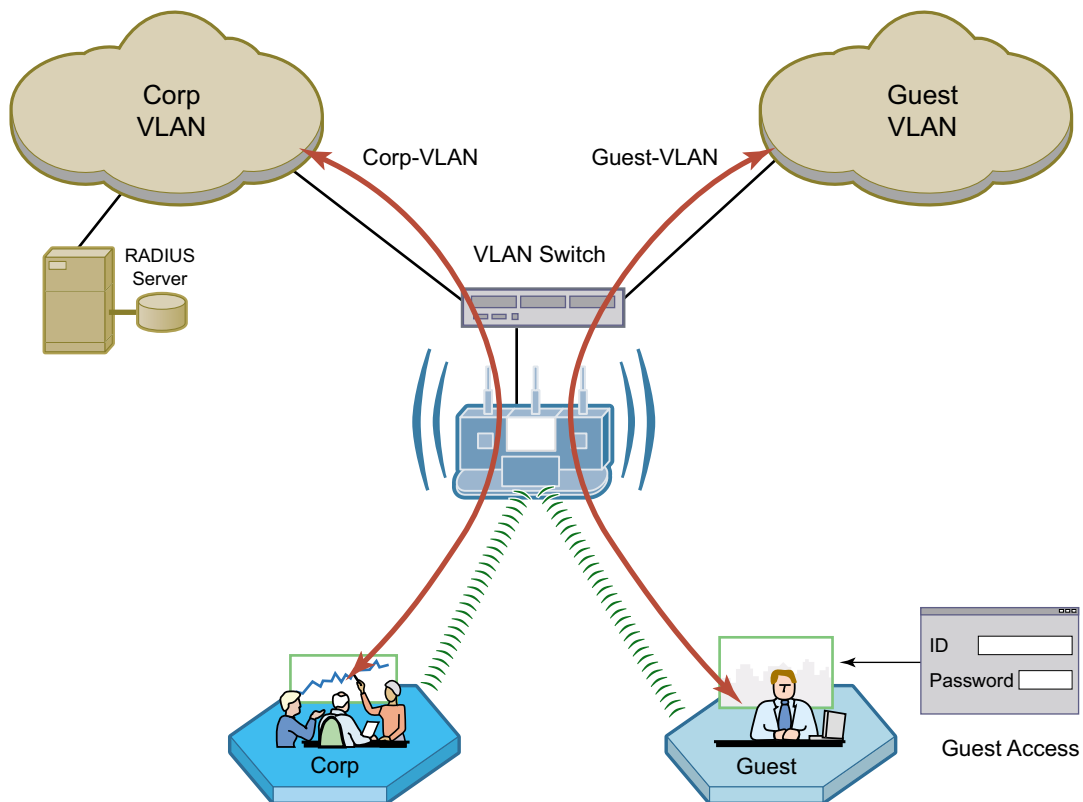
Acme Works is now a widely known and successful enterprise. With an ever increasing number of visitors requiring network access, the network administrator decides to implement a corporate guest access solution.

A guest VLAN and service profile are created and bound to the Corporate SSID, and a guest password is created. Guests can now visit Acme Works, log in using the guest password through a web browser, and obtain access to the resources available on the guest VLAN.

As additional needs arise, the network administrator can easily add new VLANs and service profiles, and change the available levels of service. New VLANs are created to segregate traffic for the Manufacturing and Engineering departments, and new service profiles are created to accommodate members of those departments. Special classes of service are assigned for applications sensitive to interruption or bandwidth fluctuation, such as voice over IP, and low priority, bandwidth-intensive applications such as FTP transfers.

The network configuration for this example is shown in Figure 11, and the feature decisions are shown in Figure 12.

**Figure 11: Example 4 Network**



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**Figure 12: Example 4 Feature Decisions**

|                                                |                                                   |                                                             |                                                       |
|------------------------------------------------|---------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------|
| Physical Network                               | <input type="checkbox"/> One AP                   | <input checked="" type="checkbox"/> Multiple APs            | <input checked="" type="checkbox"/> Wireless Backhaul |
| Network Management                             | <input checked="" type="checkbox"/> NM Portal     | <input type="checkbox"/> NMS PRO                            |                                                       |
| User Authentication                            | <input type="checkbox"/> Built-In Security Portal | <input checked="" type="checkbox"/> External RADIUS Server  |                                                       |
| Security Modes                                 | <input checked="" type="checkbox"/> WPA (default) | <input checked="" type="checkbox"/> Open                    | <input type="checkbox"/> WEP                          |
| VLAN                                           | <input type="checkbox"/> Default VLAN             | <input checked="" type="checkbox"/> Multiple VLANs          |                                                       |
| SSID                                           | <input type="checkbox"/> Single SSID (default)    | <input checked="" type="checkbox"/> Multiple SSIDs          |                                                       |
| Quality of Service<br>(Class of Service - COS) | <input type="checkbox"/> Default COS Mappings     | <input checked="" type="checkbox"/> Custom COS Mappings     |                                                       |
| Service Profile                                | <input type="checkbox"/> Default Service Profile  | <input checked="" type="checkbox"/> Custom Service Profiles |                                                       |
| Guest Access                                   | <input type="checkbox"/> Disabled (default)       | <input checked="" type="checkbox"/> Enabled                 |                                                       |

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The following table lists the tasks required to configure guest access and provides pointers to the detailed instructions in this guide.

**Table 6: Example 4 Configuration Tasks**

| Task                             | Explanation                                                                                                                                                                                                                         |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Set up guest VLANs               | <ul style="list-style-type: none"> <li>Configure a VLAN for guest access.</li> </ul> Reference: “Configuring VLANs” on page 111                                                                                                     |
| Create guest service profile     | <ul style="list-style-type: none"> <li>Add a guest service profile with the guest VLAN and desired COS and open security.</li> </ul> Reference: “Profile Table” on page 89 and “SSID Details” on page 87                            |
| Configure landing page           | <ul style="list-style-type: none"> <li>Choose an internal or external landing page and assign guest password.</li> </ul> Reference: “Configuring Guest Access with VLANs” on page 173                                               |
| Distribute configuration updates | <ol style="list-style-type: none"> <li>Make any configuration changes in the NM Portal AP.</li> <li>Regenerate the default policy and redistribute to the enrolled AP(s).</li> </ol> Reference: “Working with Policies” on page 197 |

### Example 5: Large Campus with Branch Offices

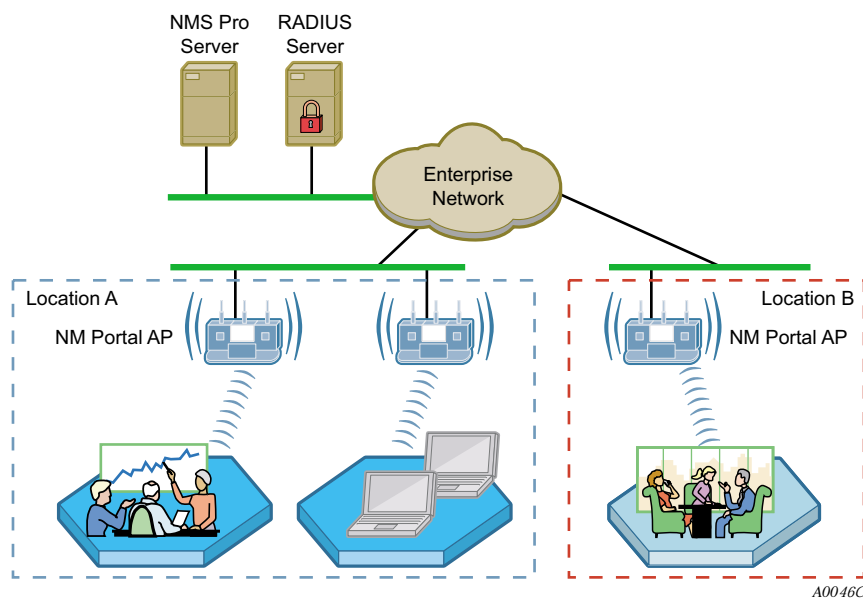
This example shows how a company can incorporate centralized network management to control a large campus with branch offices. The company has planned its network to include the NMS Pro Network Management System. This solution will provide network administrators with extensive control and oversight, centralized monitoring, and fault management.

**NOTE:** AP configurations must be reset to factory defaults before they can be enrolled by NMS Pro. For this reason, it is best to make the decision to use NMS during initial network planning, before APs are installed in the network. For further information, see “Resetting the Access Point” on page 31 in this guide and also see the *NMS Pro Installation and User Guide*.

The campus buildings and branch offices lend themselves to a hierarchical management structure in which an NM Portal AP is configured on each building subnet. Each NM Portal AP handles policy distribution and software upgrades at its location as directed by NMS Pro. The NM Portal AP also serves as a backup security portal in the event that another RADIUS authentication server in its authentication zone becomes unavailable.

The network configuration for this example is shown in Figure 13 and the feature decisions are shown in Figure 14.

**Figure 13: Example 5 Network**



**Figure 14: Example 5 Feature Decisions**

|                                                |                                                              |                                                             |                                                       |
|------------------------------------------------|--------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------|
| Physical Network                               | <input type="checkbox"/> One AP                              | <input checked="" type="checkbox"/> Multiple APs            | <input checked="" type="checkbox"/> Wireless Backhaul |
| Network Management                             | <input checked="" type="checkbox"/> NM Portal                | <input checked="" type="checkbox"/> NMS PRO                 |                                                       |
| User Authentication                            | <input checked="" type="checkbox"/> Built-In Security Portal | <input checked="" type="checkbox"/> External RADIUS Server  |                                                       |
| Security Modes                                 | <input checked="" type="checkbox"/> WPA (default)            | <input checked="" type="checkbox"/> Open                    | <input type="checkbox"/> WEP                          |
| VLAN                                           | <input type="checkbox"/> Default VLAN                        | <input checked="" type="checkbox"/> Multiple VLANs          |                                                       |
| SSID                                           | <input type="checkbox"/> Single SSID (default)               | <input checked="" type="checkbox"/> Multiple SSIDs          |                                                       |
| Quality of Service<br>(Class of Service - COS) | <input type="checkbox"/> Default COS Mappings                | <input checked="" type="checkbox"/> Custom COS Mappings     |                                                       |
| Service Profile                                | <input type="checkbox"/> Default Service Profile             | <input checked="" type="checkbox"/> Custom Service Profiles |                                                       |
| Guest Access                                   | <input type="checkbox"/> Disabled (default)                  | <input checked="" type="checkbox"/> Enabled                 |                                                       |

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The following table summarizes the tasks required to provide network management for the campus installation:

**Table 7: Example 5 Configuration Tasks**

| Task                           | Explanation                                                                                                                                                                                                                                        |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Install NMS Pro                | Reference: <i>NMS Pro Installation and Configuration Guide</i>                                                                                                                                                                                     |
| Enroll APs                     | <ul style="list-style-type: none"> <li>Use the NM Portal in the local building or the campus NMS Pro system to enroll additional APs.</li> </ul> Reference: “Enrolling APs” on page 181 or the <i>NMS Pro Installation and Configuration Guide</i> |
| Create and distribute policies | <ul style="list-style-type: none"> <li>Use NMS Pro to create configuration policies and distribute them to APs across the network.</li> </ul> Reference: <i>NMS Pro Installation and Configuration Guide</i>                                       |



# 3 Installing the Access Point Using the Configuration Interfaces

This chapter explains how to install and quickly configure the Airgo Access Point and provides instructions for accessing the web and command line interfaces. The chapter includes the following topics:

- [Hardware Components](#)
- [System Requirements](#)
- [Installation Requirements](#)
- [Installing the Access Point](#)
- [Using the Configuration Interfaces](#)
- [Using AP Quick Start to Initialize the Access Point](#)
- [Navigating the Web Interface](#)
- [Configuration Wizards](#)

## Hardware Components

The Airgo Access Point shipping package contains the following items:

- Airgo Access Point
- Power supply and separate AC cord
- Software and documentation

## System Requirements

The following are required to connect to the Airgo Access Point:

- For web browser or network management portal access, a computer with a web browser capable of secure HTTP connections (HTTPS)
- For SSH connection, a computer with an SSH utility (the PuTTY application meets this requirement and is available as freeware)
- 10/100 Ethernet cable to connect to the AP

The computer designated for AP access should be located on the same Local Area Network (LAN), with a compatible IP address and subnet mask, or it must be able to be routed to the AP.

To connect directly to the console port in order to access the command line interface, have the following available:

- A 9-pin DCE female-to-female null modem connector to connect the PC to the Access Point
- Terminal emulator software

## Installation Requirements

Airgo Access Points are radio-frequency devices and are therefore susceptible to RF interference and obstructions. When selecting locations for AP placement, try to choose places free of large

metallic structures such as equipment racks, steel bookcases, or filing cabinets, and locations not crowded by computer enclosures.

If using an external antenna with the AP (optional), try to place the unit as high as possible, where it is free of obstruction. Install the AP away from sources of RF interference, such as microwave ovens, cordless phones, electric motors, and similar appliances.

#### **Power and Cabling Requirements**

The following equipment is required to install the Airgo Access Point:

- AC power outlet (100-240V, 50-60Hz standard) to power the AP (a surge-protected power supply is recommended)
- RJ-45 port on a standard 10/100BaseT Ethernet device (hub, switch, router, or similar device), if connecting to a wired network
- Industry standard Category 5 UTP Ethernet cables
- 9-pin-to-9-pin DCE serial null modem cable or serial-to-USB cable if connecting the console

#### **Network Information Requirements**

Have the following information accessible before configuring the AP:

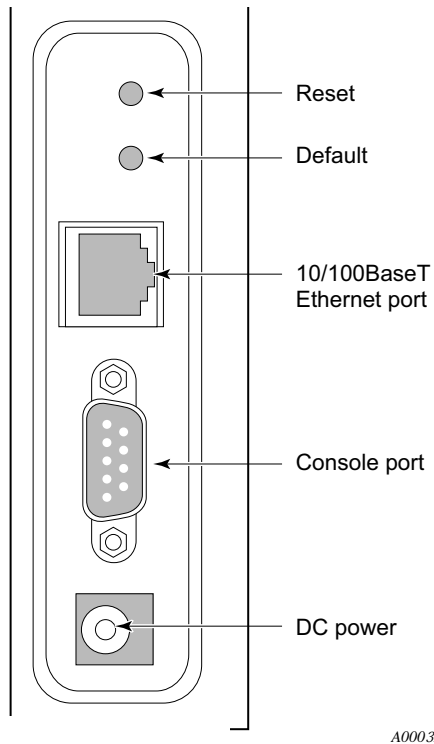
- IP address assigned to the AP (fixed IP address or DHCP-reserved address)
- IP addresses for the default gateway, DNS server, and NTP server if DHCP is not used to provide IP addresses
- IP address of the SMTP email server if the AP is to send alerts to a specified email address
- Email address of the administrator who will receive the alerts

### **Installing the Access Point**

Follow these steps to install the Airgo Access Point:

- 1 Connect the Ethernet cable to the RJ-45 Ethernet connector on the AP (see Figure 15).
- 2 Plug the other end of the Ethernet cable into an available Ethernet port on your wired network.
- 3 (Optional) If an external antenna is to be used, attach it to the AP. Place or mount the antenna in an unobstructed location.
- 4 Plug the AC power cable into the power module.
- 5 Plug the other end of the AC power cable into an approved three-prong grounded outlet (surge-protected and/or UPS is recommended).
- 6 Connect the power module connector to the power connector on the AP.

The Airgo Access Point powers up automatically.

**Figure 15: Airgo AP Connections**

### Using Power Over Ethernet

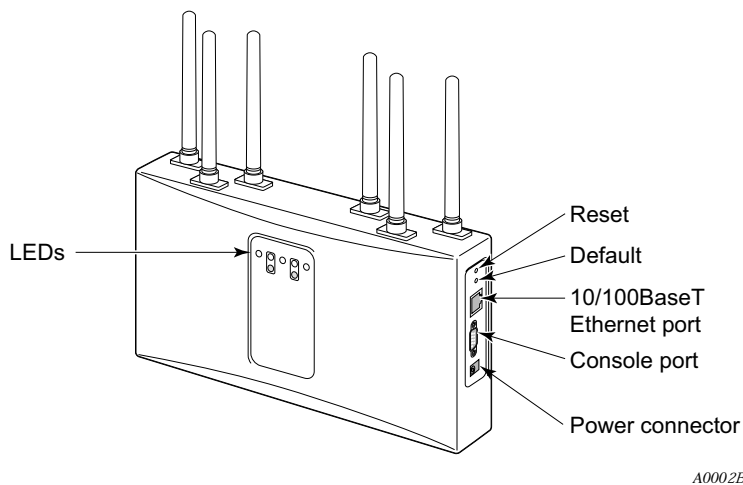
Power-over-Ethernet (PoE), based on the 802.3af standard, can be used to supply power to the Airgo AP. If both DC power and PoE are used at the same time, then failover takes place automatically in the event that one of the power sources is lost. For failover, the following rules apply:

- The AP uses the power source with the highest voltage.
- Unplugging either cable causes power to switch automatically to the other source, which may cause the AP to reboot.

### Placement and Orientation

Make sure that the Airgo AP is positioned in an upright position for airflow and antenna placement (Figure 16).

**Figure 16: Airgo AP Placement**



## Verifying the Installation

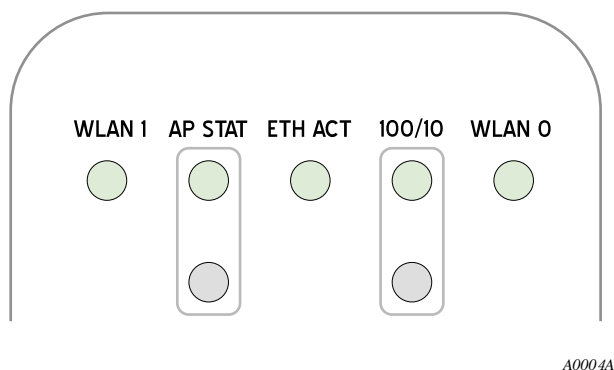
To verify the Airgo Access Point is operational, examine the front of the AP.

- Is the status LED red or green? If not, check the power connections and whether the AC outlet has power.
- (For wired-AP installations) Is the Ethernet connection LED on? If not, check the Ethernet cable to make sure it is seated securely in both the AP and the network port.

## Interpreting the LEDs

Refer to Figure 17 and Table 8 for LED definition.

**Figure 17: Airgo AP LEDs**



**Table 8: LED Definitions**

| <b>LED</b> | <b>Description</b>                                                                                                                                                                                                                                                                                                                                                                                                            |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| WLAN1      | Blinks green for activity.                                                                                                                                                                                                                                                                                                                                                                                                    |
| AP STAT    | Two AP status LEDs indicate the AP status. When the AP is reset or powered on, the bottom LED turns red and then the top LED blinks green. Once the AP successfully boots up, the top LED turns green and stays green.<br><br>When the AP is reset to defaults, the LEDs light up in the same sequence as described above. If the AP has a buzzer installed, two short beeps indicate that the AP is being reset to defaults. |
| ETH ACT    | Blinks green for activity.                                                                                                                                                                                                                                                                                                                                                                                                    |
| 100/10     | Indicates Ethernet Link. Two LEDs. Only one of them will be lit up at a time. <ul style="list-style-type: none"> <li>• Top LED: 100BT Link – Lights up green when 100Mbit link is established. Off means no link on 100Mbit.</li> <li>• Bottom LED: 10BT Link – Lights up yellow when 10Mbit link is established. Off means no link on 10Mbit.</li> </ul>                                                                     |
| WLAN0      | Blinks green for activity.                                                                                                                                                                                                                                                                                                                                                                                                    |

## Connecting the Serial Port

Follow these steps to connect a terminal to the serial port for command line interface access:

- 1 Attach a serial null modem cable to the AP (see Figure 15).
- 2 Attach the other end of the cable to the serial port of your computer.
- 3 Use a terminal emulation tool such as HyperTerminal. Configure the terminal as follows:
  - 115,200 BAUD
  - 8-bits
  - No parity
  - 1 stop bit
  - No flow control

A command prompt should now be available to access the command line interface.

## Resetting the Access Point

Reset the AP in any of the following ways. If the AP has a buzzer installed, the AP beeps once when reset. If the AP has a buzzer installed and is reset to factory defaults, then the AP beeps twice when booted.

| <b>Method</b>         | <b>Description</b>                                                                                        |
|-----------------------|-----------------------------------------------------------------------------------------------------------|
| Web browser interface | Use the Configuration Management panel under System Configuration. See “Reset Configuration” on page 249. |
| Reset button          | Press the reset button on the side of the AP.                                                             |
| Power down            | Power down the AP by disconnecting the power cable (not recommended).                                     |

Reset the configuration of the AP to the factory default in any of the following ways:

| Method                              | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Web browser interface               | Use the Configuration Management panel under System Configuration. See “Reset Configuration” on page 249.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| CLI                                 | Use the command sequence:<br><pre>config system &gt; reset-to-defaults factory-defaults</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Reset and default buttons on the AP | <p>This is useful if the administrative password is lost; however, before performing the reset, make sure to have the original factory-assigned AP password available. Follow these steps:</p> <ol style="list-style-type: none"><li>1 Make sure the AP is connected to power (power adaptor or Power-over-Ethernet).</li><li>2 On the side of the AP, hold down both the Reset and the Default buttons. The button closest to the antenna is the Reset button. The button below it is the Default button.</li><li>3 Release only the Reset button and continue to hold down the Default button. After 10 seconds, the Status LED blinks from red to green twice. If the AP has a buzzer, a beep indicates that the restore operation has started.</li><li>4 Now release the Default button. The AP continues to reboot. The Status LED turns green when the reboot is successful and the AP is operational. During this process, all passwords and configurations are reset to factory defaults. If the AP was previously enrolled in a network, it must be re-enrolled. The new administrator password is now the original AP unique password that was set at the factory.</li></ol> |

 **NOTE:** The AP configuration may not revert back to factory defaults if the Reset button is pressed immediately after issuing the `reset-to-defaults factory-defaults` command from the CLI or applying the reset function from the AP web interface (“Reset Configuration” on page 249). To ensure that the configuration reverts back to factory defaults, allow the reset to defaults operation to reboot the AP automatically.

## Factory Default Settings

Each AP is shipped with the following factory default settings:

| Item                   | Description                                                                                                                                                                                                                                                                             |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Password               | Each AP is shipped with a unique administration password provided in the paperwork shipped with the AP.                                                                                                                                                                                 |
| Certificate Thumbprint | Each AP internally contains a unique digital certificate and associated thumbprint (key) included in the paperwork shipped with the AP.                                                                                                                                                 |
| IP Address             | <p>When an AP boots for first time and is able to access a DHCP server, it will obtain an IP address. If an AP fails to secure an IP address lease from a DHCP server, it will default to the IP address of 192.168.1.254.</p> <p>Each NM Portal AP should have a fixed IP address.</p> |

| Item (continued)    | Description                                                                                                                                                                                                                                          |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Security Mode       | The default security mode for the AP is WPA-PSK authentication with AES encryption.                                                                                                                                                                  |
| Radio Configuration | The default global configuration for radio settings is “US, Indoor,” which allows operation in all twelve IEEE 802.11a channels. “US, Any” permits operation only in the middle and upper UNII bands (8 channels) for IEEE 802.11a (5GHz) operation. |

## Using the Configuration Interfaces

Four different secure interfaces are available for administering the Airgo Access Point:

- Web browser (https)
- Command line interface (SSH or console)
- SNMP (SNMPv3)
- Policy management (https, XML-based)

This section explains how to access each of these interfaces. The configuration procedures in this guide are all presented using the web browser interface. For additional information on the CLI, see the *CLI Reference Manual*.

## Using the Web Browser Interface

The Airgo AP web browser interface is the easiest way to configure an AP or check the current settings. It includes the QuickStart facility to get the AP running as quickly as possible with a full set of AP features. NM Portal can also be launched from the web interface.



**NOTE:** In the web interface, a red asterisk (\*) next to a field name indicates that the field is required. Error messages are presented in text near the top of the panel below the information box.

To connect to the AP using the web browser interface requires an IP connection to the AP network and a computer with a browser capable of Secure Sockets Layer (SSL) connections. Follow these steps:

- 1 Launch the web browser.
  - a If your network has a DHCP server, enter the DHCP-assigned address of the AP in the address bar.
  - b If your network does not use a DHCP server, assign the static address 192.168.1.1/24 to your computer, and then enter `https://192.168.1.254` in the browser address bar.



**NOTE:** Each AP has DHCP enabled by default. If you are installing the AP on a network that already has a DHCP server, enter the DHCP-assigned address of the AP to access the web interface.

- 2 Depending on the browser security settings, a security alert may open with a prompt on whether to accept the Airgo Networks security certificate. Click **Yes** to accept the certificate and to open the login panel.
- 3 In the login panel, enter or confirm the administrative username, enter the password, select a language, and click **OK** to open the web interface. The factory default for administrator access is username: admin. If the AP has not been initialized, the username field is grayed out. The

factory default password is shipped with the AP on a paper insert. Use the password from the insert to log in.

- 4 The system response at this point depends upon whether the AP has already been initialized.
  - a If the AP has been initialized, the Home feature panel opens. See “The Home Panel” on page 40.
  - b If the AP has not been initialized, the QuickStart Welcome panel opens. Use the QuickStart panels described in the next section to quickly configure the AP.

## Using AP Quick Start to Initialize the Access Point

When accessing the web interface for the first time or after resetting the AP to factory defaults, the Welcome panel of the AP Quick Start Wizard opens (Figure 18). From this panel, initialize the AP in either of two roles:

- Normal Access Point
- Portal Access Point (NM Portal)

**Figure 18: AP Quick Start Welcome Panel**

**Welcome to AP Quick Start Configuration Wizard to bootstrap this access-point quickly.**  
This Access Point provides two distinct roles:

- Normal Access Point
- Portal Access Point

Both these roles allow you to use this access-point as an IEEE 802.11 wireless network node. However, the Portal AP role provides additional functionality to manage a small office or branch office network. Some of the benefits of Portal AP are:

- Configuration of wireless network using secure AP enrollment
- Policy-based configuration of wireless network
- Authentication of wireless users with its built-in RADIUS server and certificate based identity management system
- Monitoring of wireless network for faults, configuration, performance and security (FCAPS)
- Upgrading wireless network with new software images

Prior to configuring this access-point, please gather the following information:

- IP Address assigned to this access-point (requires a fixed IP address either assigned via DHCP or manually configured)
- If static IP-address is assigned to this AP, configure Default Gateway, DNS Server and NTP Servers addresses
- IP address of your SMTP (or email) server

**Begin the AP Quick Start Configuration Wizard by selecting one of the two options below:**

Both roles allow the AP to function as an IEEE 802.11 wireless network node. As a portal AP, the following additional functions are available:

- Configuration of the Airgo Networks wireless network using secure AP enrollment and policy-based configuration of APs
- Authentication of wireless users via built-in RADIUS server and certificate-based identity management system

- Monitoring of Airgo Networks network for faults, configuration alerts, performance, and security (FCAPS)
- Upgrade of the Airgo AP network with new software images

## Initializing a Normal AP

- 1 Click **Bootstrap Normal AP** from the Quick Start Welcome panel to open the first initialization panel (Figure 19).

**NOTE:** Click **Logout** if it is necessary to leave the Quick Start panels. If you log out prior to completing the setup process, the settings are not saved.

**Figure 19: QuickStart Configuration Parameters**

Welcome to AP Quick Start Configuration Wizard to bootstrap this access-point quickly.  
This Access Point provides two distinct roles:

- Normal Access Point
- Portal Access Point

Both these roles allow you to use this access-point as an IEEE 802.11 wireless network node. However, the Portal AP role provides additional functionality to manage a small office or branch office network. Some of the benefits of Portal AP are:

- Configuration of wireless network using secure AP enrollment
- Policy-based configuration of wireless network
- Authentication of wireless users with its built-in RADIUS server and certificate based identity management system
- Monitoring of wireless network for faults, configuration, performance and security (FCAPS)
- Upgrading wireless network with new software images

Prior to configuring this access-point, please gather the following information:

- IP Address assigned to this access-point (requires a fixed IP address either assigned via DHCP or manually configured)
- If static IP-address is assigned to this AP, configure Default Gateway, DNS Server and NTP Servers addresses
- IP address of your SMTP (or email) server

Begin the AP Quick Start Configuration Wizard by selecting one of the two options below:

The following fields are available on this panel; however, it is not necessary to reset any of these fields to initialize the AP:

| Field                           | Description                                                                                                                                                                                                                       |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AP Hostname                     | Alphanumeric name for the AP. The factory default for this field is AP followed by the MAC address of the AP's Ethernet interface (eth0).                                                                                         |
| Enable DHCP Assigned IP Address | Checkbox that indicates whether DHCP is used to obtain an IP address. If the box is cleared, the static Management IP Address fields are activated; if the box is selected, the static Management IP Address fields are inactive. |

| Field               | Description                                                                                                                                                                                                             |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IP Address/Maskbits | Static IP address and subnet prefix for the AP. Required if the IP address is not obtained automatically. The default is 192.168.1.254/24.<br><b>NOTE:</b> It is required that each NM Portal have a static IP address. |
| Default Gateway     | IP address of the gateway to the wired network. Required for complete network access, if the IP address is not obtained automatically. The default is the existing network gateway.                                     |
| Domain Name Servers | IP address of the server supplying DNS service. Required for complete network access, if the IP address is not obtained automatically. The default is the DNS server for the existing network.                          |
| Date                | Current date in MM/DD/YYYY format                                                                                                                                                                                       |
| Time                | Current time in HH:MM:SS format (hours 0-23)                                                                                                                                                                            |
| Time Zone           | US zone or GMT option. For US zone, click the radio button and select a time zone. For GMT, click the radio button and select an offset in HH:MM format.                                                                |

- Click **Next** to continue to the next panel (Figure 20). Use this panel to configure network identity.

**Figure 20: QuickStart Network Identity**

**SSID**

SSID Name \* DeerCreekCo

**Network Density**

Network Density ☒ Low ☐ Medium ☐ High

**Bootstrap Security Mode \***

WPA Pre-Shared Key with AES ☒

WEP ☐ WEP-64 ☐ WEP-128

Open Access ☐

**WPA-PSK Security Mode**

WPA-PSK password

**WEP Mode**

WEP Key

<< Back Next >> Logout

- Configure the following information on this panel:

| Field     | Description                                                                                                                   |
|-----------|-------------------------------------------------------------------------------------------------------------------------------|
| SSID Name | Service set identifier for the network, also known as the Wireless Network Name. The default name must be changed. (required) |

| Field                   | Description                                                                                                                                                                                                                                 |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Network Density         | Indicates the proximity of APs to each other. For closely spaced APs that can support high data rates, select the high density option. For maximum coverage at lower data rates, select the low density option. The default setting is Low. |
| Bootstrap Security Mode | WPA-PSK, WEP-64, WEP-128, or Open security option. The option determines the security mode for the AP.                                                                                                                                      |
| WPA-PSK Security Mode   | Activated if WPA is selected as the security mode. Enter a alphanumeric string at least eight characters in length. (required if security mode is WPA-PSK)                                                                                  |
| WEP Key                 | Activated if WEP is selected as the security mode. Enter a WEP key. A WEP-64 key is 10 hex characters, and a WEP-128 key is 26 hex characters. (required if security mode is WEP)                                                           |

4 Click **Next** after making selections.

The last two panels (Figure 21) configure up to two radios on the AP. After entering settings on the first of the two panels, click **Next** to open the second panel.

**Figure 21: QuickStart Radio Parameters**

5 Set the following information:

| Field                        | Description                                                                                                                      |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Select Radio Interface       | Specific radio to be configured on the AP (wlan0 or wlan1). These correspond to the WLAN0 and WLAN1 LEDs on the front of the AP. |
| Select Operating Band & Mode | 802.11b mode in the 2.4GHz band, 802.11b or g mode in the 2.4GHz band, 802.11a mode in the 5GHz band, or auto selection (Any).   |

| Field             | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Configure Channel | <p>Select Auto-Select Channel or Assign Fixed Channel options. In both of these cases, the channel set used for auto-scanning can also be restricted.</p> <ul style="list-style-type: none"><li>• Auto-Select: Select at-startup to automatically determine the channel when the AP is booted, or periodic to auto-select the channel at the specified number of minutes.</li><li>• Assign Fixed Channel: Select a static channel.</li></ul> <p><b>NOTE:</b> The fixed channel must be a valid channel number, and it must be compatible with the AP hardware for the country in which the AP is installed. If an invalid or incompatible channel is assigned, the bootstrapping process can be completed successfully, but an error message appears to remind the user of the channel incompatibility. If this occurs, change the channel assignment after bootstrapping by following the instructions in “Global Configuration” on page 61. This section includes a table of valid channel settings.</p> |

 **NOTE:** The defaults for radio configuration have been selected for the best operational radio behavior across a variety of environments. Modifying these parameters alters radio behavior, which may have an impact on network performance or services. For example, selecting an operating band of 5GHz (802.11a) may prevent legacy client adapters from associating to the AP.

 **NOTE:** If DHCP is used to assign an IP address to the AP, the lowest MAC address should be pinned to the fixed IP address.

- 6 After entering settings for both radios, click **Finish** to complete the initialization process. (If initializing a portal AP, as described in the next section, the button is labeled **Next**.)

#### Initializing the Portal AP

Using the QuickStart panels to initialize NM Portal is similar to initializing a normal AP. The first four panels, as described in the previous section, are the same as for the normal AP. When configuring the second radio, click **Next** to set the administration and networking configuration (Figure 22).

**Figure 22: Portal QuickStart panel**

The screenshot shows a web interface titled "Configure AP Admin and SNMPv3 Password" and "Configure Administrator Email Notification". It contains four input fields: "Admin Password \*" (masked with dots), "Confirm Admin Password \*" (masked with dots), "SMTP Server Name or IP Address" (containing "192.168.168.1"), and "Administrator Email Address" (containing "admin@DeerCreekCo.com"). At the bottom are three buttons: "<< Back", "Finish", and "Cancel".

**7** Enter the following information consistent with your corporate standards:

| Field                          | Description                                                                                                                                                                                            |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Admin Password                 | Enter and confirm the password used to manage this AP and other enrolled APs. The password must be between 8 and 32 characters and is used for local administrator login and SNMP v3 login. (required) |
| SMTP Server Name or IP Address | Address of your SMTP server                                                                                                                                                                            |
| Administrator Email Address    | Email address of the person to be notified regarding alerts                                                                                                                                            |

**8** Click **Finish** to complete the initialization process and bring up the AP Explorer Home panel. The process takes approximately two minutes. When the process is complete, the Home panel opens.

**i** **NOTE:** After the AP has been configured, there are two potential authentication paths for the administrative user login. If the username is `admin`, then the password is first checked against the local database. If the local login fails, or if the username is not `admin`, then the password is compared with the password stored in any configured RADIUS servers. The local admin password is the same as the SNMPv3 password.

## Navigating the Web Interface

The Airgo AP web interface is divided into three main areas. The menu tree (Figure 23) provides access to all the panels and features of the web interface. To expand a menu in the menu tree, click the arrow to the left of the menu name.

**Figure 23: Menu Tree**



The lower left alarm panel (Figure 24) lists the number of current alarms. To update the alarm summary, click the browser refresh button.

**Figure 24: Alarm Area**



When you select an item from the menu tree, the information is displayed in the Detail panel, which takes up most of the browser window (shown for the Home panel in Figure 25).

**i** **NOTE:** Use the Menu Bar rather than the browser Back button to switch to other panels in the Airgo AP web interface.

## Getting Help

To access the Online Help system at any time, click the Help button in the upper right area of the AP Web interface. The Help system opens to provide assistance on the current panel, and includes links to the table of contents and index.

## The Home Panel

The Home panel (Figure 25) opens when you first log in to the web interface, or if **Home** is selected from the menu tree. The Home screen contains top-level summary information about the AP. To access detailed information, click **More** for any of the following sections:

- AP Summary—Opens the Bootstrap Configuration panel under the AP Quick Start menu (see “Quick Start Panels” on page 42).

- Version Summary—Opens a detailed list of model and serial numbers and hardware and software versions (see “Version Table” on page 47).
- Wireless Summary links—Opens panels to configure SSID, client stations, radios, and encryption.
- Management Summary—Shows current network management address settings.

**Figure 25: Home Panel**

**Menu Tree**

- AP Explorer - Home
- AP Quick Start
- System Services
- Wireless Services
- Networking Services
- Security Services
- Guest Access Services
- Launch NM Explorer
- MANAGE WIRELESS NETWORK
- Alarm Summary
- Alarms 21

**AP Explorer | Home**

Welcome to Access Point Explorer. This web user interface provides configuration information for this Access Point (AP). To access AP Explorer features, click the "Menu Tree" links in the frame to the left. Feature details are displayed in the frame on the right. This Home page provides summary information for the currently selected AP. Be sure to log out at the end of this session.

| AP Summary      |                         |
|-----------------|-------------------------|
| AP Hostname     | AP_00-0A-F5-00-01-F2    |
| Mgmt IP Address | 192.168.1.250/24        |
| AP Location     | Floor 1 South           |
| Admin Contact   | admin@deer creekco.com  |
| AP Clock        | Thu Sep 9 05:34:47 2004 |

| Wireless Summary    |                                           |
|---------------------|-------------------------------------------|
| SSID                | DeerCreekCo                               |
| Associated Stations | 0                                         |
| Number of Radios    | wlan0 (AP 2.4Ghz-6)<br>wlan1 (AP 5Ghz-64) |
| Encryption          | WPA with AES                              |

| Version Summary     |          |
|---------------------|----------|
| Software Version    | 1.4.0    |
| License information | BizClass |

| Management Summary |               |
|--------------------|---------------|
| Primary NMS        | Unavailable   |
| Auxiliary NMS      | 192.168.1.250 |

## Quick Start Panels

Use the AP Quick Start menu items to open the Bootstrap Configuration and Version panels. Each of the tabs in the Bootstrap Configuration panel corresponds to one of the screens used to initialize an AP in AP Quick Start.

### IP Config Tab

The IP Config tab opens when you choose Bootstrap Configuration from the AP Quick Start menu (Figure 26). Use this tab to configure the management Address of the AP.

**NOTE:** Changing this address will also change the IP address of the management VLAN on the AP.

**Figure 26: AP Quick Start - Bootstrap Configuration - IP Config**

The screenshot displays the 'IP Config' tab within the 'AP Quick Start - Bootstrap Configuration' interface. At the top, there are navigation tabs: 'IP CONFIG', 'RADIO CONFIG', 'CLOCK CONFIG', 'PORTAL CONFIG', and 'ADMIN EMAIL'. A 'HELP' and 'LOGOUT' button are also present. Below the tabs, a breadcrumb trail reads 'AP Quick Start | Bootstrap Configuration | IP Configuration'. A text box provides context: 'The AP Quick Start web pages summarize essential configuration parameters required to bootstrap this AP. These bootstrap parameters are extracted from other AP configuration pages to provide ease of feature navigation for rapid deployment of APs. NOTE: The information on the AP Quick Start web pages appears on other pages within the AP Explorer interface.' Below this, the 'Management IP Configuration' section includes a 'DHCP Assigned IP Address' checkbox (checked), and text input fields for 'DNS IP Address' (192.168.168.1), 'Management IP Address/Maskbits' (192.168.168.24/24), and 'Gateway IP Address' (192.168.168.254). The 'System Identity Configuration' section below it contains fields for 'Host Name' (AP\_00-0A-F5-00-01-F2), 'AP Location' (Floor 1 South), and 'Administrator Contact' (admin@DeerCreekCo.com). Both sections feature 'APPLY' and 'RESET' buttons at the bottom.

This tab contains the following settings:

| Field                    | Description                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DHCP Assigned IP Address | Indicate whether to use DHCP to obtain an IP address for the AP. If the box is cleared, the other Management IP Configuration fields are activated; if the box is selected, the other Management IP Configuration fields are inactive.<br><b>NOTE:</b> If the web interface is reconfigured with a static IP address, you must explicitly log back in using the new IP address. |

| Field                          | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DNS IP Address                 | <p>Enter the IP address of the server or servers supplying DNS service. This is required if the IP address is not obtained automatically. The default is the DNS server for the existing network.</p> <p>Multiple DNS server addresses may be specified, space-separated. The AP will use the addresses in the order specified. Manually configured DNS addresses always take precedence over the DNS addresses returned by a DHCP server. If the DNS IP Address field is empty, then all manually configured DNS server addresses will be removed.</p> <p>If you delete DNS servers, only those added manually are deleted. DHCP-assigned DNS servers continue to be available.</p> |
| Management IP Address/Maskbits | Enter the IP address and subnet prefix for this AP. This is required if the IP address is not obtained automatically. The default is 192.168.1.254/24.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Gateway IP Address             | Enter the IP address of the gateway to the wired network. This is required if the IP address is not obtained automatically. The default is the existing network gateway.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Host Name                      | Enter an alphanumeric name for the AP. The factory default for this field is AP followed by the MAC address of the AP's Ethernet interface (eth0).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| AP Location                    | Enter the physical location of the AP as a text string.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Administrator Contact          | Enter contact information for the person responsible for managing this AP (phone or email address).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

Click **Apply** to save changes in each section on the screen or **Reset** to return to previously saved values.

### Radio Config Tab

Use the Radio Config tab (Figure 27) to configure bootstrap parameters for the two AP radios.

**Figure 27: AP Quick Start - Bootstrap Configuration - Radio Config**

The defaults for global radio configuration have been selected for the best operational radio behavior across a variety of environments. Changing these parameters will change radio behavior, which may impact AP performance. For example, changing network connectivity may alter wireless backhaul (wireless distribution) operation.

| Radio Configuration       |                                                                                                           |
|---------------------------|-----------------------------------------------------------------------------------------------------------|
| Radio Admin State         | wlan1 <input type="radio"/> Disable <input checked="" type="radio"/> Enable                               |
| Network Connectivity      | <input checked="" type="radio"/> Any <input type="radio"/> Wired-Only <input type="radio"/> Wireless-Only |
| Network Density           | <input checked="" type="radio"/> Low <input type="radio"/> Medium <input type="radio"/> High              |
| Multi Domain Support      | <input type="radio"/> Disable <input checked="" type="radio"/> Enable                                     |
| World Mode (Country-Code) | US ( United States ) <input type="checkbox"/> Default                                                     |
| Deployment Environment    | <input checked="" type="radio"/> Any <input type="radio"/> Indoor <input type="radio"/> Outdoor           |

APPLY RESET

Configure Radio Settings GO >>

This tab contains the following settings:

| Field                     | Description                                                                                                                                                                                                                                                                                                                                 |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Radio Admin State         | Select each AP radio (wlan0 or wlan1) to enable or disable.                                                                                                                                                                                                                                                                                 |
| Network Connectivity      | Indicate whether the radio will be used in a normal AP connected to the wired network (Wired-Only), for wireless backhaul (Wireless-Only), or may be used for either (Any). If Any is specified, the system will automatically choose wired when an Ethernet connection is available and wireless if an Ethernet connection is not present. |
| Network Density           | Indicate the relative concentration of APs in the network. For closely spaced APs that can support high data rates, select the high density option. For maximum coverage at lower data rates, select the low density option. The default setting is Low.                                                                                    |
| Multi Domain Support      | Enable or disable 802.11d operation. If Enable is selected, the radio advertises country, channel, and associated maximum transmit power information in beacons and probe responses to stations or clients in the BSS. The default setting is enabled.                                                                                      |
| World Mode - Country Code | Select <b>Default</b> to set the channel and power for the radio to the factory default country setting (U.S.). Alternatively, select a country code from the pull-down list.                                                                                                                                                               |
| Deployment Environment    | Specify the type of environment in which the AP is installed (indoor, outdoor, or both). The Environment setting determines the maximum transmit power and allowed channels of operation. The default is Any.                                                                                                                               |

For further information regarding these settings, see Chapter 4, “Configuring Radio Settings.”

## Clock Config Tab

Use the Clock Config tab (Figure 28) to set time parameters for the bootstrap configuration.

**Figure 28: AP Quick Start - Bootstrap Configuration - Clock Config**

**AP Quick-Start | Bootstrap Configuration | Clock Configuration** »

To ensure an accurate time and date, it is highly recommended that an external Network Time Protocol (NTP) server be used to auto-synchronize the AP clock. NOTE: Select the NTP server (s) and time zone that is geographically proximate to the AP.

**System Clock Configuration**

|                     |                                                                                                              |
|---------------------|--------------------------------------------------------------------------------------------------------------|
| Current Time        | Thu Sep 9 05:39:49 2004                                                                                      |
| Date (mm/dd/yyyy)   | <input type="text"/>                                                                                         |
| Time (hh:mm)        | <input type="text"/>                                                                                         |
| Time Zone *         | <input checked="" type="radio"/> US-Zone <input type="radio"/> Pacific Time <input type="text"/>             |
|                     | <input type="radio"/> --SELECT-GMT-TIMEZONE-- <input type="text"/>                                           |
| Current NTP Servers | <input type="text"/>                                                                                         |
| Synchronize Clock * | <input checked="" type="radio"/> Using NTP <input type="radio"/> Manual Synchronization <input type="text"/> |

APPLY SYNCH CLOCK NOW RESET

This tab contains the following settings:

| Field             | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Date              | Current date in MM/DD/YYYY format                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Time              | Current time in HH:MM:SS format (hours 0-23)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Time Zone         | US-zone or GMT option. For US zone, click the radio button and select a time zone. For GMT, click the radio button and select an offset in HH:MM format.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Synchronize Clock | <p>Indicate whether time will be synchronized manually through the date and time fields, or by way of an NTP server. If you select the server option, enter the IP address of the server in the space provided. If an NTP server is currently assigned, the address of the server is displayed, as shown in Figure 28 under the heading Current NTP Servers.</p> <p>Multiple NTP servers may be specified (space separated). If more than one server is specified, they are contacted in the order given. If the Synchronize Clock is empty, then all manually configured NTP servers will be deleted.</p> <p>If the AP is configured to receive an IP address via DHCP, then the DHCP server could also return the set of NTP servers. In such a scenario, the manually configured NTP servers take precedence over the DHCP returned NTP servers.</p> <p>If you delete NTP servers, only those added manually are deleted. DHCP-assigned NTP servers continue to be available.</p> |

### Portal Config Tab

Use the Portal Config tab (Figure 29) to enable portal services on this AP. See “Portal Architecture” on page 4 for a description of the portal services.

**Figure 29: AP Quick Start - Bootstrap Configuration - Portal Config**

The screenshot shows the 'Portal Config' tab selected in the 'AP Quick Start - Bootstrap Configuration' interface. The top navigation bar includes tabs for IP CONFIG, RADIO CONFIG, CLOCK CONFIG, PORTAL CONFIG (active), and ADMIN EMAIL, along with HELP and LOGOUT buttons. Below the tabs, a breadcrumb trail reads 'AP Quick-Start | Bootstrap Configuration | Portal Configuration >>'. A text box explains: 'Designate one AP in your network as a portal AP to provide management functions for other APs. Check Enrollment to have the portal AP provide discovery and registration services; check NM to have the portal AP provide network management services; check Security to have the portal AP provide wireless and admin user authentication using an internal RADIUS server.' Below this, the 'Portal Services Configuration' section shows 'Portal Services' with three checked checkboxes: Enrollment, NM, and Security.

### Admin Email Tab

If the AP is configured as a portal AP, use the Admin Email tab (Figure 30) to specify how to alert the network administrator regarding critical faults or security breaches. Configure the following fields:

| Field                | Description                                                                      |
|----------------------|----------------------------------------------------------------------------------|
| SMTP Server Address  | Enter the IP address of the SMTP server used to reach the network administrator. |
| Admin E-mail Address | Enter the email address of the network administrator.                            |

**Figure 30: AP Quick Start - Bootstrap Configuration - Admin Email**

The screenshot shows the 'Admin Email' tab selected in the 'AP Quick Start - Bootstrap Configuration' interface. The top navigation bar is the same as in Figure 29, with 'ADMIN EMAIL' now active. The breadcrumb trail is 'AP Quick-Start | Bootstrap Configuration | Admin Email >>'. A text box explains: 'The email notification feature can be configured for a portal AP. This feature provides network administrator email notification for alerts, faults, or security breaches.' Below this, the 'Admin E-mail Configuration' section contains two input fields: 'SMTP Server Address' with the value '192.168.168.1' and 'Admin E-mail Address' with the value 'rjones@acmeworks.com'. Both fields have a red asterisk indicating they are required. At the bottom are 'APPLY' and 'RESET' buttons.

## Version Table

The Version Table panel (Figure 31) lists model number, serial number, and hardware and software version information.

**Figure 31: AP Quick Start - Version Table**

**VERSION** HELP LOGOUT

**AP Quick-Start | Version Table** ✕

The AP version information comprises hardware version, software version and software licenses assigned to this AP. After a successful software upgrade procedure, tally the version of the new software image with that reported by this AP. The AP Radio Version displays model and hardware revision information which are crucial for technical support.

| Product Version Table        |                            |
|------------------------------|----------------------------|
| Vendor Name                  | xxx1202                    |
| Model Number                 | xxx1202                    |
| Model Type                   | AGN1dev                    |
| Serial Number                | XXX00000498                |
| System Hardware ID           | 00:0a:f5:00:01:f2          |
| System Hardware Version      | 1                          |
| System Hardware Options      | RTC                        |
| System Software Version      | 1.4.0                      |
| System Software Build Number | 107                        |
| System Software Build Date   | 2004-09-03,12:34:38,-08:00 |
| System Software Licenses     | BizClass, Enterprise       |

| AP Radio Version Table |                   |              |                   |
|------------------------|-------------------|--------------|-------------------|
| Interface              | MAC               | Product ID   | Hardware Revision |
| wlan0                  | 00:0a:f5:00:06:5a | AGN1323AR-00 | 1.3.0             |
| wlan1                  | 00:0a:f5:00:06:17 | AGN1323AR-00 | 1.3.0             |

## Other Panels

The other panels accessible from the menu tree contain detailed information and fields to set the AP configuration. Most of the panels have multiple tabs, and some have special entry panels.

## NM Portal Access

If the AP is booted in Portal mode, the left side of the browser interface includes a Manage Wireless Network button just below the menu tree. Click the button to open a new browser window for NM Portal services. For information on using portal services, see Chapter 9, “Managing the Network.”

## Configuration Wizards

The Airgo AP web interface includes wizards that enable fast configuration of user security and guest access.

### User Security Wizard

The User Security Wizard provides a one-stop interface for configuring user security parameters. You can use the wizard to configure security or change security settings using the individual

security panels in the AP web browser interface. For detailed information on security options, see Chapter 7, “Managing Security.”

To open the User Security Wizard:

Click **User Security Wizard** under AP Quick Start on the menu tree. The wizard opens (Figure 32).

**Figure 32: User Security Wizard**



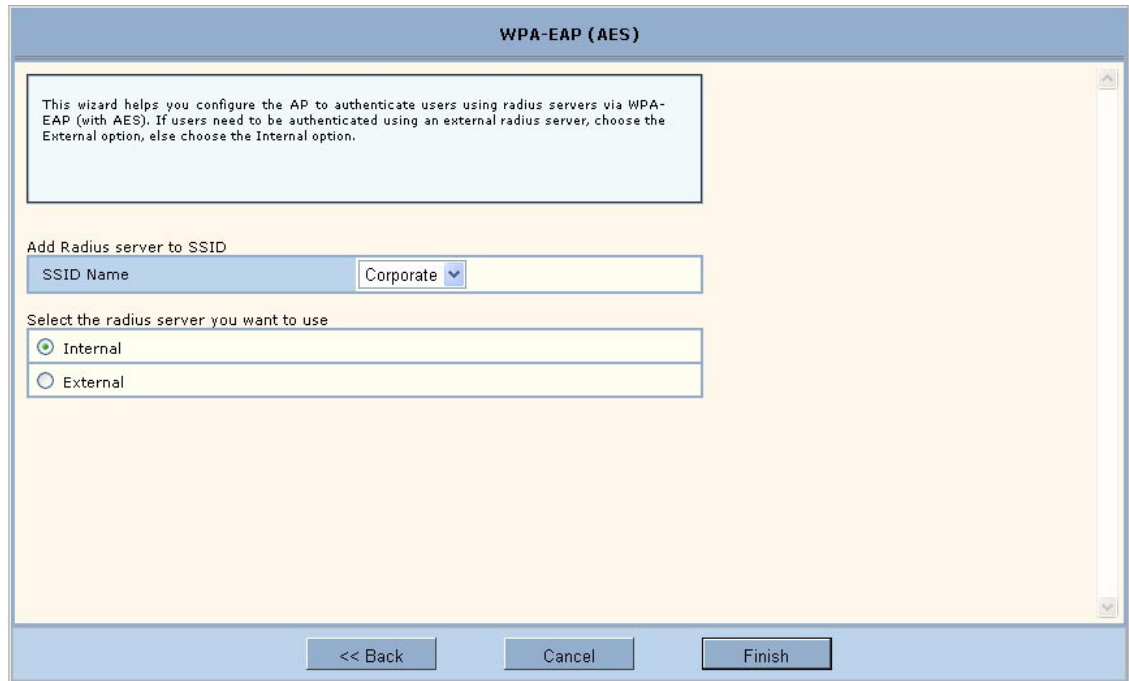
The wizard presents several options for configuring user security. For additional information about these options, see Chapter 7, “Managing Security.”

| Option                        | Description                                                                                                                                                                                                                                                                   |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| WPA-EAP (with AES encryption) | Configures the AP to work with RADIUS authentication servers. <ul style="list-style-type: none"><li>• The wizard prompts for selection of the internal RADIUS server included in the AP or an external RADIUS server.</li></ul>                                               |
| WPA-PSK                       | Configures the AP to work with pre-shared key authentication. <ul style="list-style-type: none"><li>• The wizard prompts for the pre-shared security key.</li></ul>                                                                                                           |
| WEP                           | Configures the AP to use WEP encryption to support legacy equipment. <ul style="list-style-type: none"><li>• The wizard prompts for selection of 64-bit or 128-bit key length option, up to four distinct WEP keys, and determination of which will be the default.</li></ul> |
| Open Access                   | Configures the AP with no authentication or encryption. <ul style="list-style-type: none"><li>• The wizard prompts for confirmation that this is desired.</li></ul>                                                                                                           |

The chosen security option determines the option selections that follow.

To configure WPA-EAP:

- 1 In the User Security Wizard, select **Using WPA-EAP**.
- 2 Click **Next** to open the next User Security Wizard panel (Figure 33).

**Figure 33: User Security Wizard - WPA-EAP**

The image shows a configuration wizard window titled "WPA-EAP (AES)". Inside the window, there is a text box with instructions: "This wizard helps you configure the AP to authenticate users using radius servers via WPA-EAP (with AES). If users need to be authenticated using an external radius server, choose the External option, else choose the Internal option." Below this, there is a section "Add Radius server to SSID" with a text field labeled "SSID Name" and a dropdown menu currently showing "Corporate". Underneath, there is a section "Select the radius server you want to use" with two radio button options: "Internal" (which is selected) and "External". At the bottom of the window, there are three buttons: "<< Back", "Cancel", and "Finish".

- 3 Confirm the SSID (wireless network name).
- 4 Select whether to use the internal RADIUS server included in the AP or an external RADIUS server.
- 5 Click **Finish**.

To configure WPA-PSK:

- 1 In the User Security Wizard, select **Using WPA-PSK**.
- 2 Click **Next** to open the next User Security Wizard panel (Figure 34).

**Figure 34: User Security Wizard - WPA-PSK**

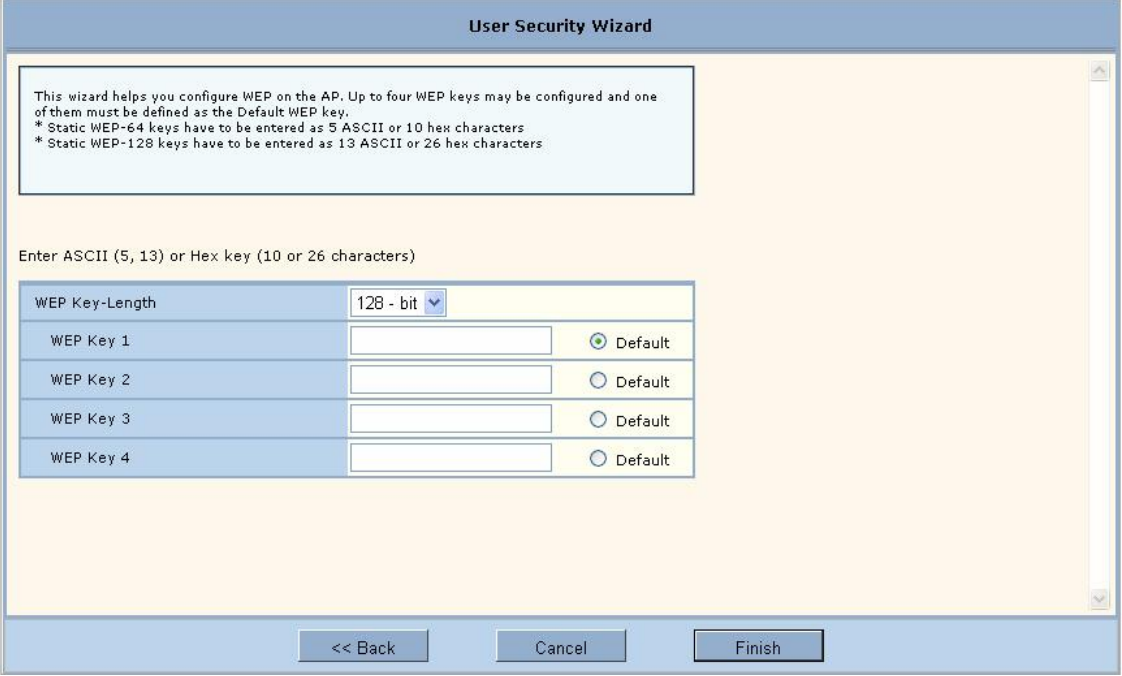
The screenshot shows a configuration window titled "User Security: WPA with PSK". Inside the window, there is a light blue box with instructional text: "This wizard helps you configure Pre-Shared key authentication support on the AP. Each SSID may be configured with a unique pre-shared key. When WPA-PSK is configured AES encryption mode will be enabled automatically." Below this box are three input fields: "SSID Name" with a dropdown menu showing "Corporate", "WPA Pre-Shared-Key" with a masked input field (seven dots), and "Confirm Key" with a masked input field (seven dots). At the bottom of the window are three buttons: "<< Back", "Cancel", and "Finish".

- 3 Enter the pre-shared key to use for network authentication and confirm your entry.
- 4 Click **Finish**.

To configure WEP:

- 1 Select **Using WEP**, and click **Next** to open the next User Security Wizard panel (Figure 35).

**Figure 35: User Security Wizard - WEP**



The image shows a 'User Security Wizard' window for configuring WEP. It has a title bar and a main content area. At the top, a text box explains the wizard's purpose and provides instructions for entering keys. Below this, a label prompts the user to 'Enter ASCII (5, 13) or Hex key (10 or 26 characters)'. A table allows selection of a WEP key length (128-bit is selected) and entry of up to four keys. Each key has a radio button to designate it as the default. At the bottom are 'Back', 'Cancel', and 'Finish' buttons.

**User Security Wizard**

This wizard helps you configure WEP on the AP. Up to four WEP keys may be configured and one of them must be defined as the Default WEP key.  
\* Static WEP-64 keys have to be entered as 5 ASCII or 10 hex characters  
\* Static WEP-128 keys have to be entered as 13 ASCII or 26 hex characters

Enter ASCII (5, 13) or Hex key (10 or 26 characters)

| WEP Key-Length |                      |                                          |
|----------------|----------------------|------------------------------------------|
| WEP Key 1      | <input type="text"/> | <input checked="" type="radio"/> Default |
| WEP Key 2      | <input type="text"/> | <input type="radio"/> Default            |
| WEP Key 3      | <input type="text"/> | <input type="radio"/> Default            |
| WEP Key 4      | <input type="text"/> | <input type="radio"/> Default            |

<< Back      Cancel      Finish

- 2 Select the WEP key length.
- 3 Enter up to four WEP keys and indicate which will be the default.
- 4 Click **Finish**.

To configure open access:

- 1 Select **Open Access** and click **Next** to open the next User Security Wizard panel (Figure 36).

**Figure 36: User Security Wizard - Open Access**



The image shows a software window titled "User Security Wizard". Inside the window, there is a light blue header bar with the title. Below the header, there is a white box containing the text: "Configure Open Access on the AP if you wish have no authentication and no encryption enabled for the wireless network. This option makes the network unsecure." Below this box, there is a section titled "Enable Open Access (no authentication and no encryption)". Under this section, there are two radio button options: "Yes" (which is selected, indicated by a green dot) and "No". At the bottom of the window, there is a blue bar containing three buttons: "<< Back", "Cancel", and "Finish".

- 2 Confirm that you want to configure the AP without user security.
- 3 Click **Finish**.

## Guest Access Wizard

The Guest Access Wizard enables you to configure the network to give guest users limited access while protecting the network from unauthorized use. For a complete description of guest access rules and options, see Chapter 8, “Configuring Guest Access.”

To open the Guest Access Wizard:

- Click **Guest Access Wizard** under AP Quick Start on the menu tree.

The wizard (Figure 37) provides options to configure an internal landing page or an external landing page for guest users who open a web browser when accessing the network.

**Figure 37: Guest Access Wizard**



The screenshot shows the 'Guest Access Wizard' window. At the top, a title bar reads 'Guest Access Wizard'. Below it, a text box explains the wizard's purpose: 'This wizard enables you to configure Guest Access support on the AP. Guest Access allows guest users to log into the wireless network and at the same time keep the guest users' traffic isolated from non-guest authenticated user traffic. Guest user traffic is not encrypted. Select the Internal option to use the guest feature built in the AP. If guest users need to be authenticated by an external HTTP server select the External option.' Below this, there is a 'Guest SSID' dropdown menu currently set to 'Corporate'. A section titled 'Do you want to use internal or external landing page?' contains two radio button options: 'Internal' (which is selected) and 'External'. At the bottom of the window, there are two buttons: 'Next >>' and 'Close'.

To use an internal landing page:

- 1 In the Guest Access wizard, select **Internal**.
- 2 Click **Next** to open the next wizard panel.
- 3 Enter and confirm a guest password (Figure 38). The password must be from one to 63 characters in length and may be manually distributed to guests who visit your corporate facility.

**Figure 38: Guest Access Wizard - Internal Landing Page**

Guest Access Wizard

Configure the guest password. The IP subnet pinhole allows guest users to access the identified subnet even before they are authenticated as guests.

Guest Password: [masked]

Confirm Guest Password: [masked]

Do you want to allow guest to browse other IP subnet ?

☐ No

☒ Yes

Allowed Subnet: 192.168.17.1

<< Back      Next >>

- 4 Indicate whether the guest users will be able to access a subnet before they are authenticated as guest users. If yes, enter the IP address of the subnet.
- 5 Click **Next**.

- 6 Select the top checkbox if you want to set up guest access without using VLANs. To set up guest access with VLANs, select an existing VLAN in which to place authenticated guest users or create a new VLAN by entering a numeric VLAN ID and VLAN name (Figure 39). The list of existing VLANs includes only those that support open access.

**Figure 39: Guest Access Wizard - VLAN Entry**

Guest Access Wizard

Select the VLAN to which guest users will be assigned, if not available then create a new VLAN. Select the QoS that guest users will be assigned.

Setup Guest Access without VLAN ☐

Setup infrastructure for guest access.

Allowed Guest VLAN ID

☒ New VLAN

VLAN ID

VLAN Name

Guest QoS

<< Back Close Finish

**7 Click Finish.**

Guest access is now configured. When guests access the external landing page, they follow an externally-determined process to log in to the network. If a subnet has been specified, then guests can access the subnet even if they are not able to log in. For further information about guest access, or to modify guest access parameters, see Chapter 8, “Configuring Guest Access.”

To use an external landing page:

- 1 In the Guest Access wizard, select **External**.
- 2 Click **Next** to open the next wizard panel.

**Figure 40: Guest Access Wizard - External Landing Page**

The screenshot shows the 'Guest Access Wizard' window. At the top, a blue header bar contains the title 'Guest Access Wizard'. Below the header, a light blue box contains instructional text: 'Configure the external HTTP server details on this page. Specify the URL that a guest user will be presented with when they try to log into the network. Specify the webserver server secret that will AP will use to authenticate itself to the webserver. The IP subnet pinhole allows guest users to access the identified subnet even before they are authenticated as guests.' Below this, there are two input fields: 'External Landing Page URL' with the value 'http://192.168.22.22/Acme\_GuestLoginPa' and 'External Web Server Secret' with the value 'deer5'. Further down, a section titled 'Do you want to allow guest to browse other IP subnet ?' has two radio buttons: 'No' and 'Yes'. The 'Yes' radio button is selected. Below this, there is an 'Allowed Subnet' input field with the value '192.168.17.1'. At the bottom of the window, there are two buttons: '<< Back' and 'Next >>'.

- 3 Enter the full URL for the external landing page (Figure 39). The URL for the landing page must use an IP address rather than a domain name. Regardless of the authentication process selected for the external page, it is necessary to forward authentication results to the AP upon completion of successful or unsuccessful guest authentication.
- 4 Enter the shared secret string that the AP will use to authenticate itself to the web server. The code must be from 1 to 63 characters in length.
- 5 Indicate whether the guest users will be able to access a subnet before they are authenticated as guest users. If yes, enter the IP address of the subnet.
- 6 Click **Next**.
- 7 Select the top checkbox if you want to set up guest access without using VLANs. To set up guest access with VLANs, select an existing VLAN in which to place authenticated guest users or create a new VLAN by entering a numeric VLAN ID and VLAN name (Figure 39). The list of existing VLANS includes only those that support open access.
- 8 If desired, select a quality of service (QoS) level. Numeric QoS values range from 0 (lowest priority) to 7 (highest priority).
- 9 Click **Finish**.

When guests access the external landing page, they follow an externally-determined process to log in to the network. If a subnet has been specified, then guests can access the subnet even if they are not able to log in. For further information about guest access, or to modify guest access parameters, see Chapter 8, “Configuring Guest Access.”

 **NOTE:** To successfully authenticate guest users using an external landing page, the external web server must be configured to accept the guest authentication requests and to respond with a URL with the correct syntax. For additional information, see Appendix C, “External Landing Page API.”



# 4 Configuring Radio Settings

This chapter describes the configuration settings for the Airgo Access Point radios and explains how to set the configuration using the Airgo AP web interface. It covers all the features accessible from the Wireless Services menu except backhaul configuration, which is discussed in Chapter 6. The chapter includes the following topics:

- [Introduction](#)
- [Configuring Radio Parameters](#)
- [Setting the Advanced Radio Configuration](#)
- [Viewing Radio Statistics](#)
- [Viewing Radio Neighbor Details](#)
- [Configuring SSID Parameters](#)
- [Multiple SSIDs](#)
- [Configuring Inter Access Point Protocol \(IAPP\)](#)
- [Performing Radio Diagnostics](#)

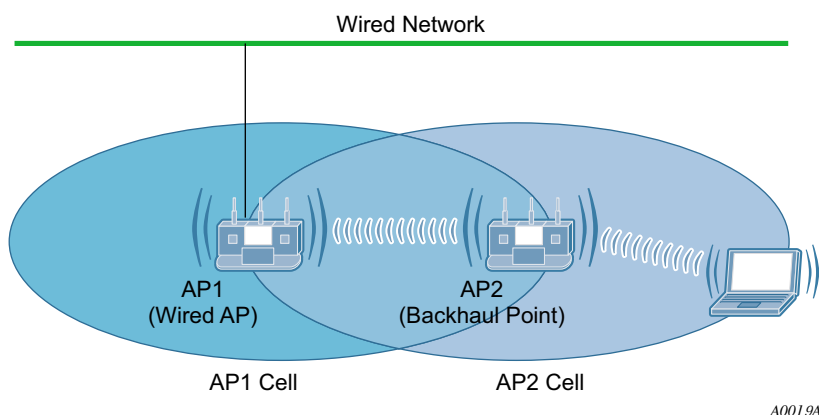
## Introduction

The Airgo Access Point can be configured with one or two radios, each of which forms a distinct wireless cell or basic service set (BSS), as shown in Figure 41. Each radio can operate in either of the following modes:

- In normal mode, the AP is connected to the wired network and the radio directly services downstream client stations or access points, or both. (AP mode).
- In wireless backhaul mode, the radio establishes a wireless link to a radio in AP mode on another Airgo AP in order to relay data through the wireless medium. The AP is not attached to a wired connection; instead it is connected through the wireless medium to another AP.<sup>1</sup> In this mode, the radio is called a Backhaul Point (BP mode). Wireless backhaul is also known as a wireless distribution system (WDS).

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<sup>1</sup>Except in certain special configurations.

**Figure 41: AP Radios and Coverage**

Use the Wireless Services items on the menu tree to access wireless parameters. The following rules apply to the wireless settings:

- Some of the settings apply globally (for both radios); others apply on a per-radio basis.
- For configuration and reference purposes, the individual radios are labeled `wlan0` and `wlan1`. The wired Ethernet interface is labeled `eth0`.
- Some of the commands apply only to one mode (AP or BP).
- If the radio is in BP mode, parameters are stored and later applied if and when the radio takes on the AP mode.

Each of the items in the Wireless Services menu leads to a specific area of radio configuration:

| Menu Item                | Description                                                                                  |
|--------------------------|----------------------------------------------------------------------------------------------|
| Radio Configuration      | General radio parameters                                                                     |
| Advanced Configuration   | 802.11 mode for each radio                                                                   |
| Radio State & Statistics | Detailed status and statistics for each radio                                                |
| Radio Neighbors          | Identity of neighboring APs within beacon range                                              |
| SSID Configuration       | Identification of the SSID parameters and assignment of service profiles                     |
| Backhaul Configuration   | Configuration of wireless backhaul links (See Chapter 6, “Configuring a Wireless Backhaul.”) |
| Station Management       | List of stations associated to the Airgo AP                                                  |
| IAPP Configuration       | Configuration of Inter-Access Point Protocol for roaming and load balancing                  |
| Radio Diagnostics        | Interface to perform link and walk tests                                                     |

To open one of the Wireless Services panels, choose the topic from the menu tree.

## Configuring Radio Parameters

Choose **Radio Configuration** from the Wireless Services menu to open the AP Radio Configuration panel. The panel contains the following tabs:

- Global Configuration — Set parameters that apply to both access point radios.
- Persona Configuration — Set the radio mode or persona for normal (AP) operation or wireless backhaul (BP).

- Channel Configuration — Configure channel usage for each radio.
- Performance and QoS — Configure enhanced data rates, performance attributes, and Wi-Fi Multimedia (WMM) quality of service support.
- Admission — Specify categories of client stations permitted to associate to the selected radio.

To configure settings on these tabs, select each in sequence, or step through using the Go links at the bottom of the panel (shown in Figure 42).

Many of the radio parameters are interdependent, and the Airgo AP performs consistency checks during configuration to prevent user actions from adversely affecting radio performance. This is especially true of dual radio APs, due to the proximity of the two radios. If you attempt to make configuration changes that are not accepted by the AP, an error message may or may not appear. Consult the appropriate section in this chapter to determine which parameters are in conflict.

## Global Configuration

Use the Global Configuration tab (Figure 42) to define settings that apply to all configured Airgo AP radios.

**NOTE:** All the settings on this tab are optional. If the AP radio is enabled when the global configuration is changed, then it is necessary to reset the AP for the changes to take effect. If the radio is disabled, the changes take effect once the radio is enabled.

**Figure 42: Radio Configuration - Global Config**

The screenshot shows the 'Global Configuration' tab of the Airgo AP configuration interface. At the top, there are tabs for 'GLOBAL CONFIG', 'ADMIN STATE', 'CHANNEL CONFIG', 'PERF & QOS', and 'ADMISSION'. The 'GLOBAL CONFIG' tab is selected. Below the tabs, there is a 'Wireless Services | Radio Configuration | Global Configuration' breadcrumb. A warning box states: 'The defaults for global radio configuration have been selected for the best operational radio behavior across a variety of environments. Changing these parameters will change radio behavior, which may impact AP performance. For example, disabling background scanning can impact self-healing wireless features.' Below the warning box, the 'Global Configuration (All Radios)' section contains a table of settings:

| Global Configuration (All Radios)  |                                                                                                      |
|------------------------------------|------------------------------------------------------------------------------------------------------|
| Network Connectivity               | <input checked="" type="radio"/> Any <input type="radio"/> Wired-Only <input type="radio"/> Wireless |
| Network Density                    | <input checked="" type="radio"/> Low <input type="radio"/> Medium <input type="radio"/> High         |
| <b>World Mode</b>                  |                                                                                                      |
| Multi Domain Support               | <input type="radio"/> Disable <input checked="" type="radio"/> Enable                                |
| Country Code                       | <input type="checkbox"/> Default                                                                     |
|                                    | US ( United States )                                                                                 |
| Deployment Environment             | <input checked="" type="radio"/> Any <input type="radio"/> Indoor <input type="radio"/> Outdoor      |
| <b>Miscellaneous Configuration</b> |                                                                                                      |
| AP Name in Beacon *                | AP-00:0a:f5:00:02:1f                                                                                 |
| Background Scanning                | <input type="radio"/> Disable <input checked="" type="radio"/> Enable                                |

At the bottom of the configuration table, there are 'APPLY' and 'RESET' buttons. Below the table, there is a list of configuration steps with 'GO >>' links:

- Next (Configure Basic Radio Settings) [GO >>](#)
- Configure SSID for Radios [GO >>](#)
- Configure Backhaul [GO >>](#)

Set the following global parameters on this tab:

| Field                             | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Network Connectivity              | <p>Specify the mode of connectivity to the wired network.</p> <ul style="list-style-type: none"> <li>The default value of Any means that the AP auto-determines whether to initiate a backhaul based on the presence or absence of an active Ethernet link. The Any setting is influenced by the number of radios in the Airgo AP and whether the AP has active Ethernet connectivity. If Any is selected, the Airgo AP is allowed to change between wireless and wired mode based on a change in Ethernet status.</li> <li>The Wired-Only setting means that the Airgo AP operates only as a wired node. The node is disabled if the Ethernet link is not active. All radios take on the AP persona unless explicitly configured as a BP radio.</li> <li>The Wireless value means that the AP operates only as a wireless backhaul node with wireless backhaul connectivity to the wired network. One radio is automatically assigned the BP persona and one the AP persona. Applies to dual radio APs only.</li> </ul> <p>The default setting of Any is recommended.</p> |
| Network Density                   | <p>Set the wireless network density (low, medium, or high). Moving APs closer to each other increases wireless capacity by providing higher data rates to clients. To support this configuration, select the high density option. For maximum coverage at lower data rates, use the low density setting. Each setting determines the defer threshold parameters for the Airgo AP. The default is low; the default setting of “low” is appropriate for maximum coverage.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| World Mode - Multi-Domain Support | <p>Enables or disables 802.11d operation. If Enable is selected, the radio advertises country, channel, and associated maximum transmit power information in beacons and probe responses to stations or clients in the BSS. The default setting is enabled.</p> <p><b>NOTE:</b> The World Mode Country Code may be statically assigned to a particular country due to restrictions prohibiting end-user selection of frequency and transmit power by some Regulatory Agencies. Refer to the system specifications for the AP being configured to determine the country in which this AP is licensed to operate. Currently, the MIC in Japan and the FCC in the United States require products producing radio waves in the 2.4 and 5GHz bands to adhere to frequency (channel) and transmit power requirements and prohibit end-user selection of alternative frequencies (channels) and transmit power.</p>                                                                                                                                                               |
| World Mode - Country Code         | <p>Specify the country of operation of the AP. Select <b>Default</b> to set the channel and power for the radio to the factory default country setting (U.S.). Alternatively, enter a country code from the pull-down menu.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

| Field (continued)                   | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| World Mode - Deployment Environment | <p>Specify the type of environment in which the AP is installed (indoor, outdoor, or both). Choosing the environment and country influences the channels of operation that the AP or BP operate in or use for scanning and the maximum radio transmit power. If the country or environment is changed, the following occur:</p> <ul style="list-style-type: none"> <li>The channel selection setting is reset to auto-select channel at startup. To configure a radio on a specific channel, apply the country configuration and then specify the channel using the Channel Configuration tab (see “Channel Configuration” on page 68).</li> <li>The channel set configuration is set to system-determined band configuration.</li> <li>All radios in the AP are reset.</li> </ul> <p>For reference, Table 9 provides a list of world modes, including countries, environments, bands, and valid channels.</p> |
| AP Name in Beacon                   | Confirm the AP node name advertised in beacons and probe responses. This is the AP name that clients see when they scan for access points. The default is the unique ID derived from the Ethernet MAC address of the AP. It is recommended that you accept the default setting. (required, AP radio only)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Background Scanning                 | Enable or disable background scanning. Background scanning is performed to collect radio interference and radio neighbor information from the surrounding RF environment. If auto-select-channel is enabled with the Periodic option, background scanning should also be enabled. See “Channel Configuration” on page 68.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

Click **Apply** to save changes or **Reset** to return to previously saved values.

**Table 9: World Modes**

| Country     | Environment | Band | Valid Channel Numbers                   |
|-------------|-------------|------|-----------------------------------------|
| USA, Canada | Any         | 2.4  | 1,2,3,4,5,6,7,8,9,10,11                 |
| USA, Canada | Indoor      | 2.4  | 1,2,3,4,5,6,7,8,9,10,11                 |
| USA, Canada | Outdoor     | 2.4  | 1,2,3,4,5,6,7,8,9,10,11                 |
| USA, Canada | Any         | 5    | 52,56,60,64,149,153,157,161             |
| USA, Canada | Indoor      | 5    | 36,40,44,48,52,56,60,64,149,153,157,161 |
| USA, Canada | Outdoor     | 5    | 52,56,60,64,149,153,157,161             |
| Mexico      | Any         | 2.4  | 1,2,3,4,5,6,7,8,9,10,11                 |
| Mexico      | Indoor      | 2.4  | 1,2,3,4,5,6,7,8,9,10,11                 |
| Mexico      | Outdoor     | 2.4  | 1,2,3,4,5,6,7,8,9,10,11                 |
| Mexico      | Any         | 5    | 149,153,157,161                         |
| Mexico      | Indoor      | 5    | 36,40,44,48,52,56,60,64,149,153,157,161 |
| Mexico      | Outdoor     | 5    | 149,153,157,161                         |
| Argentina   | Any         | 2.4  | 1,2,3,4,5,6,7,8,9,10,11                 |
| Argentina   | Indoor      | 2.4  | 1,2,3,4,5,6,7,8,9,10,11                 |
| Argentina   | Outdoor     | 2.4  | 1,2,3,4,5,6,7,8,9,10,11                 |
| Argentina   | Any         | 5    | 52,56,60,64,149,153,157,161             |
| Argentina   | Indoor      | 5    | 52,56,60,64,149,153,157,161             |

**Table 9:World Modes (continued)**

| <b>Country</b> | <b>Environment</b> | <b>Band</b> | <b>Valid Channel Numbers</b> |
|----------------|--------------------|-------------|------------------------------|
| Argentina      | Outdoor            | 5           | 52,56,60,64,149,153,157,161  |
| Brazil         | Any                | 2.4         | 1,2,3,4,5,6,7,8,9,10,11      |
| Brazil         | Indoor             | 2.4         | 1,2,3,4,5,6,7,8,9,10,11      |
| Brazil         | Outdoor            | 2.4         | 1,2,3,4,5,6,7,8,9,10,11      |
| Brazil         | Any                | 5           | 149,153,157,161              |
| Brazil         | Indoor             | 5           | 149,153,157,161              |
| Brazil         | Outdoor            | 5           | 149,153,157,161              |

Countries listed under the heading Europe include major European countries not explicitly listed by name in this table.

|         |         |     |                                                                      |
|---------|---------|-----|----------------------------------------------------------------------|
| Europe  | Any     | 2.4 | 1,2,3,4,5,6,7,8,9,10,11,12,13                                        |
| Europe  | Indoor  | 2.4 | 1,2,3,4,5,6,7,8,9,10,11,12,13                                        |
| Europe  | Outdoor | 2.4 | 1,2,3,4,5,6,7,8,9,10,11,12,13                                        |
| Europe  | Any     | 5   | 100,104,108,112,116,120,124,128,132,126,140                          |
| Europe  | Indoor  | 5   | 36,40,44,48,52,56,60,64,100,104,108,112,116,120,124,128,132, 126,140 |
| Europe  | Outdoor | 5   | 100,104,108,112,116,120,124,128,132,126,140                          |
| France  | Any     | 2.4 | 9                                                                    |
| France  | Indoor  | 2.4 | 9                                                                    |
| France  | Outdoor | 2.4 | 9                                                                    |
| France  | Any     | 5   | Not allowed                                                          |
| France  | Indoor  | 5   | 36,40,44,48,52,56,60,64                                              |
| France  | Outdoor | 5   | 9,10,11,12,13                                                        |
| Austria | Any     | 2.4 | 1,2,3,4,5,6,7,8,9,10,11,12,13                                        |
| Austria | Indoor  | 2.4 | 1,2,3,4,5,6,7,8,9,10,11,12,13                                        |
| Austria | Outdoor | 2.4 | 1,2,3,4,5,6,7,8,9,10,11,12,13                                        |
| Austria | Any     | 5   | Not allowed                                                          |
| Austria | Indoor  | 5   | 36,40,44,48,52,56,60,64                                              |
| Austria | Outdoor | 5   | Not Allowed                                                          |
| Belgium | Any     | 2.4 | 1,2,3,4,5,6,7,8,9,10,11,12,13                                        |
| Belgium | Indoor  | 2.4 | 1,2,3,4,5,6,7,8,9,10,11,12,13                                        |
| Belgium | Outdoor | 2.4 | 1,2,3,4,5,6,7,8,9,10,11,12,13                                        |
| Belgium | Any     | 5   | Not allowed                                                          |
| Belgium | Indoor  | 5   | 36,40,44,48,52,56,60,64                                              |
| Belgium | Outdoor | 5   | Not Allowed                                                          |
| Spain   | Any     | 2.4 | 10,11                                                                |
| Spain   | Indoor  | 2.4 | 10,11                                                                |
| Spain   | Indoor  | 2.4 | 10,11                                                                |
| Spain   | Any     | 5   | 100,104,108,112,116,120,124,128,132,126,140                          |

**Table 9: World Modes (continued)**

| <b>Country</b> | <b>Environment</b> | <b>Band</b> | <b>Valid Channel Numbers</b>                                        |
|----------------|--------------------|-------------|---------------------------------------------------------------------|
| Spain          | Indoor             | 5           | 36,40,44,48,52,56,60,64,100,104,108,112,116,120,124,128,132,126,140 |
| Spain          | Outdoor            | 5           | 100,104,108,112,116,120,124,128,132,126,140                         |
| Switzerland    | Any                | 2.4         | 1,2,3,4,5,6,7,8,9,10,11,12,13                                       |
| Switzerland    | Indoor             | 2.4         | 1,2,3,4,5,6,7,8,9,10,11,12,13                                       |
| Switzerland    | Outdoor            | 2.4         | 1,2,3,4,5,6,7,8,9,10,11,12,13                                       |
| Switzerland    | Any                | 5           | Not allowed                                                         |
| Switzerland    | Indoor             | 5           | 36,40,44,48                                                         |
| Switzerland    | Outdoor            | 5           | Not Allowed                                                         |
|                |                    |             |                                                                     |
| Japan          | Any                | 2.4         | 1,2,3,4,5,6,7,8,9,10,11,12,13,14                                    |
| Japan          | Indoor             | 2.4         | 1,2,3,4,5,6,7,8,9,10,11,12,13,14                                    |
| Japan          | Outdoor            | 2.4         | 1,2,3,4,5,6,7,8,9,10,11,12,13,14                                    |
| Japan          | Any                | 5           | 34,38,42,46                                                         |
| Japan          | Indoor             | 5           | 34,38,42,46                                                         |
| Japan          | Outdoor            | 5           | 34,38,42,46                                                         |
|                |                    |             |                                                                     |
| Singapore      | Any                | 2.4         | 9,10,11,12,13                                                       |
| Singapore      | Indoor             | 2.4         | 9,10,11,12,13                                                       |
| Singapore      | Outdoor            | 2.4         | 9,10,11,12,13                                                       |
| Singapore      | Any                | 5           | 52,56,60,64,149,153,157,161                                         |
| Singapore      | Indoor             | 5           | 36,40,44,48,52,56,60,64,149,153,157,161                             |
| Singapore      | Outdoor            | 5           | 52,56,60,64,149,153,157,161                                         |
|                |                    |             |                                                                     |
| Israel         | Any                | 2.4         | 4,5,6,7,8,9                                                         |
| Israel         | Indoor             | 2.4         | 4,5,6,7,8,9                                                         |
| Israel         | Outdoor            | 2.4         | 4,5,6,7,8,9                                                         |
| Israel         | Any                | 5           | 52,56,60,64,149,153,157,161                                         |
| Israel         | Indoor             | 5           | 36,40,44,48,52,56,60,64,149,153,157,161                             |
| Israel         | Outdoor            | 5           | 52,56,60,64,149,153,157,161                                         |

## Admin State Configuration

Use the Admin State tab (Figure 43) to assign the mode or persona of each radio interface.

**Figure 43: Radio Configuration - Admin State**

**Wireless Services | Radio Configuration | Admin State »**

The default configuration settings for Admin State and Radio Persona have been selected for the best radio behavior across a variety of environments. Changing these parameters will change radio behavior, which may impact AP and wireless network performance. Radio persona can be either as an access point (AP), a wireless backhaul (BP) or any one of these two.

**Radio Interface Selection**

Select Radio Interface: wlan1

**Radio Admin State Configuration**

Current Operation State: enable

Admin State of Selected Radio: ☐ Disable ☒ Enable

**Radio Persona Configuration**

Current Radio Persona: AP

Persona of Selected Radio: ☒ Any ☐ AP ☐ BP

Back (Configure Global Radio Settings) GO »

Next (Configure Radio Channels) GO »

Set the following parameters on this tab:

| Feature                       | Description                                                                                                                                                                                                                                                                                                                    |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Select Radio Interface        | Select the AP radio (wlan0 or wlan1).                                                                                                                                                                                                                                                                                          |
| Current Operation State       | Displays the current operational state of the radio.                                                                                                                                                                                                                                                                           |
| Admin State of Selected Radio | Enable or disable the selected radio. When the AP radio is in the disabled state, all valid configuration settings are saved. When the AP radio is enabled, the latest configuration is applied. It is not possible to disable the BP radio by administrative intervention. Only the AP radio may be disabled.                 |
| Current Radio Persona         | Displays the current mode of operation of the radio.                                                                                                                                                                                                                                                                           |
| Persona of Selected Radio     | Select whether the AP radio is to operate as a normal AP (AP) or in backhaul point mode (BP). Select <b>Any</b> to determine the radio mode automatically based on network connectivity, configuration, number of radios, and presence of Ethernet connectivity. It is recommended that you accept the default setting of Any. |



**NOTE:** Each access point can have at most one BP radio.

Click **Apply** to save changes or **Reset** to return to previously saved values.

### Admin State Interdependencies

If Network Connectivity on the Radio Global tab (“Global Configuration” on page 61) is set to Wireless, then at least one radio must have the BP or Any persona. If the Network Connectivity setting is Wired or Any, then the personas of AP, BP, and Any are all permitted.

Table 10 shows how the Network Connectivity setting on the Global Configuration tab relates to the Radio Persona Configuration on the Admin state tab.

**Table 10: Radio Settings for Network Connectivity and Persona**

| Number of Radios | Wired Connection <sup>a</sup> | Network Connectivity Setting | Persona Setting                          | Resulting Radio Persona or Mode |
|------------------|-------------------------------|------------------------------|------------------------------------------|---------------------------------|
| One              | Yes                           | Any                          | Any or AP                                | AP                              |
| One              | Yes                           | Any                          | BP                                       | BP                              |
| Two              | Yes                           | Any                          | All combinations of Any and AP           | Both radios AP                  |
| Two              | Yes                           | Any                          | All combinations that specify a BP radio | 1 radio AP, 1 radio BP          |
| Two              | No                            | Any                          | One radio set as BP                      | 1 radio AP, 1 radio BP          |
| Two              | No                            | Any                          | Both radios AP                           | Not permitted                   |
| One              | Yes                           | Wired                        | Any                                      | AP                              |
| Two              | Yes                           | Wired                        | All combinations of Any and AP           | Both radios AP                  |
| Two              | No                            | Wireless                     | All combinations except both radios AP   | 1 radio AP, 1 radio BP          |
| Two              | No                            | Wireless                     | Both radios AP                           | Not permitted                   |

<sup>a</sup>Wired Connection means that the AP has Ethernet connectivity and that the connection is active.

## Channel Configuration

Use the Channel Configuration tab (Figure 44) to define rules for selecting radio channels. If two radios are installed in the same AP, each radio operates in a different band (2.4GHz for one radio and 5GHz for the other).

**Figure 44: Radio Configuration - Channel Config**

The screenshot shows the 'Channel Configuration' tab selected in the top navigation bar. The interface includes a breadcrumb trail: 'Wireless Services | Radio Configuration | Channel Configuration'. A note box states: 'To maximize network throughput, check Automatic Channel Selection with a periodic evaluation of every 30 minutes. The Channel Set can be restricted to either a specific band or to an explicit channel-list, if required.'

**Radio Interface Selection**

Select Radio Interface: wlan1

**Channel Configuration**

Channel Number: ☐

Automatic Channel Selection: ☒ periodic (in minutes) 30

**Channel Set Configuration**

Channel Set: ☒ Band System determined band

☐ Channel-list (ex: 1 2...)

Buttons: APPLY, RESET

**Reselect Channel**

Current Channel ID: 64

Force Select Best Channel:

Navigation links:

- Back (Configure Basic Radio Settings)
- Next (Configure Radio Performance)
- Configure QOS

Set the following values in the Radio Interface Selection and Channel Configuration areas of the tab:

| Feature                | Description                                                                                   |
|------------------------|-----------------------------------------------------------------------------------------------|
| Select Radio Interface | Select the AP radio (wlan0 or wlan1).                                                         |
| Channel Number         | Select a valid channel for radio operation, or accept the Automatic Channel Selection option. |

| Feature (continued)         | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Automatic channel selection | Specify whether the channel is chosen when the AP is started, or whether it is selected periodically. The time range for periodic channel selection is 30 minutes to 24 hours (1440 minutes). It is recommended that you accept the default setting of automatic channel selection of periodic at 30 minutes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Channel Set                 | <p>Determine which channels the AP scans in order to determine the best channel for operation. If Auto-Selection is enabled, this determines the channel set for auto-selection. The following choices are available for channel set:</p> <p>Band — Select a specific band, or the system-determined band option (recommended).</p> <ul style="list-style-type: none"> <li>• The System determined band setting means that the system chooses the channel list or band for each radio based on the number of AP radios, the persona of the radio, and the channel set of any second radio in the AP. If the radio is in AP mode, the node selects the best channel across both bands. If the radio is in BP mode, the BP radio scans on both bands.</li> <li>• If the Airgo AP is configured with two AP radios and Auto-Selection is chosen for both, the preferred band configuration for both radios is System determined. If both radios are in AP mode, one operates in the 2.4GHz band and the other in the 5GHz band.</li> <li>• If the band is 2.4 or 5GHz, the AP radio operates only in the specified band. If it is set to 2.4GHz, the AP chooses only non-overlapping channels for operation (for example 1, 6, and 11). It is not possible to set both radios to operate in the 2.4GHz or 5GHz band.</li> <li>• If both bands are selected, the AP radio chooses the best channel based on the mode and band of the other radio on the AP (if installed).</li> <li>• If a BP radio establishes a backhaul in the same band as the other AP radio, this triggers the AP radio to change bands, provided that the AP radio is configured for auto-selection and the system determined band.</li> </ul> <p>Channel List — Enter a specific list of channels to be scanned, separated by a single space (e.g., 1 2 6 11 13...). Overlapping channels can be specified in the 2.4GHz band.</p> |

 **NOTE:** World mode and environment settings influence the channel and channel set configurations. See “Global Configuration” on page 61 for information on world modes.

Click **Apply** to save changes or **Reset** to return to previously saved values. Click **Reselect Channel** to force the channel selection algorithm for the AP radio to trigger, including a switch-over to a better channel, if available. The Reselect Channel button applies only to the selected AP radio interface.

## Performance and QoS

Use the Performance and QoS tab (Figure 45) to configure enhanced, True MIMO™ data rates of 72, 96, or 108 Mbps.

**Figure 45: Radio Configuration - Performance**

GLOBAL CONFIG ADMIN STATE CHANNEL CONFIG **PERF & QOS** ADMISSION HELP LOGOUT

Wireless Services | Radio Configuration | Performance & QOS >>

Where strict adherence to IEEE 802.11 standard modes of operation is not required, Performance Configuration settings provide for the selection of higher data rates with lower latency. Enhanced data rates of 72, 96, and 108 Mbps within a single channel are supported as is enhanced rate adaptation, which provides automatic data rate selection based on link quality.

**Radio Interface Selection**

Select Radio Interface wlan1

**Wireless Quality of Service (QoS)**

|                            |                              |                                          |
|----------------------------|------------------------------|------------------------------------------|
| Radio Persona              | Any                          |                                          |
| Wi-Fi Multimedia (WMM) QoS | <input type="radio"/> Enable | <input checked="" type="radio"/> Disable |
| IEEE 802.11e QoS           | <input type="radio"/> Enable | <input checked="" type="radio"/> Disable |

APPLY RESET

**Performance Configuration**

|                     |                                             |                               |
|---------------------|---------------------------------------------|-------------------------------|
| Enhanced Data Rates | <input checked="" type="radio"/> Enable     | <input type="radio"/> Disable |
| Rate Adaptation     | <input checked="" type="radio"/> Auto Adapt | Basic                         |
|                     | <input type="radio"/> Fixed                 | 1                             |
| Ack-mode            | immediate-ack                               |                               |

APPLY RESET

Back (Configure Radio Channel) GO >>  
 Next (Configure Dot11 Policy) GO >>  
 Configure QoS GO >>

Set the following values on this tab:

| Feature                | Description                           |
|------------------------|---------------------------------------|
| Select Radio Interface | Select the AP radio (wlan0 or wlan1). |

| Feature (continued)               | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Wireless Quality of Service (QoS) | <p>Select whether to enable wireless quality of service standards, and click <b>Apply</b> to save the settings. Click <b>Reset</b> to return to previously saved values.</p> <ul style="list-style-type: none"> <li>• Wi-Fi Multimedia (WMM) QoS: Enables or disables the Enhanced Distributed Channel Access (EDCA) mechanism in the MAC layer. If enabled, the MAC mode is set to EDCA and signaling between the AP and client station follow the procedures specified in the WMM specification. If disabled the MAC mode is set to DCF. Default is <b>Enable</b>.</li> <li>• IEEE 802.11e QoS: Enables or disables the Enhanced Distributed Channel Access (EDCA) mechanism in the MAC layer. If enabled, the MAC mode is set to EDCA and signaling between the AP and client station follow the procedures specified in the 802.11e specification. If disabled, then the MAC mode is DCF. Default is <b>Enable</b>. 802.11e QoS works only if the AP and client station both support True MIMO™.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Performance Configuration         | <p>Configure the following parameters, and then click <b>Apply</b> to save the values. Click <b>Reset</b> to return to previously saved values.</p> <ul style="list-style-type: none"> <li>• Enhanced Data Rates: Enable or disable the True MIMO™ enhanced data rates (72, 96, and 108 Mbps). This setting is rejected if the enhanced Dot11 extensions are disabled and an attempt is made to configure enhanced data rates. It is recommended that you accept the default of Enable.</li> <li>• Rate Adaptation: Enables or disables automatic data rate adaptation in the system. To use auto-adaptation, select the Auto Adapt button and select the Basic or Advanced option. Otherwise, select fixed, along with a fixed rate. It is recommended that you accept the default value of Auto Adapt and Basic.</li> <li>• Ack Mode: Determines the acknowledgement policy for data packets. The following selections are available: <ul style="list-style-type: none"> <li>• immediate-ack: Acknowledgement sent for every packet received (default)</li> <li>• burst-ack: Proprietary acknowledgement mode that increases peak throughput in environments where Airgo True MIMO data rates are reliably sustained</li> <li>• auto-ack-policy: No acknowledgement sent when data packets are received <ul style="list-style-type: none"> <li>- To enable high performance, use this setting together with one of the enhanced data rates.</li> <li>- If this setting is used, auto-adaptation cannot be enabled for the selected radio. Only the fixed rate setting applies.</li> <li>- This mode setting can be used for operations with Airgo clients.</li> </ul> </li> </ul> </li> </ul> |

Click **Apply** to save changes or **Reset** to return to previously saved values.

**Interdependencies**

The following restrictions apply to combinations of settings on the Channel Configuration and Performance and QoS tabs:

| Item                           | Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fixed data rate configurations | <ul style="list-style-type: none"><li>• If the configured channel is in the 5GHz band or the Channel Set Band/List is 5GHz, System Determined, or Both, then at least one of the fixed rates must be other than an 11b rate (1,2,5.5,or 11).</li><li>• If the configured channel is in the 2.4GHz band or the Channel Set Band/List is 2.4GHz only, then only 11b/g rates are accepted.</li></ul> <p>Assigning an enhanced rate (72, 96, and 108 Mbps) requires that the enhanced rates option be enabled.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Dot11 QoS settings             | <p>To enable the Dot11 QoS settings on the Performance tab, you must enable the standard Dot-11 extensions on the 802.11 Policy tab (see “802.11 Policy” on page 74).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Wireless Quality of Service    | <ul style="list-style-type: none"><li>• When both Wi-Fi Multimedia (WMM) QoS and IEEE 802.11e QoS are enabled, EDCA is enabled at the access point. Capability negotiations can be performed by WMM capable stations and also by 802.11e stations with the access point, and WMM and 802.11e IEs are advertised in beacons and probe responses.</li><li>• When WMM is enabled and 802.11e is disabled, EDCA is enabled at the access point. Capability negotiation with the access point can be performed only by WMM capable stations, as only WMM IEs are advertised in beacons and probe responses.</li><li>• When WMM is disabled and 802.11e is enabled, EDCA is enabled at the access point. Capability negotiation with the access point can be performed only by 802.11e capable stations, as only 802.11e IEs are advertised in beacons and probe responses.</li><li>• When both WMM and 802.11e are disabled, DCF mode is enabled at the access point. Neither the WMM or 802.11e is advertised in beacons and probe responses.</li></ul> |

## Admission

Use the Admission tab (Figure 46) to specify categories of client stations permitted to associate to the selected radio.

**Figure 46: Radio Configuration - Admission**

**Wireless Services | Radio Configuration | Admission »**

Admission Criteria provides parameters for restricting station or wireless backhaul link admission to the associate with this AP. For example, restricting admission to IEEE 802.11g only STAs would prevent IEEE 802.11b STAs from degrading wireless performance.

**Admission Criteria**

Select Radio Interface: wlan1

802.11b-g STA Admission Criteria

Accept Association From \*: ☐ 802.11g-only ☒ 802.11b-and-g

Multi-Vendor STA Admission Criteria

Multi Vendor Station \*: ☒ Accept ☐ Reject

Backhaul Admission Criteria

Accept Association From \*: ☒ STA-or-Trunk ☐ Trunk Only ☐ STA Only

Maximum Number of Trunks: 6

**APPLY** **RESET**

[Configure IAPP Settings](#) **GO >>**

Set the following values on this tab:

| Feature                                                    | Description                                                                                                                                                                                                                                                                  |
|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Select Radio Interface                                     | Select the AP radio (wlan0 or wlan1).                                                                                                                                                                                                                                        |
| 802.11b-g STA Admission Criteria - Accept Association from | Applies to the 2.4GHz band only. Specify the type of 802.11g-or 802.11b and g client stations permitted to associate. Selecting 802.11g-only keeps 802.11b stations from degrading BSS performance. 802.11b- and g- is the default setting.                                  |
| Multi-Vendor STA Admission Criteria - Multi-Vendor Station | Accept allows all stations to associate; Reject restricts association to compatible client stations, excluding non-compatible or non-Airgo Networks stations.                                                                                                                |
| Backhaul Admission Criteria - Accept Association From      | Indicates whether to accept association from client stations, trunks, or both:<br>STA-or-Trunk — Accept association from client stations or BP radios.<br>Trunk Only — Accept associations only from BP radios.<br>STA Only — Accept associations only from client stations. |
| Max Number of Trunks                                       | Determines the maximum number of trunks allowed to form with the AP radio (range is 1-10). Default is 6.                                                                                                                                                                     |

## Setting the Advanced Radio Configuration

Select **Advanced Configuration** from the Wireless Services menu to open the Advanced Configuration feature panel. The panel contains the following tabs:

- 802.11 Policy — Set the 802.11 modes for the AP radios.
- MAC Configuration —Set details of the radio beacon and MAC configuration for each radio.

To configure settings on these tabs, select each in sequence, or step through the tabs using the Go links at the bottom of the panel.

### 802.11 Policy

Use the 802.11 tab (Figure 47) to set the 802.11 modes and data rates for each AP radio.

**Figure 47: Advanced Configuration - 802.11 Policy**

The screenshot shows the 'IEEE 802.11 Policy' configuration panel. At the top, there are tabs for '802.11 POLICY' and 'MAC CONFIG', along with 'HELP' and 'LOGOUT' buttons. Below the tabs is a breadcrumb trail: 'Wireless Services | Advanced Configuration | IEEE 802.11 Policy >>'. A text box explains that the IEEE 802.11 Policy affects advertised capabilities in beacons and provides instructions on choosing modes and enabling extensions. The main configuration area is titled 'IEEE 802.11 Policy Configuration' and includes a 'Select Radio Interface' dropdown set to 'wlan1'. Under 'IEEE 802.11 Configuration', there are radio buttons for '802.11b Only' and '802.11g' (selected), checkboxes for 'IEEE 802.11 Extensions' (Standard and Enhanced, both checked), and a checkbox for '802.11G Protection'. The 'Select Basic Rate Set (Standard Rates in Mbps)' section has three input fields: '802.11a Basic Rate Set' (6 12 24), '802.11g Rate Set' (6 12 24) with a 'Clear' button, and '802.11b Rate Set' (1 2 5.5 11). At the bottom are 'APPLY' and 'RESET' buttons. Navigation links at the very bottom allow going back to 'Configure Radio Performance' or forward to 'Configure MAC-Operational settings'.

Set the following values on this panel:

| Feature                      | Description                                                                                                  |
|------------------------------|--------------------------------------------------------------------------------------------------------------|
| Select Radio Interface       | Select the AP radio (wlan0 or wlan1).                                                                        |
| IEEE 802.11 Mode in 2.4 Band | Select whether the radio is configured for 802.11b or 802.11g operation when it operates in the 2.4GHz band. |

| Feature (continued)    | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IEEE 802.11 Extensions | <p>Enable 802.11 Standard Extensions to turn on support for 802.11e-h-i-g modes. Select 802.11 Enhanced Extensions to support higher data rates between the AP and compatible stations. If the Enhanced option is selected, then it is possible to enable the following through the command line interface (they are not automatically enabled).</p> <ul style="list-style-type: none"> <li>Enhanced rate set (specific flag needs to be set).</li> <li>Proprietary burst ack. This is a proprietary acknowledgement mode that increases peak throughput in environments where Airgo True MIMO data rates are reliably sustained.</li> <li>Advanced rate adaptation.</li> <li>Wireless backhaul AP name in beacon (if not enabled, the AP name in beacon is suppressed).</li> </ul> |
| 802.11G Protection     | <p>Select to enable 802.11g protection mode, short slot time, and short preamble if the radio is operating in 802.11g mode.</p> <p>If the checkbox is selected, all three aspects are enabled; if not, all three aspects are disabled. The default setting is Disabled.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Select Basic Rate Set  | <p>Enter basic data rates for the different 802.11 modes. To set rates, select <b>Set</b> and enter the rates with a space as the delimiter. The basic 802.11 rates are advertised in beacons and inform the client stations of the minimum set of rates it must support to be part of the BSS. 802.11 control frames such as ACKS, CTS, and RTS are transmitted at basic rates.</p>                                                                                                                                                                                                                                                                                                                                                                                                |

Click **Apply** to save changes or **Reset** to return to previously saved values.

## MAC Configuration

Use the MAC Configuration tab (Figure 48) under special circumstances if it is necessary to tune low level operational parameters of the radio Medium Access Control (MAC) layer.

**NOTE:** Changes on the MAC Configuration tab should only be made by trained network personnel. The AP radio restarts automatically when these parameter changes are applied.

**Figure 48: MAC Configuration Tab**

The screenshot shows a web interface for configuring the MAC layer. At the top, there are tabs for '802.11 POLICY' and 'MAC CONFIG', with 'MAC CONFIG' being the active tab. To the right of the tabs are 'HELP' and 'LOGOUT' buttons. Below the tabs, the breadcrumb 'Wireless Services | Advanced Configuration | MAC Configuration' is displayed. A text box contains a note about default settings. The main configuration area is titled 'Radio MAC Configuration' and includes a dropdown for 'Select Radio Interface' (set to 'wlan1'). Below this are two sections: 'Beacon Configuration' with fields for 'Beacon Period (Milliseconds)' (100) and 'DTIM Period (n x Beacon Period)' (1), and 'Threshold Configuration' with fields for 'Fragmentation Threshold' (2000), 'RTS Threshold' (2347), 'Short Retry Limit' (100), and 'Long Retry Limit' (100). At the bottom of the configuration area are 'APPLY' and 'RESET' buttons. At the very bottom of the page, there is a 'Back (Configure Dot11 Policy)' link and a 'GO >>' button.

| Radio MAC Configuration           |       |
|-----------------------------------|-------|
| Select Radio Interface            | wlan1 |
| Beacon Configuration              |       |
| Beacon Period (Milliseconds) *    | 100   |
| DTIM Period (n x Beacon Period) * | 1     |
| Threshold Configuration           |       |
| Fragmentation Threshold           | 2000  |
| RTS Threshold                     | 2347  |
| Short Retry Limit                 | 100   |
| Long Retry Limit                  | 100   |

APPLY RESET

Back (Configure Dot11 Policy) GO >>

Set the following parameters on the MAC Configuration tab:

| Field                                             | Description                                                                                                                                                                                                                                                                                                        |
|---------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Select Radio Interface                            | Select the AP radio (wlan0 or wlan1).                                                                                                                                                                                                                                                                              |
| Beacon Period                                     | Enter the desired interval between RF beacons in milliseconds. It is recommended that you accept the default of 100 ms. (required).                                                                                                                                                                                |
| DTIM (delivery traffic indication message) Period | Enter the frequency, in beacon periods, at which the radio forwards multicast and broadcast packets to client stations. It is recommended that you accept the default of 1 beacon period. (required).                                                                                                              |
| Fragmentation Threshold                           | Enter the maximum packet size that can be transmitted as a single unit. A low setting may be desirable in areas that have significant interference or poor signal conditions. The range is 256-2346. It is recommended that you accept the default of 2000.                                                        |
| RTS Threshold                                     | Enter a packet size greater than which the AP issues a request-to-send (RTS) message before sending the packet. Enter a low threshold if the ambient conditions might make it relatively difficult for clients to associate to the AP. The range is 0-2347. It is recommended that you accept the default of 2347. |
| Short Retry Limit                                 | Enter a number of transmission retries (greater than or equal to data frame MSDU size) after which a transmission is deemed a failure. The range is 0-255.                                                                                                                                                         |
| Long Retry Limit                                  | Enter a number of transmission retries (greater than or equal to data frame MSDU size) after which a transmission is deemed a failure. The range is 0-255.                                                                                                                                                         |

Click **Apply** to save changes or **Reset** to return to previously saved values. The changes take effect immediately if the radio is enabled.

## Viewing Radio Statistics

Select **Radio State & Statistics** from the Wireless Services menu to view the current state of each radio and the current communication statistics. This panel contains the following tabs:

- Radio State — View current configuration.
- Radio Statistics — View information about current transmission activity.

### Radio State

The Radio State tab (Figure 49) contains details on the current configuration and utilization of each radio interface. The state information varies according to whether the radio is operating as a normal access point radio (AP mode) or as a backhaul point (BP mode).