UBIQUITI
NETWORKS

airOS® 5

Operating System for Ubiquiti® M Series Products

Release Version: 5.6

USER GUIDE

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Chapter 1: Overview

Introduction

Welcome to airOS® v5.6 – the latest evolution of the airOS Configuration Interface by Ubiquiti Networks. airOS v5.6 provides numerous updates, including:

- Private SNMP MIB
- IPv6 Support
- QoS for VLANs
- Password Length increased to More than 8 Symbols
- TCP Support for Remote System Logging
- WPA-AES/WPA2-AES Security Only (WEP optional for AP-Repeater mode)
- 5 MHz Increments Available for Frequency Selection When 5 GHz Devices Operate in airMAX® Mode (instead of channel shifting)

airOS is an advanced operating system capable of powerful wireless and routing features, built upon a simple and intuitive user interface foundation.

This User Guide describes the airOS operating system version 5.6, which is integrated into all M Series products provided by Ubiquiti Networks.

Note: For compatibility, legacy or 802.11 a/b/g devices should use legacy firmware with airMAX support (such as airOS firmware v4.0). Legacy clients can only work as airMAX clients with the M Series device acting as an airMAX AP.

Supported Products

airOS v5.6 supports the M Series product versions, including the following:

- airRouter™
- Rocket™M
- Rocket™M GPS
- Rocket™M Titanium
- NanoBeam®M
- NanoBridge®M
- NanoStation®locoM/NanoStationM
- Bullet™M
- Bullet™M Titanium
- PicoStation®M
- PowerBeam™M
- PowerBridge®M
- airGrid®M
- WispStation™M
- airGateway™

For more information, visit: **www.ubnt.com**

airOS v5.6 Network Modes

airOS supports the following network modes:

- Transparent Layer 2 Bridge
- Router
- SOHO Router

airOS v5.6 Wireless Modes

airOS supports the following wireless modes:

- Access Point
- Station / Client
- AP-Repeater

System Requirements

- Microsoft Windows 7/8, Linux, or Mac OS X
- Java Runtime Environment 1.6 (or above)
- Web Browser: Mozilla Firefox, Apple Safari, Google Chrome, or Microsoft Internet Explorer 8 (or above)

Getting Started

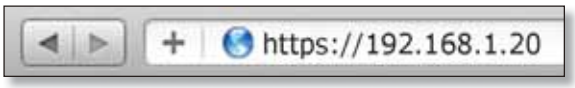
To access the airOS Configuration Interface, perform the following steps:

1. Configure the Ethernet adapter on your computer with a static IP address on the 192.168.1.x subnet (for example, IP address: *192.168.1.100* and subnet mask: *255.255.255.0*).
2. Launch your web browser. Enter **https://** and the default IP address of your device in the address field. Press **Enter** (PC) or **Return** (Mac).

Device	Default IP Address
airRouter	192.168.1.1
Other Devices	192.168.1.20

Note: HTTPS is the default protocol starting with airOS v5.5.4.

For example, enter **192.168.1.20** to access the Rocket.



3. Upon initial login, the *Terms of Use* appear on the login screen. Enter **ubnt** in the *Username* and *Password* fields, and select the appropriate choices from the *Country* and *Language* drop-down lists. Check the box next to *I agree to these terms of use*, and click **Login**.

4. Upon subsequent login, the standard login screen appears. Enter **ubnt** in the *Username* and *Password* fields, and click **Login**.

Note: To enhance security, we recommend that you change the default login in *System* > *System Accounts*. For details, go to **"System Accounts" on page 54**.

M Series Product Verification

Starting with M series product models manufactured in 2012, the airOS Configuration Interface (v5.5.2 or later) will verify whether a product is genuine or counterfeit.

Prior to 2012

For M series product models manufactured prior to 2012, airOS will NOT display any logo in the lower left corner of the screen.

Starting in 2012

For new M series product models introduced in 2012 or later, airOS will display a Genuine Product logo in the lower left corner of the screen.

New production versions of existing M series product models began using the Genuine Product logo in 2012. (Not all M series product models manufactured in 2012 will display a Genuine Product logo.)

For any M series product that is not an official Ubiquiti product, airOS will display a counterfeit warning. Please contact Ubiquiti at **support@ubnt.com** regarding this product.

Note: If neither the Genuine Product logo nor counterfeit warning appears, the device was manufactured prior to the genuine product verification process and is probably genuine. If you have any questions, please email **support@ubnt.com**.

Navigation

The airOS Configuration Interface contains seven main pages, each of which provides a web-based management page to configure a specific aspect of the Ubiquiti device:

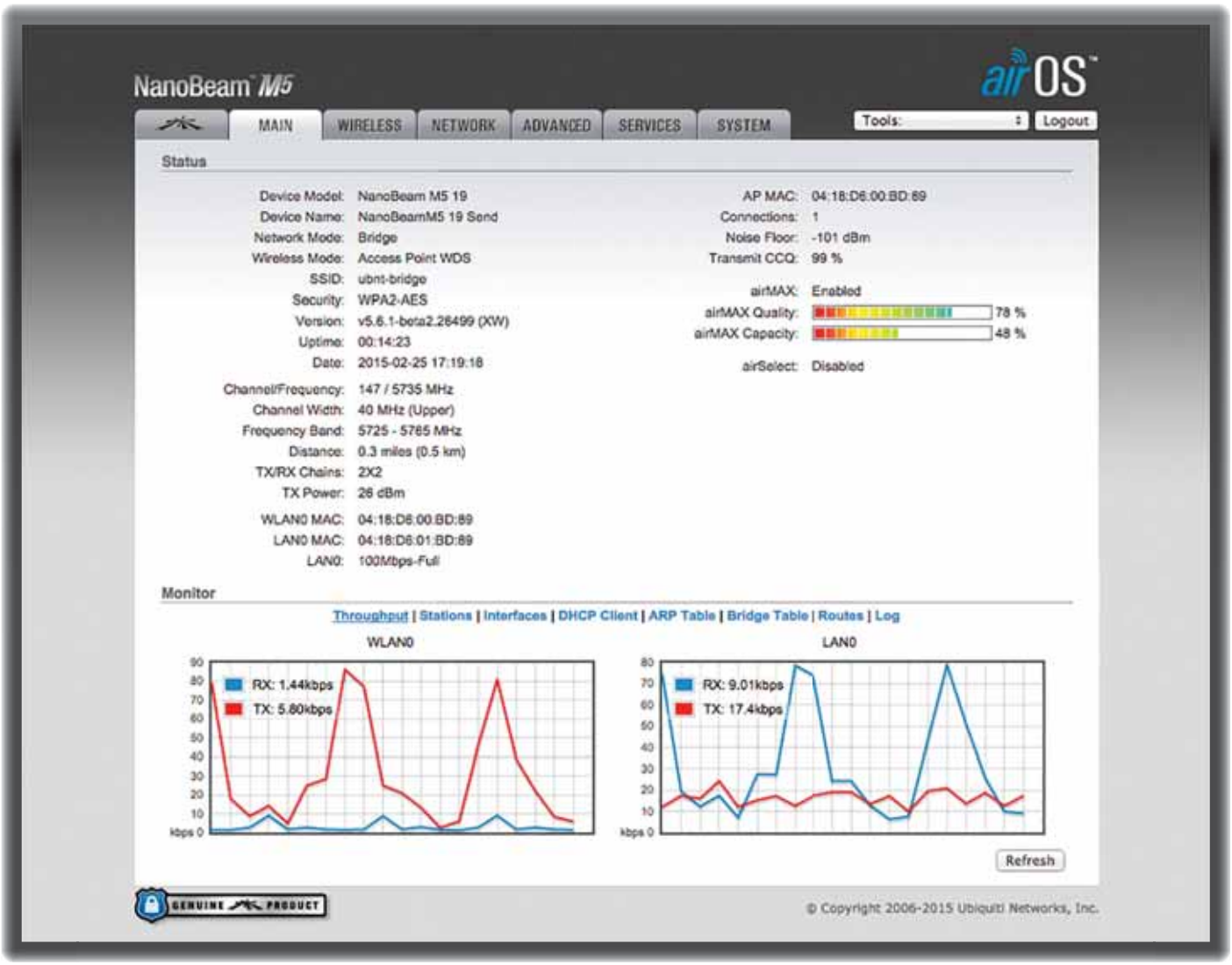
- **Ubiquiti Logo** The **"Ubiquiti Logo" on page 15** controls Ubiquiti's proprietary technologies, such as airMAX, airView, airSelect, and airSync (GPS Series devices only).

  Note: By default, indoor products, such as the airRouter, do not display the *Ubiquiti logo* page. However, you can enable the *Ubiquiti logo* page through *System* > *Miscellaneous* > *airMAX Technology Features*. For more information, see **"Miscellaneous" on page 55**.

- **Main** The **"Main" on page 5** displays device status, statistics, and network monitoring links.
- **Wireless** The **"Wireless" on page 23** configures basic wireless settings, including the wireless mode, Service Set Identifier (SSID), 802.11 mode, channel and frequency, output power, data rate module, and wireless security.
- **Network** The **"Network" on page 31** configures the network operating mode; Internet Protocol (IP) settings; IP aliases; VLANs; packet filtering, bridging, and routing routines; and traffic shaping.
- **Advanced** The **"Advanced" on page 45** provides more precise wireless interface controls, including advanced wireless settings, advanced Ethernet settings, and signal LED thresholds.
- **Services** The **"Services" on page 49** configures system management services: Ping Watchdog, Simple Network Management Protocol (SNMP), servers (web, SSH, Telnet), Network Time Protocol (NTP) client, Dynamic Domain Name System (DDNS) client, system log, and device discovery.
- **System** The **"System" on page 53** controls system maintenance routines, administrator account management, location management, device customization, firmware update, and configuration backup. You can also change the language of the web management interface.

Each page also contains network administration and monitoring tools:

- **"Align Antenna" on page 57**
- **"Site Survey" on page 57**
- **"Discovery" on page 58**
- **"Ping" on page 58**
- **"Traceroute" on page 59**
- **"Speed Test" on page 59**
- **"airView" on page 60**



Chapter 2: Main

The *Main* page displays a summary of the link status information, current values of the basic configuration settings (depending on the operating mode), network settings and information, and traffic statistics.

Status

Device Name Displays the customizable name or identifier of the device. The Device Name (also known as host name) is displayed in registration screens and discovery tools.

Network Mode Displays the network operating mode. airOS supports three modes: *Bridge*, *Router*, and *SOHO Router*. The default setting is device-specific. Configure the *Network Mode* on the *Network* page (for details, refer to **"Network Role" on page 31**).

Wireless Mode Displays the operating mode of the radio interface. airOS supports three operating modes: *Station*, *Access Point*, and *AP-Repeater*. The default setting is device-specific. Configure the *Wireless Mode* on the *Wireless* page. If *Station* or *Access Point* mode is enabled, then you can also select **WDS** (Wireless Distribution System) as needed.

airOS also supports *airView* (spectrum analyzer) mode, a temporary mode that terminates all wireless connections. To select *airView* mode, click **Tools** > **airView** or click **Launch airView** on the *Ubiquiti Logo* page. When the device is running in *airView* mode, all wireless connections will be terminated during the airView session. Close the **airView** window to return to the previous wireless mode. Any M Series device may operate in only one of these modes at a time. For example, if the device is running in *Access Point* mode, it cannot simultaneously run in *Station* mode.

SSID Displays the wireless network name (SSID). The wireless network name depends upon the wireless mode selected:

- In *Station* mode, this displays the SSID of the AP the device is associated with.
- In *Access Point* mode, this displays the SSID configured on the device using the *Wireless* page.

Security Displays the wireless security method being used on the device. If *None* is displayed, then wireless security has been disabled, although you can still use RADIUS MAC authentication.

Version Displays the airOS software version.

Uptime This is the total time the device has been running since the latest reboot (when the device was powered up) or software upgrade. The time is displayed in days, hours, minutes, and seconds.

Date Displays the current system date and time, which is retrieved from the Internet using NTP (Network Time Protocol). The NTP Client is disabled by default on the *Services* page. The device doesn't have an internal clock, and the date and time may be inaccurate if the NTP Client is disabled or the device isn't connected to the Internet.

Channel/Frequency Displays the channel number and corresponding operating frequency. The device uses the channel and radio frequency specified to transmit and receive data. Valid channel and frequency ranges will vary depending on local country regulations. If the *Channel/Frequency* is labeled as "DFS", then the device is using a DFS (Dynamic Frequency Selection) channel. (DFS channels/frequencies are not available on all devices.)

Channel Width This is the spectral width of the radio channel used by the device. airOS v5.6 supports 3, 5, 7, 8, 10, 14, 20, 25, 28, 30, and 40 MHz; however, available channel widths are device-specific. In *Station* mode, *Auto 20/40* MHz is the value by default.

Frequency Band Displays the actual operating frequency range of the device. This is based on the selected frequency, channel width, and extension channel on the *Wireless* page.

Distance Displays the current distance between devices in kilometers and miles for Acknowledgement (ACK) frames. Changing the distance value will change the ACK (Acknowledgement) timeout accordingly. The ACK timeout specifies how long the device should wait for an acknowledgement from a partner device confirming frame reception before it concludes that there has been an error and resends the frame. You can adjust the *Distance* value; for more information, see **"Distance" on page 46**).

TX/RX Chains Displays the number of independent spatial data streams the device is transmitting (TX) and receiving (RX) simultaneously within one spectral channel of bandwidth. This ability is specific to 802.11n devices that rely on Multiple-Input Multiple-Output (MIMO) technology. Multiple chains increase data transfer performance significantly. The number of chains Ubiquiti devices use is hardware-specific because every TX/RX chain requires a separate antenna.

Antenna (Only applicable to devices with antenna options.) The antenna type (*Internal*, *External*, or *External + Internal*) is displayed. For more information, see **"Antenna" on page 26**.

WLAN0 MAC Displays the MAC address of the device as seen on the wireless network.

LAN0 MAC Displays the MAC address of the device as seen on the LAN.

LAN1 MAC Displays the MAC address of the device as seen on the WAN interface. This is the device's MAC address as seen over the Internet.

LAN0/LAN1 Displays the Ethernet port speed and duplex mode, such as *1000Mbps-Full* or *100Mbps-Full*. This can indicate that a cable is not plugged into a device or there is no active Ethernet connection.

AP MAC In *Access Point* or *AP-Repeater* mode, this displays the MAC address of the device. In *Station* mode, this displays the MAC address of the AP the device is associated with.

Signal Strength (Available in *Station* mode only.) Displays the received wireless signal level (client-side). The represented value coincides with the graphical bar. Use the antenna alignment tool to adjust the device antenna to get a better link with the wireless device. The antenna of the wireless client has to be adjusted to get the maximum signal strength. *Signal Strength* is measured in dBm (the decibels referenced to 1 milliwatt). The conversion is defined as dBm=10log10(P/1mW). So, 0 dBm would be 1 mW and -72 dBm would be 0.0000006 mW. A signal strength of -80 dBm or better (-50 to -70 dBm) is recommended for stable links.

Chain or Horizontal/Vertical or External/Internal (Vertical) (Available in *Station* mode only.) Displays the wireless signal level (in dBm) of each signal. Devices with fixed antennas display *Horizontal/Vertical* instead of *Chain*. When chains are displayed, the number of chains is device-specific.

The NanoStationM900 loco displays *External/Internal (Vertical)* if the *Antenna* option on the *Wireless* page is set to *External + Internal (2x2)*. For more information, see **"Antenna" on page 26**.

Connections (Available in *Access Point* or *AP-Repeater* mode only.) Displays the number of wireless devices connected to the device.

Noise Floor Displays the current value (in dBm) of the environmental noise (from interference) the receiver hears on the operating frequency. airOS considers the *Noise Floor* while evaluating the signal quality (Signal-to-Noise Ratio SNR, RSSI). The value mean depends on the signal strength above the *Noise Floor*.

Transmit CCQ This index evaluates the wireless Client Connection Quality (CCQ). The level is based on a percentage value for which 100% corresponds to a perfect link state.

TX Rate/RX Rate (Available in *Station* mode only.) Displays the current 802.11 data transmission (TX) and data reception (RX) rates.

airMAX Indicates the airMAX status. If airMAX is enabled, the device will only accept airMAX clients. airMAX also features advanced QoS autodetection settings. For more information, refer to **"airMAX Settings" on page 15**.

Note: For compatibility, legacy or 802.11 a/b/g devices should use legacy firmware with airMAX support (such as airOS firmware v4.0). Legacy clients can only work as airMAX clients with the M Series device acting as an airMAX AP.

airMAX Priority Available if *airMAX* is enabled in *Station* mode only. Indicates the *airMAX Priority* set on the *Ubiquiti logo* page. By default the AP gives all active clients the same amount of time. However, if the clients are configured with different priorities, the AP will give clients more or less time, depending on the priority.

airMAX Quality Available if *airMAX* is enabled. *airMAX Quality* (AMQ) is based on the number of retries and the quality of the physical link. If this value is low, you may have interference and need to change frequencies. If AMQ is above 80% and you do not notice any other issues, then you do not need to make any changes.

airMAX Capacity Available if *airMAX* is enabled. *airMAX Capacity* (AMC) is based on airtime efficiency. For example, if you have one client with a low data rate or you are using a 1x1 device (such as Bullet or airGrid) alongside other clients that are 2x2, then it will use up more airtime (slots) for the same amount of data, reducing time (or capacity) for other clients. The lower the AMC, the less efficient the AP is. If you only have one client, this may not matter, but when you have many clients (for example, more than 30), then AMC becomes very important, and you want it to be as high as possible.

If you are looking at the client, AMC shows the theoretical capacity of that client, based on current TX/RX rates and quality. AMC is a percentage based on what the maximum performance would be if the link were perfect. Clients with poor airtime efficiency can negatively affect other clients by taking up more airtime while transmitting at lower speeds. For example, client A is at MCS 12 (78 Mbps) because of low signal. The client could theoretically do MCS 15 (130 Mbps), so AMC is based on the ratio of current rate/maximum rate (78 Mbps divided by 130 Mbps), which is 60%. In a similar fashion, a 1x1 device will always have a maximum AMC of 50%, because it provides half the performance of a 2x2 device.

If you are looking at the AP, then AMQ and AMC are averages of all clients' values. If you want to discover what is lowering your values on heavily populated APs, single out the weak clients. You can either use airControl™ (recommended), or you can go to each client individually. Try to upgrade to a higher-gain antenna (to allow a better data rate), or upgrade to a 2x2 device if you are using a 1x1 device.

airSelect (Available in *Access Point* or *AP-Repeater* mode only.) Indicates the airSelect status. If *airSelect* is enabled, airSync is not available. Access airSelect setup through *Ubiquiti Logo > airSelect*.

Hop Interval Available if *airSelect* is enabled. The duration (in milliseconds) that the AP will stay on one frequency before moving to the next.

airSync (GPS Series Only) Indicates the airSync status. If *airSync* is enabled, *airSelect* is not available, and the device in *Master* mode reports the number of airSync-enabled devices in *Slave* mode. Access airSync setup through *Ubiquiti Logo > airSync*.

GPS Signal Quality (GPS Series Only) Displays GPS signal quality as a percentage value on a scale of 0-100%.

Latitude/Longitude (GPS Series Only) Based on GPS tracking, reports the device's current latitude and longitude. Clicking the link opens the reported latitude and longitude in a browser using Google Maps™ (**http://maps.google.com**).

Altitude (GPS Series Only) Based on GPS tracking, reports the device's current altitude above sea level.

Custom Scripts Displayed if custom scripts are present on the device. If custom scripts are running, then the *Main* page displays the status of this option as "Detected" and the *Manage* button. Click **Manage** and the *Custom Scripts Management* screen appears:

- **Enabled** Select to run the custom script.
- **Script Name** Displays a descriptive name.
- **Download Script** Click to download the custom script.
- **Remove Script** Click to delete the custom script.
- **Save** To save changes, click **Save**.

  Note: The device will be automatically restarted when changes are saved.

- **Close** To close this screen, click **Close**.

airMAX Gateway Displayed if your airMAX device is a CPE connected to an airMAX Gateway. You can click *Connected (Click to manage)* to remotely provision the airGateway.

The CPE must be running airOS v5.5.8 or higher to be compatible for pairing. Follow these instructions on the CPE:

1. On the *Wireless* page, configure *Wireless Mode*: **Station**.
2. On the *Network* page, configure *Network Mode*: **Router**.
3. For the *Configuration Mode*, select **Advanced**.
4. View the *Bridge Network* section. Remove all ports and then remove the Bridge. (Refer to **"WAN Network Settings" on page 34** for more information.)
5. In the *LAN Network Settings* section, add **LAN0** and configure the rest of the settings. (Do not use the 192.168.1.x subnet on the CPE's *LAN0* setup.)
6. Click **Change**.

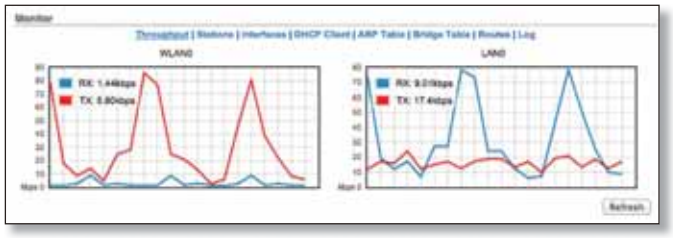
To pair the airGateway, follow these instructions:

1. Reset the airGateway to its factory defaults. (If the devices are already connected, then reboot both devices.)
2. Follow the instructions in the airGateway Quick Start Guide (available at **downloads.ubnt.com**) to connect the airGateway to the CPE.
3. Access the Configuration Interface of the CPE.
4. On the *Main* page, click **Connected (Click to manage)** to remotely access the airGateway.

Monitor

There are various monitoring tools accessible via the links on the *Main* page. The default is *Throughput*, which is displayed when you first open the *Main* page.

Throughput



Throughput displays the current data traffic on the LAN and WLAN in both graphical and numerical form. The chart scale and throughput dimension (Bps, Kbps, Mbps) change dynamically depending on the mean throughput value. The statistics are updated automatically.

Refresh If there is a delay in the automatic update, click **Refresh** to manually update the statistics.

Stations

(Available in *Access Point* or *AP-Repeater* mode only.) This selection lists the stations that are connected to the device.

The following statistics for each station are displayed in the station statistics window:

Station MAC Displays the MAC address of the station. This is a clickable link that will display additional station information.

Device Name Displays the station's host name. The device name can be changed on the *System* page.

TX Signal, dBm The *TX Signal, dBm Combined* value represents the last transmitted wireless signal level. Click **Combined** to display the separate Chain 0 and Chain 1 signal values. Then you can click **Chain0/Chain1** to display the combined signal value. (Devices with fixed antennas display *Horizontal/Vertical* instead of *Chain*. When chains are displayed, the number of chains is device-specific.)

RX Signal, dBm The *RX Signal, dBm Combined* value represents the last received wireless signal level. Click **Combined** to display the separate Chain 0 and Chain 1 signal values. Then you can click **Chain0/Chain1** to display the combined signal value. (Devices with fixed antennas display *Horizontal/Vertical* instead of *Chain*. When chains are displayed, the number of chains is device-specific.)

Noise, dBm The *Noise* value represents the noise level.

Latency (Available if the *Auto Adjust* setting is enabled through *Advanced Wireless* > *Advanced Wireless Settings*.) Displays the latency value, in milliseconds, for wireless frames.

Distance (Available if the *Auto Adjust* setting is enabled through *Advanced Wireless* > *Advanced Wireless Settings*.) Displays the current distance between devices in miles for Acknowledgement (ACK) frames. Click **miles** to display the distance in km. Then you can click **km** to display the distance in miles.

With *Auto Adjust* enabled, the auto-acknowledgement timeout algorithm of the device dynamically optimizes the frame acknowledgement timeout value without user intervention.

TX/RX, Mbps The *TX* value represents the data rates, in Mbps, of the last transmitted packets, and the *RX* value represents the data rates, in Mbps, of the last received packets.

CCQ, % This index evaluates the wireless Client Connection Quality (CCQ). The level is a percentage value for which 100% corresponds to a perfect link state.

Connection Time Displays the station's association time to the AP. The time is expressed in days, hours, minutes, and seconds.

Last IP Displays the station's last IP address. Click the IP address to access the device.

Action Displays available options for this station. For example, click **kick** to drop the connection to this station.

Refresh To update the information, click **Refresh**.

Station Information

Detailed information is displayed when you click a specific MAC address:

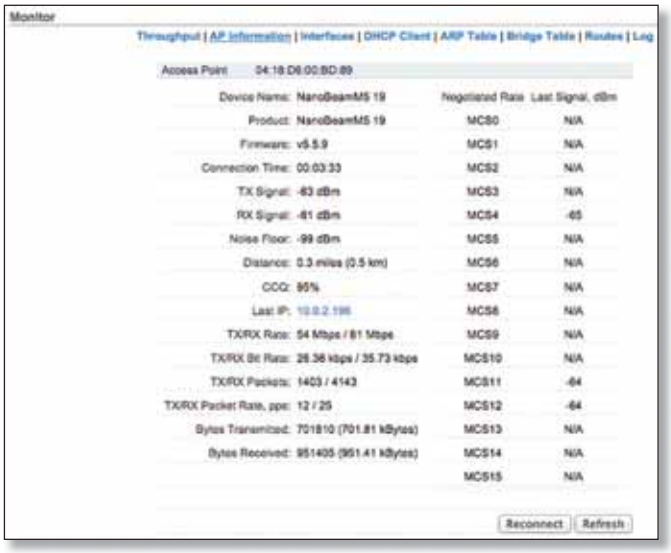
- **Station** Displays the MAC address of the station.
- **Device Name** Displays the host name of the station.
- **Product** Displays the product name of the device.
- **Firmware** Displays the firmware version of airOS.
- **Connection Time** Displays the amount of time the station has been connected to the device. The time is expressed in days, hours, minutes, and seconds.

- **RX Signal** The value represents, in dBm, the last received wireless signal level.
- **TX Signal** The value represents, in dBm, the last transmitted wireless signal level.
- **Noise Floor** Displays the current value (in dBm) of the environmental noise (from interference) the receiver hears on the operating frequency. airOS considers the *Noise Floor* while evaluating the signal quality (Signal-to-Noise Ratio SNR, RSSI). The value mean depends on the signal strength above the *Noise Floor*.
- **Distance** (Available if the *Auto Adjust* setting is enabled through *Advanced Wireless* > *Advanced Wireless Settings*.) Displays the current distance between devices in kilometers and miles for Acknowledgement (ACK) frames. With *Auto Adjust* enabled, the device's auto-acknowledgement timeout algorithm dynamically optimizes the frame acknowledgement timeout value without user intervention.
- **CCQ** The value represents the quality of the connection to the AP. This index evaluates the wireless Client Connection Quality (CCQ). The level is a percentage value for which 100% corresponds to a perfect link state.
- **TX Power** Displays the transmit power (in dBm) of the station.
- **airMAX Priority** The *airMAX Priority* of this station's traffic in comparison to the other stations.
- **airMAX Quality** The *airMAX Quality* level is based on a percentage value for which 100% corresponds to a perfect link state.
- **airMAX Capacity** This is an index of the maximum data rate the link is operating at. A lower capacity number indicates a unit that is slowing down the system.
- **Last IP** Displays the station's last IP address. Click the IP address to access the device.
- **TX/RX Rate** Displays the actual 802.11n data rate, which is restricted by the wireless link modulation/mode/protocol used, in Mbps, of the last transmitted and received packets.
- **TX/RX Bit Rate** Displays the actual bit rate, in bps, of the user data/traffic load/data stream/throughput (the number of bits transmitted and received from the station during the last second).
- **TX/RX Packets** Displays the total number of packets transmitted and received from the station during the connection uptime.
- **TX/RX Packet Rate, pps** Displays the mean value of the transmitted and received packet rates.
- **Bytes Transmitted** Displays the total amount of data (in bytes) transmitted during the connection and a user-friendly equivalent in parentheses. Example:

  Bytes Transmitted: 6329846 (6.33 MBytes)
- **Bytes Received** Displays the total amount of data (in bytes) received during the connection and a user-friendly equivalent in parentheses.
- **Negotiated Rate/Last Signal, dBm** Values represent the received wireless signal level along with the data rates of recently received packets. *N/A* is displayed as the *Last Signal* if no packets were received on that specific data rate.
- **Kick** To drop the connection to the station, click **Kick**.
- **Refresh** To update the information, click **Refresh**.
- **Close** To close the *Station Info* window, click **Close**.

AP Information

(Available in *Station* mode only.) This selection lists the connection statistics of the AP associated with the device.



Access Point Displays the MAC address of the AP.

Device Name Displays the host name of the AP.

Product Displays the product name of the device.

Firmware Displays the firmware version of airOS.

Connection Time Displays the amount of time the device has been connected to the AP. The time is expressed in days, hours, minutes, and seconds.

RX Signal The value represents, in dBm, the last received wireless signal level.

TX Signal The value represents, in dBm, the last transmitted wireless signal level.

Noise Floor Displays the current value (in dBm) of the environmental noise (from interference) the receiver hears on the operating frequency. airOS considers the *Noise Floor* while evaluating the signal quality (Signal-to-Noise Ratio SNR, RSSI). The value mean depends on the signal strength above the *Noise Floor*.

Distance (Available if the *Auto Adjust* setting is enabled through *Advanced Wireless* > *Advanced Wireless Settings*.) Displays the current distance between devices in miles for Acknowledgement (ACK) frames. Click **miles** to display the distance in km. Then you can click **km** to display the distance in miles.

CCQ The value represents the quality of the connection to the AP. This index evaluates the wireless Client Connection Quality (CCQ). The level is a percentage value for which 100% corresponds to a perfect link state.

Last IP Displays the device's last IP address. Click the IP address to access the device.

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Bytes Transmitted: 6329846 (6.33 MBytes)

Bytes Received Displays the total amount of data (in bytes) received during the connection and a user-friendly equivalent in parentheses.

Negotiated Rate/Last Signal, dBm Values represent the received wireless signal level along with the data rates of recently received packets. *N/A* is displayed as the *Last Signal* if no packets were received on that specific data rate.

Reconnect To establish the wireless link to the AP again, click **Reconnect**.

Refresh To update the information, click **Refresh**.

Interfaces

Displays the name, MAC address, MTU, IP address, and traffic information for the device's interfaces.

Interface Displays the name of the interface.

MAC Address Displays the MAC address of the interface.

MTU Displays the Maximum Transmission Unit (MTU), which is the maximum frame size (in bytes) that a network interface can transmit or receive. The default is *1500*.

IP Address Displays the IP addresses of the interface.

Note: There are typically two addresses per management interface in case IPv6 is enabled. Example:

192.168.1.20 FE80::227:22FF:FEEC:E770/64

RX Bytes Displays the total amount of data (in bytes) received by the interface.

RX Errors Displays the number of receive errors.

TX Bytes Displays the total amount of data (in bytes) transmitted by the interface.

TX Errors Displays the number of transmit errors.

Refresh To update the information, click **Refresh**.

DHCP Client

(Available in *Router* or *SOHO Router* mode only.) Displays the device's WAN IP address, netmask, DNS servers, and gateway while the device is operating as a DHCP client of an external DHCP server.

Interface Displays the interface that connects to the WAN.

IP Address Displays the IP address assigned by an external DHCP server connected to the WAN interface. If an external DHCP server is not found, the IP address will use the *DHCP Fallback IP* defined in the *WAN Network Settings*. See **"WAN Network Settings" on page 34** for additional details.

Netmask Displays the Netmask assigned by an external DHCP server connected to the WAN interface. If an external DHCP server is not found, the IP address will use the *DHCP Fallback Netmask* defined in the *WAN Network Settings*. See **"WAN Network Settings" on page 34** for additional details.

Gateway Displays the gateway address assigned by an external DHCP server connected to the WAN interface.

Primary/Secondary DNS IP Displays the DNS IP address(es) assigned by an external DHCP server. The Domain Name System (DNS) is an Internet "phone book" that translates domain names to IP addresses. These fields identify the server IP addresses that the device uses for translation.

DHCP Server Displays the IP address of the external DHCP server that assigns the WAN IP address to the device.

Domain Displays the domain name.

Total Lease Time Shows the total time (validity) of the leased IP address assigned by the external DHCP server.

Remaining Lease Time Displays the remaining time of the leased IP address assigned by the external DHCP server.

Renew To request new IP settings from the external DHCP server, click **Renew**.

Release To release the current IP settings, click **Release**.

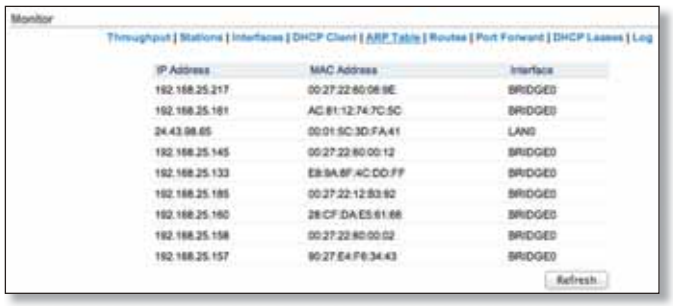
Note: Releasing the DHCP client's IP settings may terminate the management connection to the device.

Refresh To update the information, click **Refresh**.

ARP Table

Lists all the entries of the Address Resolution Protocol (ARP) table currently recorded on the device.

ARP is used to associate each IP address to the unique hardware MAC address of each device on the network. It is important to have unique IP addresses for each MAC address or else there will be ambiguous routes on the network.



IP Address Displays the IP address assigned to a network device.

MAC Address Displays the MAC address of the device.

Interface Displays the interface that connects to the device.

Refresh To update the information, click **Refresh**.

Bridge Table

(Available in *Bridge* mode only.) The table displays the entries in the system *Bridge Table*.

Bridge The name of the bridge.

MAC Address The network device identified by its MAC address.

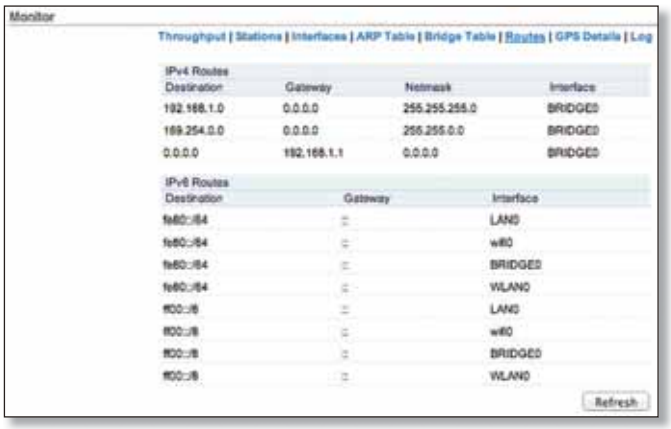
Interface The *Bridge Table* shows which bridge port or interface, LAN (Ethernet) or WLAN (Wireless), the specific network device is associated with. airOS can forward packets only to the specified port of the device, eliminating redundant copies and transmits.

Aging Timer Displays aging time for each address entry (in seconds). After a specific timeout, if the device has not seen a packet coming from a listed address, it will delete that address from the *Bridge Table*.

Refresh To update the information, click **Refresh**.

Routes

Lists all the entries in the system routing table.



airOS examines the destination IP address of each data packet traveling through the system and chooses the appropriate interface to forward the packet to. The system choice depends on static routing rules, the entries that are registered in the system routing table. Static routes to specific hosts, networks, or the default gateway are set up automatically according to the IP configuration of all the airOS Configuration Interfaces.

Note: You can also manually add static routes (refer to **"Static Routes" on page 43** for details).

IPv4 Routes

Destination Displays the IP address of the destination network or host.

Gateway Displays the IP address of the appropriate gateway.

Netmask Displays the netmask of the destination network: *255.255.255.255* for a destination host or *0.0.0.0* for the default route.

Interface Displays the interface that will receive the packets for that route.

Note: The default route is the route that is used when no other routes for the destination are found in the routing table.

IPv6 Routes

For IPv6 addresses, the airOS Configuration Interface supports "::" (double-colon) notation, which substitutes "::" for a contiguous sequence of 16-bit blocks set to zero. Here is an example: *2001:db8::1*

If written out, the IPv6 address becomes: *2001:db8:0000:0000:0000:0000:0000:0001*

Note: You can also manually add static routes (refer to **"IPv6 Static Routes" on page 44** for details).

Destination Displays the IP address of the destination network or host.

Gateway Displays the IP address of the appropriate gateway.

Interface Displays the interface that will receive the packets for that route.

Refresh To update the information, click **Refresh**.

Firewall

When the firewall is enabled on the *Network* page, this option is available. By default, there are no firewall rules.

If the device is operating in *Bridge* mode, the table lists active firewall entries in the FIREWALL chain of the standard ebtables filter table.

If the device is operating in *Router* or *SOHO Router* mode, the table lists active firewall entries in the FIREWALL chain of the standard iptables filter table.

Firewall Rules IP and MAC level access control and packet filtering in airOS are implemented using an ebtables (bridging) or iptables (routing) firewall that protects the resources of a private network from outside threats by preventing unauthorized access and filtering specified types of network communication.

Refresh To update the information, click **Refresh**.

Configure firewall rules on the *Network* page. See **"Firewall" on page 42** or **"IPv6 Firewall" on page 43** for additional details.

Port Forward

(Available in *Router* or *SOHO Router* mode only.) Port forwarding allows you to connect to a specific service such as an FTP server or web server. Port forwarding creates a transparent tunnel through a firewall/NAT, granting access from the WAN side to the specific network service running on the LAN side.

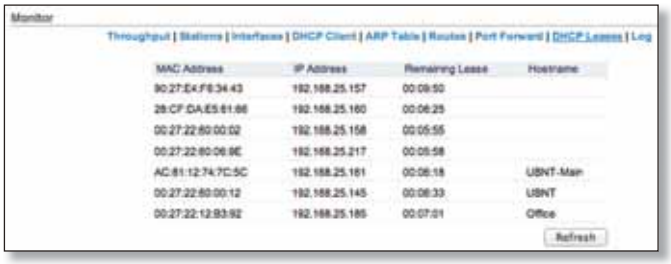
Port Forward Rules Lists active port forward entries in the PREROUTING chain of the standard iptables nat table, while the device is operating in *Router* or *SOHO Router* mode.

Refresh To update the information, click **Refresh**.

Configure port forwarding rules on the *Network* page. See **"Traffic Shaping" on page 44** for additional details.

DHCP Leases

(Available in *Router* or *SOHO Router* mode only with the DHCP server feature enabled.) Displays the current status of the IP addresses assigned by the device's DHCP server to its local DHCP clients.



MAC Address Displays the client's MAC address.

IP Address Displays the client's IP address.

Remaining Lease Displays the remaining time of the leased IP address assigned by the DHCP server.

Hostname Displays the device name of the client.

Refresh To update the information, click **Refresh**.

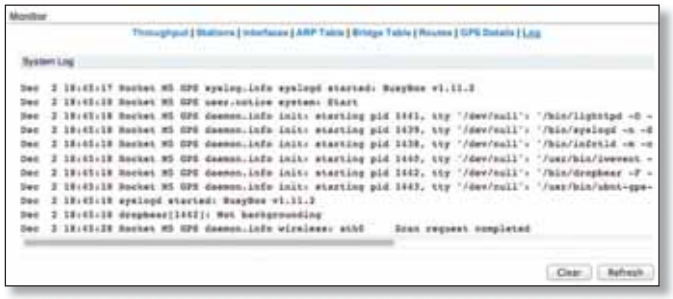
GPS Details (GPS Series Only)

GPS Details (available on GPS Series devices only) displays GPS *Satellite* details and *Signal* quality.

Refresh To update the information, click **Refresh**.

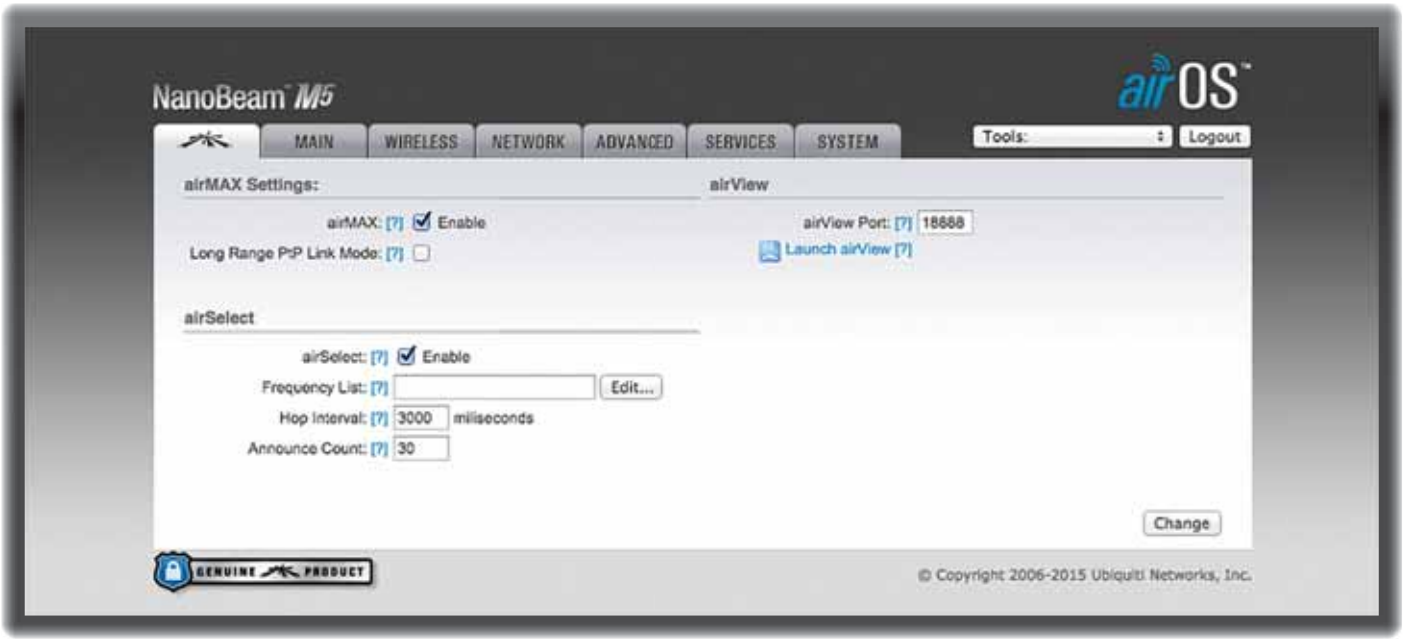
Log

When logging is enabled (see **"System Log" on page 52** to enable logging), this option lists all registered system events. By default, logging is not enabled.



Clear To delete all entries in the system log, click **Clear**.

Refresh To update the log content, click **Refresh**.



Chapter 3: Ubiquiti Logo

The *Ubiquiti logo* page displays settings to enable, launch, and change settings for Ubiquiti's proprietary features, including:

- **airMAX®** Provides superior wireless performance, more clients per Access Point (AP), and lower latency under load.
- **airSelect®** Dynamically changes the wireless channel to avoid interference.
- **airView®** Ubiquiti's spectrum analyzer.
- **airSync™** Synchronizes transmissions by GPS Series devices to eliminate co-location transmit interference.

Note: By default, indoor products, such as the airRouter, do not display the *Ubiquiti logo* page. However, you can enable the *Ubiquiti logo* page through *System* > *Miscellaneous* > *airMAX Technology Features*. For more information, see **"Miscellaneous" on page 55**.

Change To save or test your changes, click **Change**.

A new message appears. You have three options:

- **Apply** To immediately save your changes, click **Apply**.
- **Test** To try the changes without saving them, click **Test**. To keep the changes, click **Apply**. If you do not click *Apply* within 180 seconds (the countdown is displayed), the device times out and resumes its earlier configuration.
- **Discard** To cancel your changes, click **Discard**.

airMAX Settings

airMAX is Ubiquiti's proprietary Time Division Multiple Access (TDMA) polling technology. airMAX improves overall performance in Point-to-Point (PtP) and Point-to-MultiPoint (PtMP) installations and noisy environments because it reduces latency, increases throughput, and offers better tolerance against interference. Because of its advantages, airMAX also increases the maximum possible number of users that can associate with an AP that uses airMAX.

airMAX assigns time slots for each device communication to avoid the "hidden node" problem, which occurs when a node is visible from a wireless AP, but not from other nodes communicating with the originating AP.

airMAX also features advanced Quality of Service (QoS) autodetection settings. For airMAX to classify and differentiate types of traffic when applying QoS rules, the traffic must have a special value within the TOS (Type of Service) range and set in the IP Header DSCP (Differentiated Services Code Point) field. The original software or hardware device is responsible for setting this value; airMAX will prioritize traffic only if this value is set.

There are four WME (Wireless Multimedia Enhancements) categories, which range from lowest to highest priority in this order:

- Best Effort
- Background
- Video
- Voice

By default, all traffic is classified as *Best Effort*, so no prioritization is applied. The categories can be defined using the following values:

802.1p Class of Service	TOS Range	DSCP Range	WME Category
0 – Best Effort	0x00-0x1f	0-7	Best Effort
1 – Background	0x20-0x3f	8-15	Background
2 – Spare	0x40-0x5f	16-23	Background
3 – Excellent Effort	0x60-0x7f	24-25, 28-31	Best Effort
4 – Controlled Load	0x80-0x9f	32-39	Video
5 – Video (<100 ms latency)	0xa0-0xbf	40-45	Video
6 – Voice (<10 ms latency)	0x68, 0xb8, 0xc0-0xdf	26-27, 46-47, 48-55	Voice
7 – Network Control	0xe0-0xff	56-63	Voice

For compatibility, legacy or 802.11 a/b/g devices should use legacy firmware with airMAX support (such as airOS firmware v4.0). Legacy clients can only work as airMAX clients with the M Series device acting as an airMAX AP.

Note: To support legacy clients using airMAX, the M Series device must run airOS v5.5 or above.

airMAX Settings include:

- **airMAX** (Available in *Access Point* or *AP-Repeater* mode only.) If airMAX is enabled, the device operates in airMAX mode and only accepts connections from airMAX devices.

  Note: If airMAX is enabled, you cannot connect standard Wi-Fi devices, such as laptops, tablets, or smartphones, to the AP.

  If the device is in *Station* mode under *Wireless* > *Wireless Mode*, the device will automatically enable *airMAX* when it is connecting to an airMAX AP.

- **Long Range PtP Link Mode** (Available in *Access Point* or *AP-Repeater* mode only.) Acknowledgment (ACK) timeout settings are limited by device hardware specifications.

  Note: Enable *Long Range PtP Link Mode* for PtP links only.

  If the following two conditions apply to your device:

  - Connects to a single station or client (a PtP situation)
  - The actual link distance exceeds hardware ACK timeout limits:
    - 27 km or 17 miles (40 MHz mode)
    - 51 km or 32 miles (20 MHz mode)

  then select **Long Range PtP Link Mode**.

  Note: If you use *Long Range PtP Link Mode*, then the *Auto Adjust* setting on the *Advanced* page is not available.

  If your device has multiple stations or clients, do not use *Long Range PtP Link Mode*; instead, enable the *Auto Adjust* setting on the *Advanced* page (see **"Auto Adjust" on page 46** for additional details).

- **airMAX Priority** (Available in *Station* mode only.) It defines the number of time slots (or amount of airtime) assigned to each client. By default the AP gives all active clients the same amount of time. However, if the clients are configured with different priorities, the AP will give clients more or less time, depending on the priority.

  Note: airMAX Priority only functions when multiple clients have it enabled.

  airMAX Priority options include:

  - **High** 4 time slots (4:1 ratio)
  - **Medium** 3 time slots (3:1 ratio)
  - **Low** 2 time slots (2:1 ratio)
  - **None** 1 time slot (Default setting for clients; 1:1 ratio)

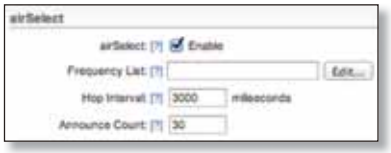
  Clients with a higher priority have access to more of the AP's airtime, providing higher possible throughput and lower latency when sharing with other active clients. For example, if there are 3 clients, 1 set to *None*, 1 set to *Medium*, and 1 set to *High*, the *None* client will get 1 time slot, the *Medium* client will get 3 time slots, and the *High* client will get 4 time slots.

airSelect

Note: If you enable airSelect, then airSync is not available.

(Available in *Access Point* mode only.) airSelect is a technology that avoids interference and increases throughput. It dynamically changes the wireless channel by periodically hopping to the least used channel in the Frequency List (user-defined) within a designated time interval (user-defined in milliseconds). airSelect tracks interference levels on each channel used, hopping more frequently to those with the least amount of interference.

airSelect options include:

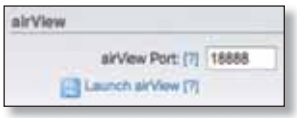


- **airSelect** Check the box to enable airSelect. When airSelect is enabled, the AP and all associated clients quickly hop between frequencies to avoid interference.
- **Frequency List** Available when airSelect is enabled. Click **Edit** to select the frequencies that the AP will use for airSelect. Available frequencies are device-dependent.
- **Hop Interval** Available when airSelect is enabled. The duration (in milliseconds) that the AP will stay on one frequency before moving to the next. The default value is *3000* milliseconds (ms).
- **Announce Count** Available when airSelect is enabled. The number of times between hops the AP will announce the next hop information (such as frequency) to clients. For example, if the *Hop Interval* is set to *3000* ms (default), and the *Announce Count* is set to *30* (default), then every 100 ms the AP will send an announcement with upcoming hop information to the clients. The larger the time period between the *Announce Count* and *Hop Interval*, the higher the risk of timing drift (hops not being synchronized), so we recommend that you keep the defaults or configure the AP to send an announcement every 100 ms (set the *Announce Count* to 1/100th of the *Hop Interval*).

airView

Use the airView Spectrum Analyzer to analyze the noise environment of the radio spectrum and intelligently select the optimal frequency to install a PtP airMAX link.

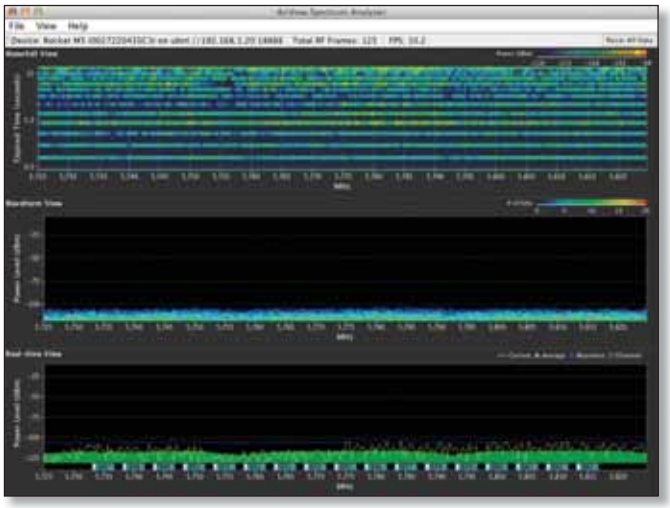
airView options include:



- **airView Port** Defines the TCP port used by airView on the device. The default port is *18888*.
- **Launch airView** There are two system requirements for the airView Spectrum Analyzer:
  - Your system is connected to the device via Ethernet. Launching airView will terminate all wireless connections on the device.
  - Java Runtime Environment 1.6 (or above) is required on your client machine to use airView.

  Click **Launch airView** to use the airView Spectrum Analyzer. On first use, the following window appears.

- **Do NOT warn me about this in the future** Check the box to bypass this window in future launches of the airView Spectrum Analyzer.
- **Launch airView** Click **Launch airView** to download the Java Network Launch Protocol (jnlp) file and complete the launch of airView.



Main View

Device Displays the device name, MAC (Media Access Control) address, and IP address of the device running airView.

Total RF Frames Displays the total number of Radio Frequency (RF) frames gathered since the start of the airView session or since the *Reset All Data* button was last clicked.

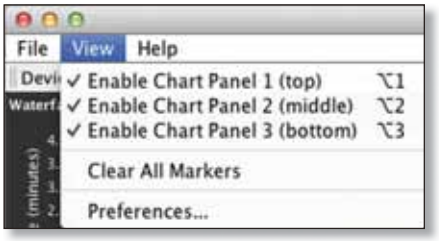
FPS Displays the total number of frames per second (FPS) gathered since the start of the airView session or since the *Reset All Data* button was last clicked. The wider the interval amplitude, the fewer the FPS will be gathered.

Reset All Data Click to reset all gathered data. Use this option to analyze the spectrum for another location or address.

File Menu

Click **Exit** to end the airView session.

View Menu



Enable Chart Panel 1 (top) Displays the Waterfall or Channel Usage chart in Chart Panel 1, depending on which option you have selected in *Preferences*. This time-based graph shows the aggregate energy collected or channel usage for each frequency since the start of the airView session.

Enable Chart Panel 2 (middle) Displays the Waveform chart in Chart Panel 2. This time-based graph shows the RF signature of the noise environment since the start of the airView session. The energy color designates its amplitude. Cooler colors represent lower energy levels (with blue representing the lowest levels) in that frequency bin, and warmer colors (yellow, orange, or red) represent higher energy levels in that frequency bin.

Enable Chart Panel 3 (bottom) Displays the Real-time chart (traditional spectrum analyzer) in Chart Panel 3. Energy (in dBm) is shown in real time as a function of frequency.

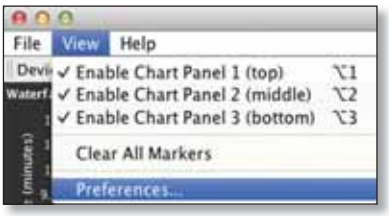
Note: Energy is the power ratio in decibels (dB) of the measured power referenced to one milliwatt (mW).

Clear All Markers Resets all previously assigned markers. Markers are assigned by clicking a point, which corresponds with a frequency on the Real-time chart.

Preferences Changes airView settings, such as enabling or disabling charts and traces, or specifying the frequency interval.

Preferences

Select **View** > **Preferences** to display the *Preferences - airView Spectrum Analyzer* window.



Charts

Enable top chart Check the box to enable the top chart. Select the desired chart to display in the top chart panel on the main view. There are two options:

- **Waterfall** This time-based graph shows the aggregate energy collected for each frequency since the start of the airView session. The energy color designates its amplitude. Cooler colors represent lower energy levels (with blue representing the lowest levels) in that frequency bin, and warmer colors (yellow, orange, or red) represent higher energy levels in that frequency bin.

  The Waterfall View's legend (top-right corner) provides a numerical guide associating the various colors to power levels (in dBm). The low end of that legend (left) is always adjusted to the calculated noise floor, and the high end (right) is set to the highest detected power level since the start of the airView session.
- **Channel Usage** For each Wi-Fi channel, a bar displays a percentage showing the relative "crowdedness" of that specific channel. To calculate this percentage, the airView Spectrum Analyzer analyzes both the popularity and strength of RF energy in that channel since the start of an airView session.

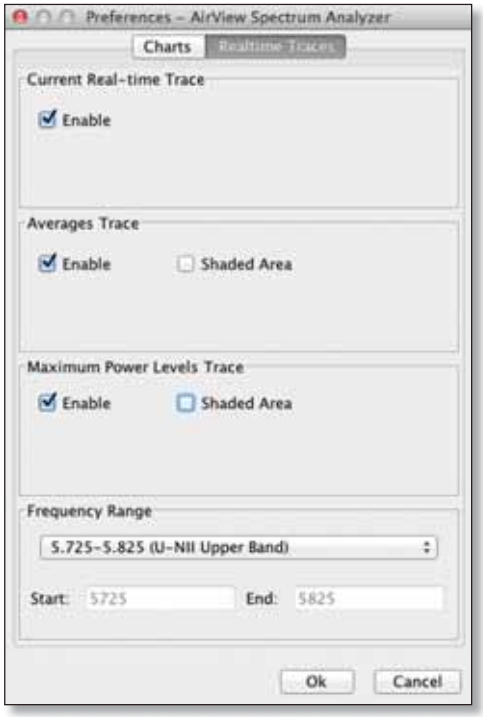
Enable Waveform chart (middle) Check the box to enable the middle chart. This time-based graph shows the RF signature of the noise environment since the start of the airView session. The energy color designates its amplitude. Cooler colors represent lower energy levels (with blue representing the lowest levels) in that frequency bin, and warmer colors (yellow, orange, or red) represent higher energy levels in that frequency bin.

The spectral view over time will display the steady-state RF energy signature of a given environment.

Enable Real-time chart (bottom) Check the box to enable the bottom chart. This graph displays a traditional spectrum analyzer in which energy (in dBm) is shown in real time as a function of frequency. There are three traces in this view:

- **Current** (Yellow) Shows the real-time energy seen by the device as a function of frequency.
- **Average** (Green) Shows the running average energy across frequency.
- **Maximum** (Blue) Shows updates and maximum power levels across frequency.

Realtime Traces



The following settings apply only to the *Real-time* chart:

Current Real-time Trace Check the *Enable* box to enable the real-time trace. When enabled, the yellow outline on the *Real-time* chart represents the real-time power level of each frequency. The refresh speed depends on the FPS.

Averages Trace Check the *Enable* box to enable the averages trace. When enabled, the averages trace is represented by the green area on the *Real-time* chart, which displays the average received power level data since the start of the airView session. To enable a shaded green area, check the *Shaded Area* box. To display only a green outline without the shaded area, uncheck the *Shaded Area* box.

Maximum Power Levels Trace Check the *Enable* box to enable the maximum power trace. When enabled, the maximum power trace is represented by the blue area on the *Real-time* chart, which displays the maximum received power level data since the start of the airView session. To enable a shaded blue area, check the *Shaded Area* box. To display only a blue outline without the shaded area, uncheck the *Shaded Area* box.

Frequency Range Select the amplitude of the frequency interval to be scanned from the *Frequency Range* drop-down list. Available frequencies are device-dependent. There are pre-defined ranges for the most popular bands. You can enter a custom range; select **Custom Range** from the *Frequency Range* drop-down list and enter the desired values in the *Start* and *End* fields.

Help

Click **About** to view the version and build number of the airView Spectrum Analyzer.

airSync (GPS Series Only)

Note: If you enable airSync, then airSelect is not available.

(Available in *Access Point* mode only.) airSync (available on GPS Series devices only) synchronizes airMAX APs with a satellite reference timing signal. When enabled, airSync eliminates receive (RX) errors due to co-location transmit interference.

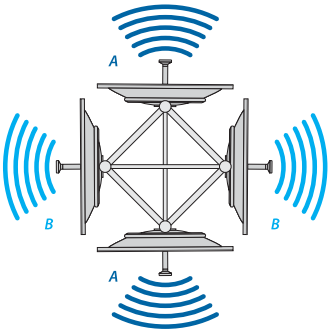
Note: To use airSync, all Stations must run airOS v5.5 or higher; otherwise, they cannot connect to any of the APs.

We recommend the following guidelines:

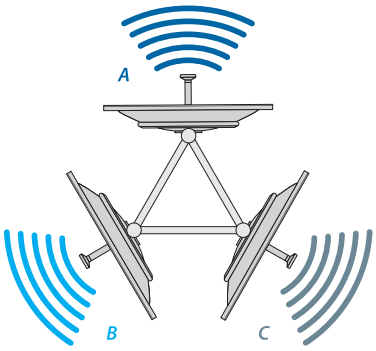
- Adjacent sectors should use different frequencies.
- Back-to-back sectors can use the same frequency.
- Do not use the same frequency on ALL of your co-located APs. Some of your co-located APs may be able to use the same frequency, depending on the scenario. See the following examples: *Four APs* and *Two APs*.
- The number of frequencies you should use depends on the number of APs you have on a single tower because a client can get confused if it receives signals on the same frequency from two different APs.
- If you are using more than one frequency, ensure that you have 20 MHz separation between the frequency band edges. For example: if frequency range A ends at 5815 MHz, then frequency range B should start at 5835 MHz or higher.

We have the following examples:

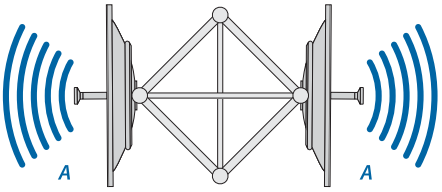
- **Four APs** Use two different frequencies. Set the same frequency on each back-to-back pair of APs (this is the ABAB channel design). For example, a client is located equidistant from two APs (one set to frequency A and one set to frequency B). The client will only receive signals from the AP that shares its frequency.



Three APs Set a different frequency on each AP (this is the ABC channel design). For example, a client is located equidistant from two APs (one set to frequency A and one set to frequency B). The client will only receive signals from the AP that shares its frequency. A different client is located equidistant from a different pair of APs (one set to frequency B and one set to frequency C). This client will only receive signals from the AP that shares its frequency.



- **Two APs** Set the same frequency on both APs located back to back (this is the AA channel design).



To sync multiple APs, these are the requirements:

- The master AP has IP connectivity (specifically UDP) to the slave APs.
- All APs have an active GPS signal.
- You have configured the transmit and receive durations on the master AP.

After you configure these durations, or slots, on the master AP, they are passed along to all slave APs. The same transmit and receive durations allow each AP to determine when to start transmitting, and when to start receiving.

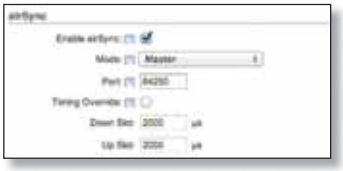
Slots are configured in *µs* (microseconds) and specify the period of time the AP will transmit (*Down Slot*), and receive (*Up Slot*). The *Down Slot* sets the amount of time for client users to download, while the *Up Slot* sets the amount of time for client users to upload.

You can think of the *Down Slot* period and *Up Slot* period as a ratio. If the *Down Slot* is set to 4000 µs, and the *Up Slot* is set to 2000 µs, the AP allocates 66% [4000/(4000+2000)] of its time providing clients' download slots, while the AP allocates the remaining 33% to clients' upload slots.

Some usage scenarios may require use of the *Timing Override* feature, depending on users' upload and download traffic. If an AP group's users will primarily be downloading, increase the ratio of *Down Slots* to *Up Slots*.

Similarly, if an AP group has more business users and needs higher upload speeds, use a more even *Down Slot*/*Up Slot* ratio. Depending on traffic patterns, you may need to adjust the *Down Slot*/*Up Slot* ratio as needed.

airSync options include:

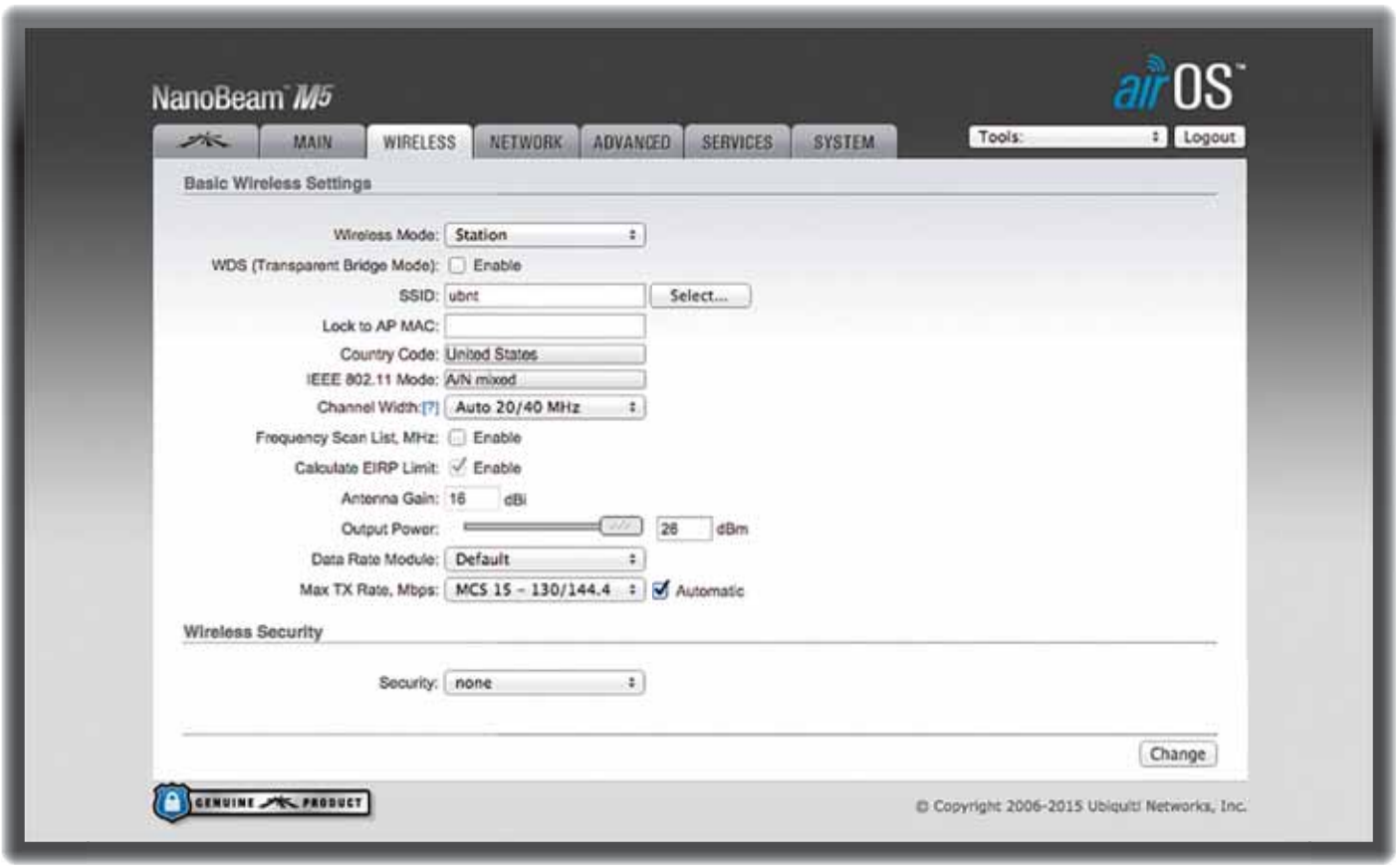


- **Enable airSync** Check the box to enable airSync.
- **Mode** Available when airSync is enabled. Select **Master** or **Slave** depending on which device is configured in *Master* mode and which devices are configured in *Slave* mode. The device in *Master* mode synchronizes with all connected peers in *Slave* mode.
- **Port** Available when airSync is enabled. By default, the port is set to *64250* but you can change the value in the field.

- **Timing Override (Master)** Available when airSync is enabled on the Master AP. Check the box to enable *Timing Override*. Uncheck the box to disable *Timing Override* and restore default settings, which vary depending on the channel bandwidth:

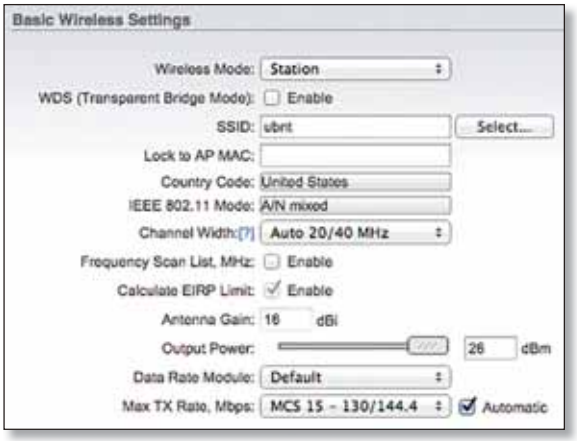
Channel Bandwidth	Down Slot	Up Slot
40 MHz	2000 µs	2000 µs
30 MHz	4000 µs	4000 µs
20 MHz	4000 µs	4000 µs
10 MHz	4000 µs	4000 µs
8 MHz	4000 µs	4000 µs
5 MHz	8000 µs	8000 µs

- **Master IP (Slave)** Available when airSync is enabled on the slave AP. Enter the IP address of the master AP.



Chapter 4: Wireless

The *Wireless* page contains everything needed to set up the wireless part of the link. This includes SSID, channel and frequency settings, device mode, data rates, and wireless security.



Change To save or test your changes, click **Change**.

A new message appears. You have three options:

- **Apply** To immediately save your changes, click **Apply**.
- **Test** To try the changes without saving them, click **Test**. To keep the changes, click **Apply**. If you do not click *Apply* within 180 seconds (the countdown is displayed), the device times out and resumes its earlier configuration.
- **Discard** To cancel your changes, click **Discard**.

Basic Wireless Settings

In this section, configure the basic wireless settings, such as wireless mode, wireless network name (SSID), country code, 802.11 mode, output power, and data rates.

Wireless Mode Specify the *Wireless Mode* of the device. The mode depends on the network topology requirements. airOS supports the following modes:

- **Station** If you have a client device to connect to an AP, configure the client device as *Station* mode. The client device acts as the subscriber station while it is connecting to the AP. The SSID of the AP is used, and all the traffic to and from the network devices connected to the Ethernet interface is forwarded.

  Note: If *WDS (Transparent Bridge Mode)* is disabled, the radio uses arpnat, which results in non-transparent bridging. To have a fully transparent bridge, select **Station** and then enable *WDS (Transparent Bridge Mode)*.

- **Access Point** If you have a single device to act as an AP, configure it as *Access Point* mode. The device functions as an AP that connects multiple client devices. If you have multiple APs repeating signals where Ethernet connections are not readily available, then use *AP-Repeater* mode.

  Note: For *Access Point (WDS)* mode, select **Access Point** and then enable *WDS (Transparent Bridge Mode)*.

- **AP-Repeater** If you have multiple APs, configure them as *AP-Repeater* mode to create a wireless network infrastructure, WDS. If the *Auto* option is enabled, all APs using the same wireless mode (*AP-Repeater*) and SSID automatically establish the WDS connections. (Client devices can still connect to APs in *AP-Repeater* mode.)

  Note: For *AP-Repeater* mode, the WPA™/WPA2™ security methods will not work; instead, use *none* or the *WEP* security method (this may compromise the security of your network). You still have the option of using RADIUS MAC authentication and MAC ACL.

  WPA or WPA2 requires different roles on AP configuration (authenticator or supplicant).

WDS (Transparent Bridge Mode) (Available in *Access Point* or *Station* mode only.) In most cases, we recommend that you use WDS because it enables transparent Layer 2 traffic. To use *WDS* with *Station* or *Access Point* mode, check the *Enable* box.

The WDS protocol is not defined as a standard, so there may be compatibility issues between equipment from different vendors.

- **Station (WDS)** *Station (WDS)* mode should be used if the device is connecting to an AP in *Access Point (WDS)* mode.
- **Access Point (WDS)** *Access Point (WDS)* mode allows Layer 2 bridging with devices in *Station (WDS)* mode.

  Note: If you connect devices running in *Station (WDS)* mode to a device running in *Access Point (WDS)* mode, then all security methods (including WPA/WPA2 encryption) are available and work properly.

Auto (Available in *AP-Repeater* mode only.) Check the *Auto* box to automatically establish WDS connections between APs in *AP-Repeater* mode. If the *Auto* option is enabled, the device will choose WDS Peers (APs in *AP-Repeater* mode) according to the SSID setting.

Note: All APs in *AP-Repeater* mode (WDS Peers) must operate on the same frequency channel, use the same channel spectrum width, and share the same security settings.

WDS Peers (Available in *AP-Repeater* mode only.) If you do not enable the *Auto* option, then specify the APs in *AP-Repeater* mode. Enter the MAC address of each AP in each *WDS Peers* field. One MAC address should be specified for a Point-to-Point (PtP) connection use case. You can specify up to six WDS Peers for a Point-to-Multi-Point (PtMP) connection use case.

SSID If the device is operating in *Access Point* or *AP-Repeater* mode, specify the wireless network name or SSID (Service Set Identifier) used to identify your WLAN. All the client devices within range will receive broadcast messages from the AP advertising this SSID.

If the device is operating in *Station* mode, specify the SSID of the AP the device is associated with. There can be several APs with an identical SSID.

Select (Available in *Station* mode only.) To display the list of available APs, click **Select**.

The *Site Survey* tool will search for available wireless networks in range on all supported channels and allow you to select one for association. In case the selected network uses encryption, you'll need to configure security on the *Wireless* page.

- **Lock to AP** Select the AP from the list. Click **Lock to AP** to allow the station to always maintain a connection to an AP with a specific MAC address.
- **Select** Select the AP from the list and click **Select** for association.
- **Scan** Click **Scan** to refresh the list of available wireless networks.

You can change the list of Scanned Frequencies for the Site Survey using the *Frequency List* option if it is enabled.

Lock to AP MAC (Available in *Station* mode only.) This allows the station to always maintain a connection to an AP with a specific MAC address. This is useful as sometimes there can be multiple APs using the same SSID. Enter a MAC address in the *Lock to AP MAC* field, and the station will lock to the AP with this specific MAC address and not roam between several APs with the same SSID.

Hide SSID (Available in *Access Point* or *AP-Repeater* mode only.) When *Hide SSID* is enabled, the SSID (wireless network name) will not be broadcast to wireless stations.

Country Code Each country has their own power level and frequency regulations. *To ensure the device operates under the necessary regulatory compliance rules, you must select the country where your device will be used*. The IEEE 802.11 mode, channel and frequency settings, and output power limits will be tuned according to the regulations of the selected country.

IEEE 802.11 Mode This is the radio standard used for operation of your device. 802.11b, 802.11a, and 802.11g are older standards, while 802.11n is a newer standard that provides higher capacity and better performance. Options include:

- **A/N mixed** Connects to an 802.11a or 802.11n network. This mode offers better compatibility. *A/N mixed* mode is selected by default on the following devices:
  - **M900 Series devices**
  - **M3 Series devices**
  - **M365 Series devices**
  - **M5 Series devices**
- **B/G/N mixed** Connects to an 802.11b, 802.11g, or 802.11n network. This mode offers better compatibility. *B/G/N mixed* mode is selected by default on the following devices:
  - **M2 Series devices**

DFS (Only applicable to specific 5 GHz devices configured with specific *Country Codes*.) Radar systems use specific frequencies in the 5 GHz range. DFS (Dynamic Frequency Selection) technology avoids interference with radar signals. Depending on the regulations of the country selected in the *Country Code* option:

- Specific 5 GHz devices may be allowed use of DFS frequencies in the UNII-2 band (5.25 - 5.725 GHz) if they use DFS technology.
- The *DFS* option may be available in airOS. If available, then you can use this option to enable or disable DFS functionality.

Before your device starts using a DFS frequency, it may lose connection for 1 or 10 minutes during the Channel Availability Check (CAC) time, depending on the frequency. (In particular, weather radar frequencies, 5600 - 5650 MHz, may have long wait times.)

If your device detects a radar on that frequency, it adds this frequency to a blacklist for 30 minutes. If only one frequency is on the *Frequency List*, then the device will lose connection for 30-40 minutes after it detects the radar. Also, any radio operating with Equivalent Isotropic Radiated Power (EIRP) > 200 mW will lose connection for 30 minutes if it detects a radar.

Channel Width Displays the spectral width of the radio channel. You can use this option to control the bandwidth consumed by your link.

Using higher bandwidth increases throughput. Using lower bandwidth:

- Reduces throughput proportional to the reduction in channel size. For example, as 40 MHz increases possible speeds by 2x, half spectrum channel (10 MHz) decreases possible speeds by 2x.
- Increases the number of available, non-overlapping channels, so networks can scale better.
- Increases the Power Spectral Density (PSD) of the channel, so you can increase the link distance – more robust links over long distances.

Available channel widths are device-specific. Supported wireless channel spectrum widths include:

- **3 MHz** The channel spectrum with the width of 3 MHz.
- **5 MHz** The channel spectrum with the width of 5 MHz (known as Quarter-Rate mode).
- **7 MHz** The channel spectrum with the width of 7 MHz.
- **8 MHz** The channel spectrum with the width of 8 MHz.
- **10 MHz** The channel spectrum with the width of 10 MHz (known as Half-Rate mode).
- **14 MHz** The channel spectrum with the width of 14 MHz.
- **20 MHz** The standard channel spectrum width of 20 MHz (selected by default).

  Note: To connect standard Wi-Fi devices that use the 2.4 GHz band, ensure that *20 MHz* is selected.
- **25 MHz** The channel spectrum with the width of 25 MHz.
- **28 MHz** The channel spectrum with the width of 28 MHz.
- **30 MHz** The channel spectrum with the width of 30 MHz.
- **40 MHz** The channel spectrum with the width of 40 MHz.
- **Auto 20/40 MHz** (Available in *Station* mode only.) Offers better compatibility.

Channel Shifting (Not available for 5 GHz products.) Enables special channels with a frequency offset regarding standard 802.11b/g/n channels. This is a proprietary feature developed by Ubiquiti Networks. Channel shifting uses non-standard (non-802.11) channels offset from the standard channels. All the channels can be shifted by 2 MHz (in 802.11b/g/n) from the default central channel frequency.

Note: *Channel Shifting* is not compatible with legacy products.

The benefits of *Channel Shifting* include private networking and inherent security, so your network is less likely to be detected by other Wi-Fi devices.

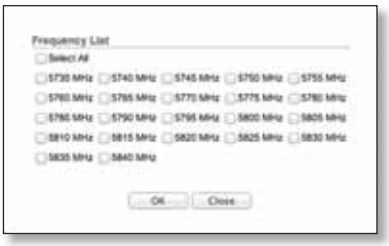
Frequency, MHz The default, *auto*, allows the device to automatically select the frequency. You can specify a frequency from the drop-down list. You can change the list using the *Frequency List* option if it is enabled.

If DFS frequencies in the UNII-2 band (5.25 - 5.725 GHz) should be available for your device but are not displayed in the drop-down list, then the DFS frequencies are locked. For information on how to unlock the DFS frequencies, refer to this option, **"UNII-2 Band" on page 55**.

Extension Channel (Available in *Access Point* or *AP-Repeater* mode only with *40 MHz* channel width enabled.) A 40 MHz channel is two 20 MHz channels bonded together. The *Extension Channel* tells the radio to append an additional channel either above or below the existing standard channel. For example, if you select *5805 MHz* (40 MHz channel) and *Lower*, the radio will use (5775 to 5795 MHz) + (5795 to 5815 MHz), but if you select *5805 MHz* (40 MHz channel) and *Upper*, the radio will use (5795 to 5815 MHz) + (5815 to 5835 MHz).

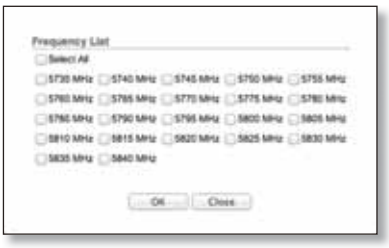
Frequency List, MHz (Available in *Access Point* or *AP-Repeater* mode only.) Multiple frequencies are available to avoid interference between nearby APs. The frequency list varies depending on the selected *Country Code*, *IEEE 802.11 Mode*, *Channel Width*, and *Channel Shifting* options. This restricts AP operation to the selected frequencies when the *auto* option is enabled.

Once enabled, click **Edit** to open the *Frequency List* window.



Select the frequencies and click **OK**, or click **Close** to close the window without any selections.

Frequency Scan List, MHz (Available in *Station* mode only.) This restricts scanning to only the selected frequencies. The benefits are faster scanning as well as filtering out unwanted APs in the results. The *Site Survey* tool will look for APs in selected frequencies only. Once enabled, click **Edit** to open the *Frequency List* window.



Select the frequencies that you want to scan and click **OK**, or click **Close** to close the window without any selections.

Calculate EIRP Limit (Not applicable to the NanoStationM900 loco.) Mandatory for all US products with fixed antennas, this option should remain enabled so it forces the transmit output power to comply with the regulations of the selected country. If enabled, you cannot set EIRP above the amount allowed per regulatory domain (different maximum output power levels and antenna gains are allowed for each IEEE 802.11b/g/n regulatory domain or country).

To disable *EIRP Limit* calculation, you must enable the *Installer EIRP Control* setting on the *Advanced* page.

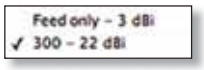
Antenna (Available for devices with multiple antenna gain options.) Devices that have internal antennas do not offer the *Antenna* field; however, their default settings (if applicable) are still listed for your reference.

Note: NanoBeam with dish antenna models are now renamed as PowerBeam.

Follow the instructions for your M model device:

- **airGridM2/M2 HP** Select the size of the grid reflector, **11x14 – 16 dBi** or **17x24 – 20 dBi**. For no gain, select **Not specified**. If you are not using a grid reflector, then keep the default, *Feed only - 3 dBi*.
- **airGridM5/M5 HP** Select the size of the grid reflector, **11x14 – 23 dBi**, **17x24 - 28 dBi** (M5), or **17x24 – 27 dBi** (M5 HP). For no gain, select **Not specified**. If you are not using a grid reflector, then keep the default, *Feed only - 3 dBi*.
- **LiteStationM5** Select the appropriate option, **Horizontal** (6 dBi) or **Vertical** (6 dBi). The default is *Horizontal*.
- **NanoBeamM5 16** The default is *16 dBi*.
- **NanoBeamM5 19** The default is *19 dBi*.
- **NanoBridgeM2** If you are not using a dish reflector, then select **Feed only - 3 dBi**. Otherwise, keep the default, *18 dBi*.
- **NanoBridgeM3/M365** The default is *19 dBi*.
- **NanoBridgeM5** Select the size of the dish reflector, **300 - 22 dBi** or **400 - 25 dBi**. For no gain, select **Not specified**. The default is *Feed only - 3 dBi*. If you are not using a grid reflector, then keep the default, *Feed only - 3 dBi*.
- **NanoBridgeM900** The default is *13 dBi*.
- **NanoStationM2** The default is *11 dBi*.
- **NanoStationM3/M365** The default is *12 dBi*.
- **NanoStationM5/M6** The default is *16 dBi*.
- **NanoStationM900** The default is *Internal (2x2)* for 11 dBi.
- **NanoStationlocoM2** The default is *8 dBi*.
- **NanoStationlocoM5** The default is *13 dBi*.

- **NanoStationlocoM900** Select the appropriate option: **Internal (2x2)** for 8 dBi, **External (1x1)**, or **External + Internal (2x2)**. The external RP-SMA maps to chain 0, which is the horizontal polarity internally. The default is *Internal (2x2)*.
- **PowerBeamM2 400** If you are not using a dish reflector, then select **Feed only - 3 dBi**. Otherwise, keep the default, *400 - 18 dBi*.
- **PowerBeamM5 300** If you are not using a dish reflector, then select **Feed only - 3 dBi**. Otherwise, keep the default, *300 - 22 dBi*.



- **PowerBeamM5 400** If you are not using a dish reflector, then select **Feed only - 3 dBi**. Otherwise, keep the default, *400 - 25 dBi*.
- **PowerBeamM5 620** If you are not using a dish reflector, then select **Feed only - 3 dBi**. Otherwise, keep the default, *620 - 29 dBi*.
- **PowerBridgeM3/M365** The default is *18 dBi*.
- **PowerBridgeM5** The default is *24 dBi*.
- **PowerBridgeM10** The default is *18 dBi*.

Antenna Gain (Not available if the device uses an integrated antenna.) Enter the antenna gain in dBi. With *Calculate EIRP Limit* enabled, *Antenna Gain* calculates the TX power backoff needed to remain in compliance with local regulations. The *Antenna Gain* setting complements the *Cable Loss* setting; they both affect the TX power of the device.

Cable Loss (Only applicable to devices with external antenna connectors.) Enter the cable loss in dB. With *Calculate EIRP Limit* enabled, *Cable Loss* affects the TX power of the device. In case you have high amounts of cable loss, you may increase the TX power while remaining in compliance with local regulations. The *Cable Loss* setting complements the *Antenna Gain* setting; they both affect the TX power of the device.

Output Power Defines the maximum average transmit output power (in dBm) of the device. To specify the output power, use the slider or manually enter the output power value. The transmit power level maximum is limited according to country regulations. (If the device has an internal antenna, then *Output Power* is the output power delivered to the internal antenna.)

Data Rate Module (Not applicable to the airGateway.) You have a choice of data rate algorithms to use for your link, **Default** or **Alternative**. If the *Default* is not working well for your link, you can try the *Alternative* to determine which is the best data rate algorithm for your individual situation. The *Alternative* tries to move the link to a higher data rate but continuously monitors the packet failure counters. You should get more stable data rates when using the *Alternative*; however, results will vary depending on the link's specific environment and configuration.

For example, if a problematic link has traffic stability issues and uses the *Default*, you may want to try the *Alternative* to see if it improves the situation.

Note: The *Data Rate Module* affects the TX rate only, not the RX rate. You can select *Default* or *Alternative* on a single device; this option does not depend on which algorithm is selected on the AP or its stations.

Max TX Rate, Mbps Defines the maximum data rate range (in Mbps) at which the device should transmit wireless packets. You can fix a specific data rate between MCS 0 and MCS 7 (or MCS 15 for 2x2 chain devices). We recommend that you use the automatic option, especially if you are having trouble getting connected or losing data at a higher rate. In this case, the lower data rates will be used automatically. If you select *20 MHz* for the *Channel Width*, the maximum data rate is *MCS 7 - 65/72.2* (Mbps) or *MCS 15 - 130/144.4* (Mbps). If you select *40 MHz* for the *Channel Width*, the maximum data rate is *MCS 7 - 135/150* (Mbps) or *MCS 15 - 270/300* (Mbps).

- **Automatic** If enabled, the rate algorithm selects the best data rate, depending on link quality conditions. We recommend that you use this option, especially if you are having trouble getting connected or losing data at a higher rate. For more information about data rates, refer to **"Advanced Wireless Settings" on page 45**.

Note: The *Max TX Rate* is a range because it varies, depending on which guard interval value is automatically selected by the rate algorithm. If the normal guard interval (800 ns) is used, then the data rate is lower. If the short guard interval (400 ns) is used, then the data rate is higher.

Wireless Security

In *Access Point* or *AP-Repeater* mode, configure the wireless security settings that will be used by the devices on your wireless network.

In *Station* mode, enter the security settings of the AP that the device is associated with.

The following table lists the wireless security methods available for each wireless mode:

Security Method	Access Point	AP-Repeater	Station
none	✓[1]	✓[1]	✓
WEP		✓[2]	
WPA-AES	✓		✓
WPA2-AES	✓		✓

[1] If you select *none* as your security method, then this may compromise the security of your network; however, you have the options of using RADIUS MAC Authentication and MAC ACL.

[2] If you select *WEP* as your security method, then this may compromise the security of your network; however, you have the option of using MAC ACL.

Security airOS supports the following wireless security methods:

- **none** If you want an open network without wireless security, select **none**. You still have the option of using RADIUS MAC authentication and MAC ACL.
- **WEP** WEP (Wired Equivalent Privacy) is the oldest and least secure security algorithm.
- **WPA-AES** WPA (Wi-Fi Protected Access) security mode with AES (Advanced Encryption Standard) support only. AES is also known as CCMP (Counter Mode with Cipher Block Chaining Message Authentication Code Protocol), which uses the AES algorithm.
- **WPA2-AES** WPA2 security mode with AES support only. WPA2 was developed to strengthen wireless encryption security and is stronger than WPA, so *WPA2-AES* is the strongest security option available. If all of the wireless devices on your network support this option, we recommend that you select it.

None

RADIUS MAC Authentication You can authenticate devices using their MAC addresses.

MAC Format Select the appropriate format of the MAC address.

Use Empty Password To submit the MAC address without a password, check the *Enable* box.

Auth Server IP/Port In the first field, enter the IP address of the RADIUS authentication server. RADIUS is a networking protocol providing centralized Authentication, Authorization, and Accounting (AAA) management for computers to connect to and use a network service.

In the second field, enter the UDP port of the RADIUS authentication server. The most commonly used port is the default, *1812*, but this may vary depending on the RADIUS server you are using.

Auth Server Secret Enter the password. A shared secret is a case-sensitive text string used to validate communication between an Access Point and RADIUS server.

Show Check the box if you want to view the characters of the Auth Server Secret.

Accounting Server If you are using an accounting server, check the *Enable* box.

Acct Server IP/Port If the Accounting Server is enabled, enter the IP address of the accounting server.

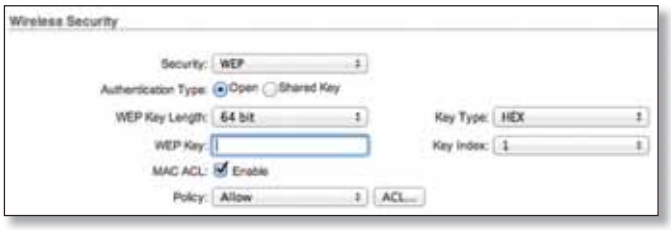
In the second field, enter the UDP port of the RADIUS accounting server. The most commonly used port is the default, *1813*, but this may vary depending on the RADIUS server you are using.

Acct Server Secret If the Accounting Server is enabled, enter the password. A shared secret is a case-sensitive text string used to validate communication between an Access Point and RADIUS server.

Show Check the box if you want to view the characters of the Acct Server Secret.

Mac ACL This option enables the MAC address Access Control List. For details, refer to **"MAC ACL" on page 30**.

WEP



Authentication Type Select one of the following authentication methods:

- **Open** This option is selected by default. The station is authenticated automatically by the AP.
- **Shared Key** The station is authenticated after the challenge, which is generated by the AP.

WEP Key Length Specifies the length of the WEP security key. Select one of the two options:

- **64-bit** This option is selected by default. A 64-bit key is 10 HEX or 5 ASCII characters in length.
- **128-bit** The 128-bit option provides more security and is 26 HEX or 13 ASCII characters in length.

Key Type Specifies the character format of the WEP key:

- **HEX** By default, this option uses hexadecimal characters. 0-9, A-F, or a-f are valid characters.
- **ASCII** ASCII uses the standard English alphabet and numeric characters.

WEP Key Enter the appropriate WEP encryption key:

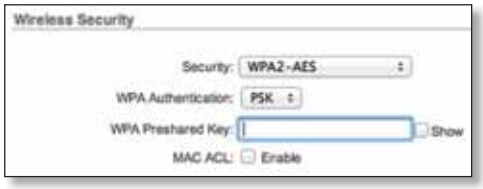
Type	HEX	ASCII
64-bit	10 hexadecimal characters (0-9, A-F or a-f) Example: **00112233AA**	5 ASCII characters Example: **ubnt1**
128-bit	26 hexadecimal characters (0-9, A-F or a-f) Example: **00112233445566778899AABBCC**	13 ASCII characters Example: **ubntproducts1**

Key Index Specifies the index of the WEP key used. Four different WEP keys can be configured at the same time, but only one is used. To set the effective key, select **1**, **2**, **3**, or **4**.

Mac ACL This option enables the MAC address Access Control List. For details, refer to **"MAC ACL" on page 30**.

WPA-AES or WPA2-AES

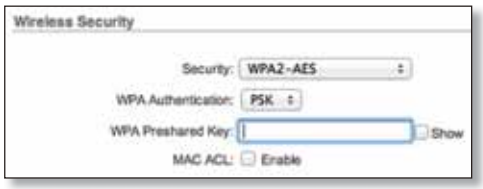
The configuration options are the same. WPA2-AES is the strongest security method. If all of the wireless devices on your network support this option, we recommend that you select it.



WPA Authentication Specify one of the following WPA key selection methods:

- **PSK** Pre-shared Key method (selected by default).
- **EAP** EAP (Extensible Authentication Protocol) IEEE 802.1x authentication method. This method is commonly used in enterprise networks.

PSK



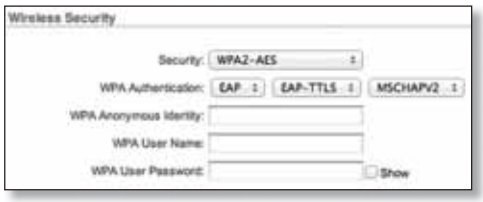
WPA Preshared Key Specify a passphrase. The preshared key is an alpha-numeric password between 8 and 63 characters long.

Show Check the box if you want to view the characters of the WEP Preshared Key.

EAP

EAP - Station Mode

The options below apply in *Station* mode only.



EAP-TTLS / EAP-PEAP Select the authentication protocol used by your AP. The inner authentication protocol is set to *MSCHAPV2* by default.

WPA Anonymous Identity Enter the identification credential used by the supplicant for EAP authentication in unencrypted form.

WPA User Name Enter the identification credential used by the supplicant for EAP authentication.

WPA User Password Enter the password credential used by the supplicant for EAP authentication.

Show Check the box if you want to view the characters of the WPA User Password.

EAP- Access Point Mode

The options below apply in *Access Point* or *AP-Repeater* mode only.

Auth Server IP/Port In the first field, enter the IP address of the RADIUS authentication server. RADIUS is a networking protocol providing centralized Authentication, Authorization, and Accounting (AAA) management for computers to connect to and use a network service.

In the second field, enter the UDP port of the RADIUS authentication server. The most commonly used port is 1812, but this may vary depending on the RADIUS server you are using.

Auth Server Secret Enter the password. A shared secret is a case-sensitive text string used to validate communication between an Access Point and RADIUS server.

Show Check the box if you want to view the characters of the Auth Server Secret.

Accounting Server If you are using an accounting server, check the *Enable* box.

Acct Server IP/Port If the Accounting Server is enabled, enter the IP address of the accounting server.

In the second field, enter the UDP port of the RADIUS accounting server. The most commonly used port is 1813, but this may vary depending on the RADIUS server you are using.

Acct Server Secret If the Accounting Server is enabled, enter the password. A shared secret is a case-sensitive text string used to validate communication between an Access Point and RADIUS server.

Show Check the box if you want to view the characters of the Acct Server Secret.

Mac ACL This option enables the MAC address Access Control List. For details, refer to **"MAC ACL" on page 30**.

MAC ACL

The options below apply in *Access Point* or *AP-Repeater* mode only.

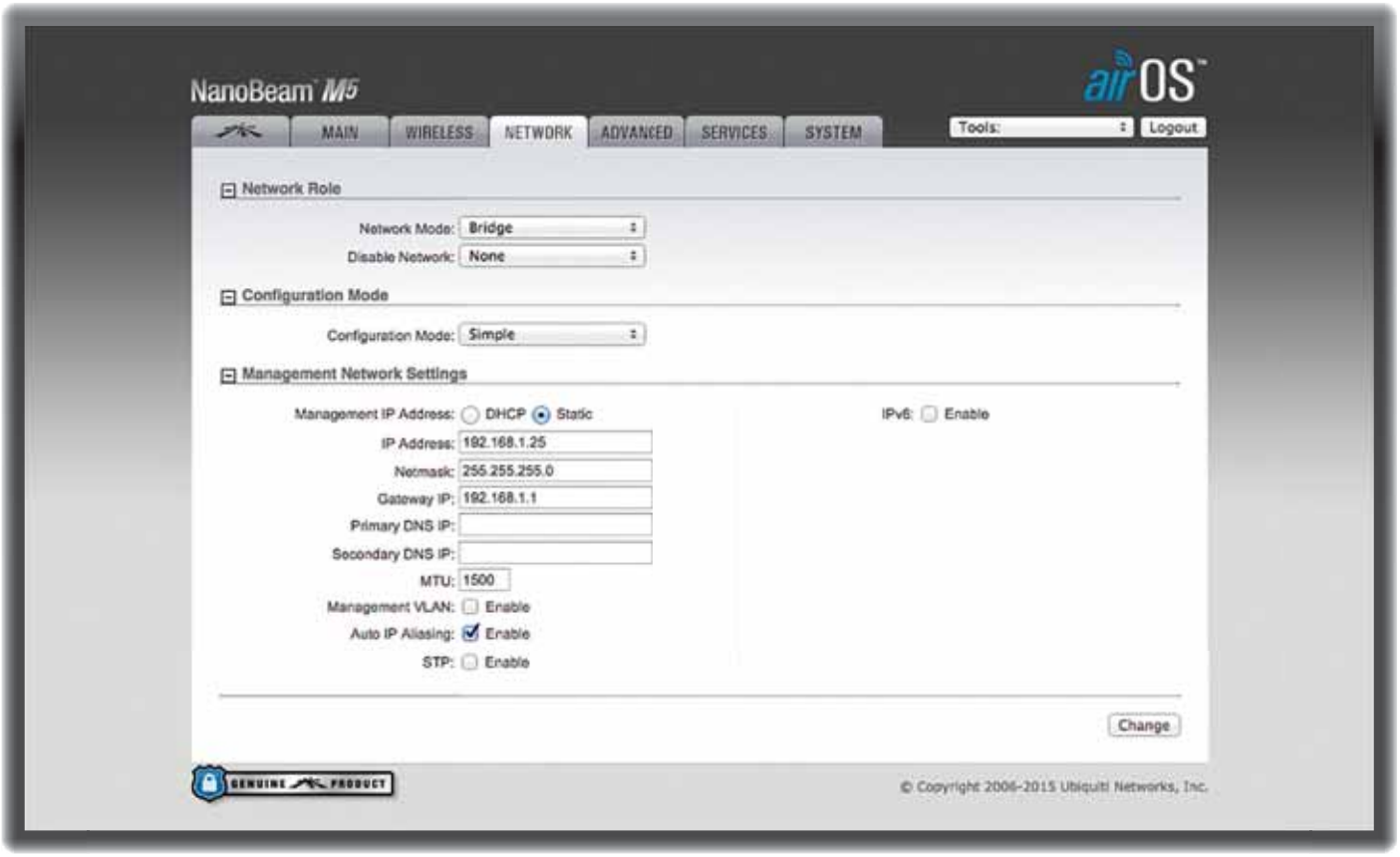
MAC ACL The MAC address Access Control List (ACL) lets you allow or deny clients connectivity to the device. When enabled, you have the following options:

Policy Select one of the policy types:

- **Allow** Wireless clients on the list can access the device. Any wireless client that is not on the list is denied access to the device.
- **Deny** Wireless clients on the list are denied access to the device. Any wireless client that is not on the list can access the device.
- **ACL** To add MAC addresses of wireless clients, click **ACL**.

- **Enabled** The policy is applied to this wireless client.
- **MAC** Enter the MAC address in this format: XX:XX:XX:XX:XX:XX (each X represents a valid hexadecimal character: 0-9, A-F, or a-f).
- **Comment** Enter a description of the wireless client.
- **Action** Click **Add** to add the MAC address of a wireless client. Click **Del** to remove the MAC address of a wireless client. Click **Edit** to make changes to an entry.

Note: MAC ACL should be used in combination with a security method such as WPA or WPA2. It should not be used as the only method of security on your network.



Chapter 5: Network

The *Network* page allows you to configure bridge or routing functionality and IP settings.

Change To save or test your changes, click **Change**.

A new message appears. You have three options:

- **Apply** To immediately save your changes, click **Apply**.
- **Test** To try the changes without saving them, click **Test**. To keep the changes, click **Apply**. If you do not click *Apply* within 180 seconds (the countdown is displayed), the device times out and resumes its earlier configuration.
- **Discard** To cancel your changes, click **Discard**.

Network Role

airOS supports *Bridge*, *Router*, and *SOHO Router* modes. Only the routers can support the router modes.

Network Mode Specify the *Network Mode* of the device. The default setting is device-specific. The mode depends on the network topology requirements.

Bridge mode is adequate if you have a very small network. However, a larger network has significantly more traffic that requires management by a device using *Router* or *SOHO Router* mode. *Router* or *SOHO Router* mode keeps broadcast traffic within its respective broadcast domain, so that broadcast traffic will not overload the overall traffic in the network.

- **Bridge** The device acts as a transparent bridge, operates in Layer 2 (like a managed switch), and usually has only one IP address (for management purposes only).

- **Router** The device is usually separated into two networks or subnets (one WAN and one LAN). The WLAN functions as the Wide Area Network (WAN). The Ethernet ports function as the LAN. Each wireless or wired interface on the WAN or LAN has an IP address (for management purposes only).

- **SOHO Router** SOHO (Small Office/Home Office) Router mode is derived from *Router* mode. The main Ethernet port labeled **<•••>** functions as the WAN port. The WLAN and other Ethernet ports function as the LAN. Each wireless or wired interface on the WAN or LAN has an IP address (for management purposes only).

The following summarizes the differences between *Bridge*, *Router*, and *SOHO Router* modes:

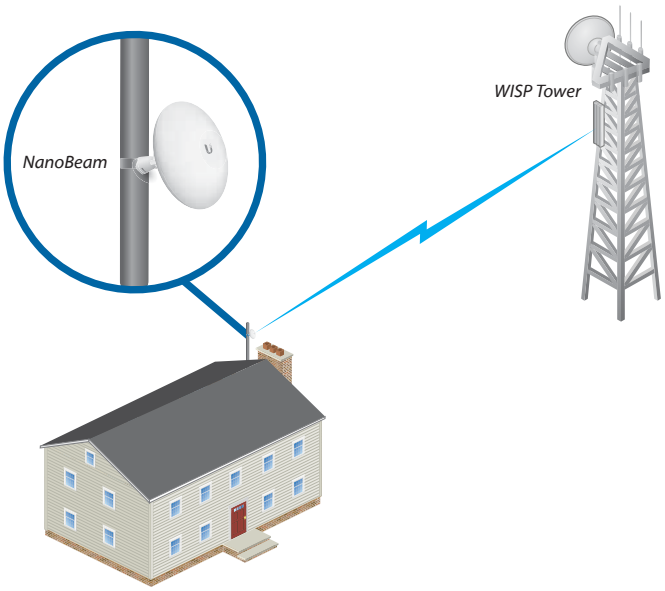
Bridge Mode

- The device forwards all network management and data packets from one network interface to the other without any intelligent routing. For simple applications, this provides an efficient and fully transparent network solution.
- There is no network segmentation, and the broadcast domain is the same. *Bridge* mode does not block any broadcast or multicast traffic. You can configure additional firewall settings for Layer 2 packet filtering and access control.
- WLAN and LAN interfaces belong to the same network segment and share the same IP address space. They form the virtual bridge interface while acting as bridge ports. The device features IP settings for management purposes.

Router Mode

- The device operates in Layer 3 to perform routing and enable network segmentation – wireless clients and the WAN interface are on a different IP subnet. *Router* mode blocks broadcasts and can pass through multicast packet traffic. You can configure additional firewall settings for Layer 3 packet filtering and access control.
- The device can act as a DHCP server and use Network Address Translation (Masquerading), which is widely used by APs. NAT acts as the firewall between the LAN and WAN.
- For example, *Router* mode is used in a typical Customer Premises Equipment (CPE) installation. The device acts as the demarcation (demarc) point between the CPE and Wireless Internet Service Provider (WISP), with the wireless interface of the device connecting to the WISP.

  The following diagram shows the NanoBeam at a residence wirelessly connecting to a WISP tower.



SOHO Router Mode

- The device operates in Layer 3 to perform routing and enable network segmentation – wireless clients and the WAN interface are on a different IP subnet. *SOHO Router* mode blocks broadcasts and can pass through multicast packet traffic. You can configure additional firewall settings for Layer 3 packet filtering and access control.
- The device can act as a DHCP server and use Network Address Translation (Masquerading), which is widely used by APs. NAT acts as the firewall between the LAN and WAN.
- For example, *SOHO Router* mode is used in an installation where the main Ethernet port connects to the Internet Service Provider (ISP) via a modem.
- In devices with one Ethernet port (while operating in *Access Point* or *AP-Repeater* mode), *SOHO Router* mode works like *Router* mode, except that the LAN port works as a WAN port, and the WLAN works as the local network. In devices with two or more Ethernet ports, the main Ethernet port becomes the WAN port, and the WLAN and other LAN ports become the local network.

Note: Do not use the *SOHO Router* mode in combination with *Station* wireless mode; this may cause the device to become inaccessible. If this did happen, reset the device to defaults; press and hold the **Reset** button for eight seconds and then release it.

Disable Network Disables the WLAN, LAN0, or LAN1 interface(s). Use this setting with caution as you cannot establish any Layer 2 or Layer 3 connection through the disabled interface. You cannot access the device from the wireless or wired network that is connected to the disabled interface.

Configuration Mode

The Network page has two views, *Simple* and *Advanced*.

Configuration Mode Select the appropriate mode for your application:

- **Simple** The following basic configuration settings are available:
  - **"Network Role" on page 31**
  - **"Configuration Mode" on page 32**

  The following settings are available in *Bridge* mode only:
  - **"Management Network Settings – Bridge Mode" on page 33**

The following settings are available in *Router* or *SOHO Router* mode only:

- **"WAN Network Settings" on page 34**
- **"LAN Network Settings" on page 38**
- **"Port Forwarding" on page 40**
- **"Multicast Routing Settings" on page 40**

The following settings are available in *SOHO Router* mode only:

- **"DHCP Address Reservation" on page 40**

- **Advanced** Displays the advanced configuration settings, in addition to the basic configuration settings:
  - **"Interfaces" on page 41**
  - **"IP Aliases" on page 41**
  - **"VLAN Network" on page 41**
  - **"Bridge Network" on page 42**
  - **"Firewall" on page 42**
  - **"IPv6 Firewall" on page 43**
  - **"Static Routes" on page 43**
  - **"Traffic Shaping" on page 44**

  The following settings are available in *Router* or *SOHO Router* mode only:

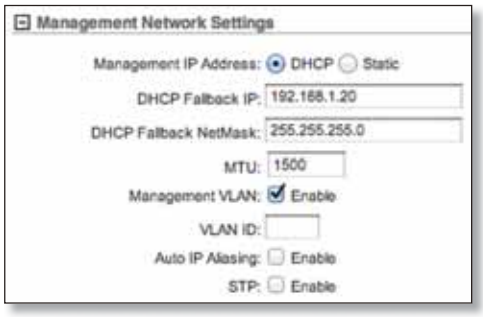
  - **"Management Network Settings – Router or SOHO Mode" on page 34**
  - **"IPv6 Static Routes" on page 44**

Management Network Settings – Bridge Mode

Management Interface (Available in *Advanced* view.) Select the interface used for management.

Management IP Address The device can use a static IP address or obtain an IP address from its DHCP server.

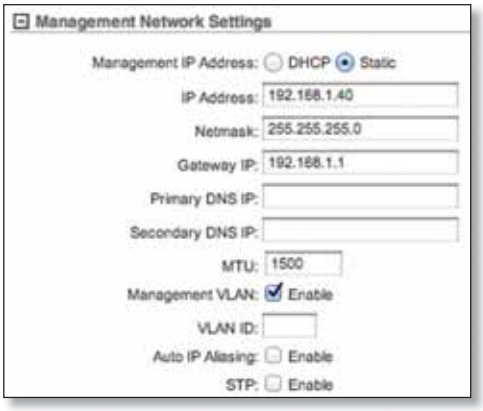
- **DHCP** The local DHCP server assigns a dynamic IP address, gateway IP address, and DNS address to the device.



  - **DHCP Fallback IP** Specify the IP address for the device to use if a DHCP server is not found.
  - **DHCP Fallback Netmask** Specify the netmask for the device to use if a DHCP server is not found.

- **Static** Assign static IP settings to the device.

  Note: IP settings should be consistent with the address space of the device's network segment.



  - **IP Address** Specify the IP address of the device. This IP will be used for device management purposes.
  - **Netmask** Enter the netmask of the device. The netmask defines the address space of the device's network segment. The netmask *255.255.255.0* is typically used for Class C networks.
  - **Gateway IP** Typically, this is the IP address of the host router, which provides the point of connection to the Internet. This can be a DSL modem, cable modem, or WISP gateway router. The device directs data packets to the gateway if the destination host is not within the local network.

  Note: In *Bridge* mode, the gateway IP address should be from the same address space (on the same network segment) as the device.

  - **Primary DNS IP** Specify the IP address of the primary DNS (Domain Name System) server for management purposes only.
  - **Secondary DNS** Specify the IP address of the secondary DNS server for management purposes only. This entry is optional and used only if the primary DNS server is not responding.

MTU (Available in *Simple* view.) The Maximum Transmission Unit (MTU) is the maximum frame size (in bytes) that a network interface can transmit or receive. The default is *1500*.

Management VLAN (Available in *Simple* view.) If enabled, automatically creates a management Virtual Local Area Network (VLAN).

- **VLAN ID** Enter a unique *VLAN ID* from 2 to 4094.

Note: If *Management VLAN* is enabled, then the device will not be accessible from other VLANs, including the untagged VLAN.

Auto IP Aliasing If enabled, automatically generates an IP address for the corresponding WLAN/LAN interface. The generated IP address is a unique Class B IP address from the 169.254.X.Y range (netmask 255.255.0.0), which is intended for use within the same network segment only. The Auto IP always starts with 169.254.X.Y, with X and Y as the last two octets from the MAC address of the device. For example, if the MAC is 00:15:6D:A3:04:FB, then the generated unique Auto IP will be 169.254.4.251.

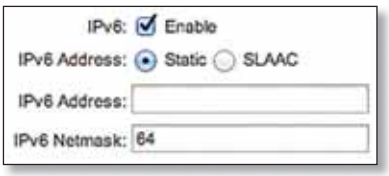
The *Auto IP Aliasing* setting can be useful because you can still access and manage devices even if you lose, misconfigure, or forget their IP addresses. Because an Auto IP address is based on the last two octets of the MAC address, you can determine the IP address of a device if you know its MAC address.

STP Multiple interconnected bridges create larger networks. Spanning Tree Protocol (STP) eliminates loops from the topology while finding the shortest path within a network.

If enabled, the device bridge communicates with other network devices by sending and receiving Bridge Protocol Data Units (BPDU). *STP* should be disabled (default setting) when the device is the only bridge on the LAN or when there are no loops in the topology, as there is no need for the bridge to use STP in this case.

IPv6 Disabled by default. Select **IPv6** if you want to use IPv6 addressing.

- **Static** Select **Static** to manually define the IPv6 settings of the device. Complete the following:
  - **IPv6 Address** Enter the IPv6 address of the device.
  - **IPv6 Netmask** Enter the IPv6 netmask of the device. The default is *64*.



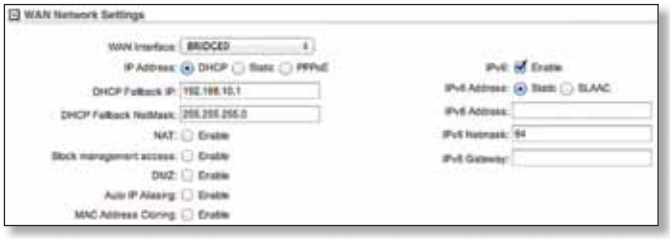
- **SLAAC** If IPv6 is enabled, then *SLAAC* (StateLess Address Auto-Configuration) is enabled by default; the device assign itself an IPv6 address.

Management Network Settings – Router or SOHO Mode

Management Interface (Available in *Advanced* view.) Select the interface used for management.

WAN Network Settings

(Available in *Router* or *SOHO Router* mode only)



WAN Interface Select the interface used for connection to the external network (Internet).

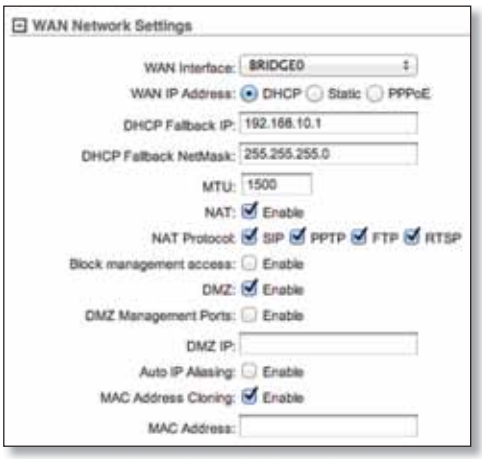
WAN IP Address The IP address of the WAN interface connected to the external network. You can use this IP address for routing and device management purposes.

The device can use one of the following:

- **"DHCP" on page 34**
- **"Static" on page 35**
- **"PPPoE" on page 36**

DHCP

The external DHCP server assigns a dynamic IP address, gateway IP address, and DNS address to the device.



DHCP Fallback IP Specify the IP address for the device to use if an external DHCP server is not found.

DHCP Fallback Netmask Specify the netmask for the device to use if an external DHCP server is not found.

MTU (Available in *Simple* view.) The Maximum Transmission Unit (MTU) is the maximum frame size (in bytes) that a network interface can transmit or receive. The default is *1500*.

NAT Network Address Translation (NAT) is an IP masquerading technique that hides private network IP address space (on LAN interface) behind a single public IP address (on WAN interface).

NAT is implemented using the masquerade type firewall rules. NAT firewall entries are stored in the iptables nat table. Specify static routes to allow packets to pass through the airOS device if NAT is disabled.

- **NAT Protocol** Devices on the LAN side behind a NAT'ed router have no transparent connectivity with devices on WAN side; this may be critical for some Internet protocols. For this purpose *NAT Protocol* has NAT helpers that enable NAT traversal for various protocols: SIP, PPTP, FTP, and RTSP.

  If NAT is enabled, you can modify data packets to allow them to pass through the device. To avoid modification of some specific types of packets, such as SIP, PPTP, FTP, or RTSP, then uncheck the respective box(es).

Block management access To block device management from the WAN interface, check this box. This feature makes *Router* or *SOHO Router* mode more secure if the device has a public IP address.

DMZ DMZ (Demilitarized Zone) specifically allows one computer/device behind NAT to become "demilitarized", so all ports from the public network are forwarded to the ports of this private network, similar to a 1:1 NAT.

- **DMZ Management Ports** The airOS device responds to requests from the external network as if it were the host device that is specified with the DMZ IP address. *DMZ Management Ports* is disabled by default; the device is accessible from the WAN port. If *DMZ Management Ports* is enabled, all management ports will be forwarded to the device, so you'll only be able to access the device from the LAN side.

  The default values of the management ports are:

Management Method	Management Port
HTTP/HTTPS	80/443 TCP
SSH	22 TCP
Telnet	23 TCP
SNMP	161 UDP
Discovery	10001 UDP
airView	18888 TCP

- **DMZ IP** Specify the IP address of the local host network device. The DMZ host device will be completely exposed to the external network.

Auto IP Aliasing If enabled, automatically generates an IP address for the corresponding WLAN/LAN interface. The generated IP address is a unique Class B IP address from the 169.254.X.Y range (netmask 255.255.0.0), which is intended for use within the same network segment only. The Auto IP always starts with 169.254.X.Y, with X and Y as the last two octets from the MAC address of the device. For example, if the MAC is 00:15:6D:A3:04:FB, then the generated unique Auto IP will be 169.254.4.251.

The *Auto IP Aliasing* setting can be useful because you can still access and manage devices even if you lose, misconfigure, or forget their IP addresses. Because an Auto IP address is based on the last two octets of the MAC address, you can determine the IP address of a device if you know its MAC address.

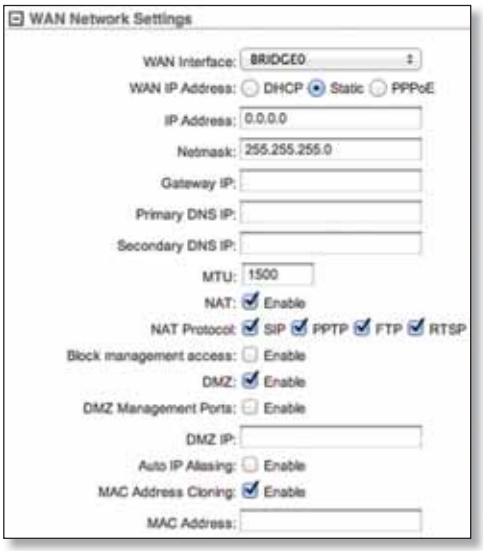
MAC Address Cloning When enabled, you can change the MAC address of the respective interface. This is especially useful if your ISP only assigns one valid IP address and it is associated to a specific MAC address. This is usually used by cable operators or some WISPs.

- **MAC Address** Enter the MAC address you want to clone to the respective interface. This becomes the new MAC address of the interface.

Static

Assign static IP settings to the device.

Note: IP settings should be consistent with the address space of the device's network segment.



IP Address Specify the IP address of the device. This IP will be used for device management purposes.

Netmask Enter the netmask of the device. The netmask defines the address space of the device's network segment. The netmask *255.255.255.0* is typically used for Class C networks.

Gateway IP Typically, this is the IP address of the host router, which provides the point of connection to the Internet. This can be a DSL modem, cable modem, or WISP gateway router. The device directs data packets to the gateway if the destination host is not within the local network.

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NAT Network Address Translation (NAT) is an IP masquerading technique that hides private network IP address space (on LAN interface) behind a single public IP address (on WAN interface).

NAT is implemented using the masquerade type firewall rules. NAT firewall entries are stored in the iptables nat table. Specify static routes to allow packets to pass through the airOS device if NAT is disabled.

- **NAT Protocol** Devices on the LAN side behind a NAT'ed router have no transparent connectivity with devices on WAN side; this may be critical for some Internet protocols. For this purpose *NAT Protocol* has NAT helpers that enable NAT traversal for various protocols: SIP, PPTP, FTP, and RTSP.

  If NAT is enabled, you can modify data packets to allow them to pass through the device. To avoid modification of some specific types of packets, such as SIP, PPTP, FTP, or RTSP, then uncheck the respective box(es).

Block management access To block device management from the WAN interface, check this box. This feature makes *Router* mode more secure if the device has a public IP address.

DMZ DMZ (Demilitarized Zone) specifically allows one computer/device behind NAT to become "demilitarized", so all ports from the public network are forwarded to the ports of this private network, similar to a 1:1 NAT.

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  The default values of the management ports are:

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MAC Address Cloning When enabled, you can change the MAC address of the respective interface. This is especially useful if your ISP only assigns one valid IP address and it is associated to a specific MAC address. This is usually used by cable operators or some WISPs.

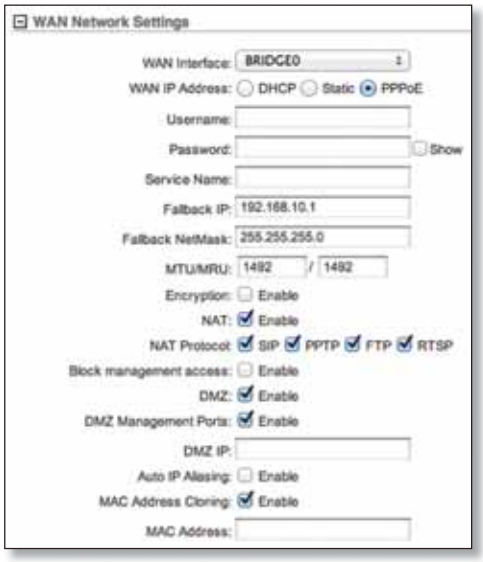
- **MAC Address** Enter the MAC address you want to clone to the respective interface. This becomes the new MAC address of the interface.

PPPoE

Point-to-Point Protocol over Ethernet (PPPoE) is a virtual private and secure connection between two systems that enables encapsulated data transport. Subscribers sometimes use PPPoE to connect to Internet Service Providers (ISPs), typically DSL providers.

Select **PPPoE** to configure a PPPoE tunnel. You can configure only the WAN interface as a PPPoE client because all the traffic will be sent via this tunnel. After the PPPoE connection is established, the device will obtain the IP address, default gateway IP, and DNS server IP address from the PPPoE server. The broadcast address is used to discover the PPPoE server and establish the tunnel.

If there is a PPPoE connection established, then the IP address of the PPP interface will be displayed on the *Main* page next to the PPP interface statistics; otherwise a *Not Connected* message and *Reconnect* button will be displayed. To re-connect a PPPoE tunnel, click **Reconnect**.



Username Specify the username to connect to the PPPoE server; this must match the username configured on the PPPoE server.

Password Specify the password to connect to the PPPoE server; this must match the password configured on the PPPoE server.

Show Check the box if you want to view the characters of the password.

Service Name Specify the name of the PPPoE service.

Fallback IP Specify the IP address for the device to use if the PPPoE server does not assign an IP address.

Fallback Netmask Specify the netmask for the device to use if the PPPoE server does not assign a netmask.

MTU/MRU The size (in bytes) of the Maximum Transmission Unit (MTU) and Maximum Receive Unit (MRU) used for data encapsulation during transfer through the PPP tunnel. The default value is *1492*.

Encryption Enables the use of Microsoft Point-to-Point Encryption (MPPE).

NAT Network Address Translation (NAT) is an IP masquerading technique that hides private network IP address space (on LAN interface) behind a single public IP address (on WAN interface).

NAT is implemented using the masquerade type firewall rules. NAT firewall entries are stored in the iptables nat table. Specify static routes to allow packets to pass through the airOS device if NAT is disabled.

- **NAT Protocol** Devices on the LAN side behind a NAT'ed router have no transparent connectivity with devices on WAN side; this may be critical for some Internet protocols. For this purpose *NAT Protocol* has NAT helpers that enable NAT traversal for various protocols: SIP, PPTP, FTP, and RTSP.

  If NAT is enabled, you can modify data packets to allow them to pass through the device. To avoid modification of some specific types of packets, such as SIP, PPTP, FTP, or RTSP, then uncheck the respective box(es).

Block management access To block device management from the WAN interface, check this box. This feature makes *Router* mode more secure if the device has a public IP address.

DMZ DMZ (Demilitarized Zone) specifically allows one computer/device behind NAT to become "demilitarized", so all ports from the public network are forwarded to the ports of this private network, similar to a 1:1 NAT.

- **DMZ Management Ports** The airOS device responds to requests from the external network as if it were the host device that is specified with the DMZ IP address. *DMZ Management Ports* is disabled by default; the device is accessible from the WAN port. If *DMZ Management Ports* is enabled, all management ports will be forwarded to the device, so you'll only be able to access the device from the LAN side.

  The default values of the management ports are:

Management Method	Management Port
HTTP/HTTPS	80/443 TCP
SSH	22 TCP
Telnet	23 TCP
SNMP	161 UDP
Discovery	10001 UDP
airView	18888 TCP

- **DMZ IP** Specify the IP address of the local host network device. The DMZ host device will be completely exposed to the external network.

Auto IP Aliasing If enabled, automatically generates an IP address for the corresponding WLAN/LAN interface. The generated IP address is a unique Class B IP address from the 169.254.X.Y range (netmask 255.255.0.0), which is intended for use within the same network segment only. The Auto IP always starts with 169.254.X.Y, with X and Y as the last two octets from the MAC address of the device. For example, if the MAC is 00:15:6D:A3:04:FB, then the generated unique Auto IP will be 169.254.4.251.

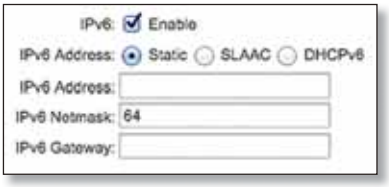
The *Auto IP Aliasing* setting can be useful because you can still access and manage devices even if you lose, misconfigure, or forget their IP addresses. Because an Auto IP address is based on the last two octets of the MAC address, you can determine the IP address of a device if you know its MAC address.

MAC Address Cloning When enabled, you can change the MAC address of the respective interface. This is especially useful if your ISP only assigns one valid IP address and it is associated to a specific MAC address. This is usually used by cable operators or some WISPs.

- **MAC Address** Enter the MAC address you want to clone to the respective interface. This becomes the new MAC address of the interface.

IPv6 Disabled by default. Select **IPv6** if you want to use IPv6 addressing.

- **Static** (Not available for PPPoE) Select **Static** to manually define the IPv6 settings of the device. Complete the following:
  - **IPv6 Address** Enter the IPv6 address of the device.
  - **IPv6 Netmask** Enter the IPv6 netmask of the device. The default is *64*.
  - **IPv6 Gateway** Enter the IPv6 address of the local gateway, which is typically the host router.



- **SLAAC** Select **SLAAC** (StateLess Address Auto-Configuration) to have the device assign itself an IPv6 address.

- **DHCPv6** Select **DHCPv6** to have an external DHCP server assign a dynamic IP address, gateway IP address, and DNS address to the device.

LAN Network Settings

(Available in *Router* or *SOHO Router* mode only)

LAN Interface In *Simple* view the LAN interface is displayed. Select the interface used for LAN connection. Click **Del** to delete the interface. If there is no interface selected, select an interface from the *Add LAN* drop-down list, and click **Add**.

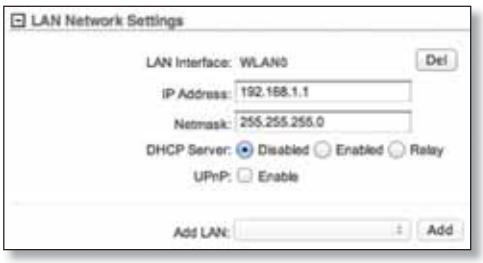
IP Address The IP address of the LAN interface. If the LAN interface is the Bridge, all the bridge ports (for example, the Ethernet and WLAN interfaces) will be considered as local network interfaces. This IP will be used for routing of the local network; it will be the gateway IP for all the devices on the local network. This IP address can be used for management of the device.

Netmask Enter the netmask of the device. The netmask defines the address space of the device's network segment. The netmask *255.255.255.0* is typically used for Class C networks.

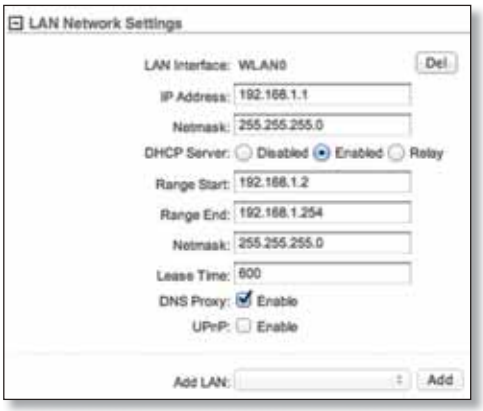
MTU (Available in *Simple* view.) The Maximum Transmission Unit (MTU) is the maximum frame size (in bytes) that a network interface can transmit or receive. The default is *1500*.

DHCP Server The built-in DHCP server assigns IP addresses to clients connected to the LAN interface.

- **Disabled** The device does not assign local IP addresses.



- **Enabled** The device assigns IP addresses to client devices on the local network.



  - **Range Start and End** Determines the range of IP addresses assigned by the DHCP server.
  - **Netmask** Enter the netmask of the device. The netmask defines the address space of the device's network segment. The netmask *255.255.255.0* is typically used for Class C networks.
  - **Lease Time** The IP addresses assigned by the DHCP server are valid only for the duration specified by the lease time. Increasing the time ensures client operation without interruption, but could introduce potential conflicts. Decreasing the lease time avoids potential address conflicts, but might cause more slight interruptions to the client while it acquires a new IP address from the DHCP server. The time is expressed in seconds.

- **DNS Proxy** The Domain Name System (DNS) proxy server forwards the DNS requests from the hosts on the local network to the DNS server. If enabled, the device (LAN port) will act as the DNS proxy server and forward DNS requests from the hosts on the local network to the real DNS server.
- **Primary DNS** If *DNS Proxy* is disabled, then specify the IP address of the primary DNS server for DHCP clients.
- **Secondary DNS** If *DNS Proxy* is disabled, then specify the IP address of the secondary DNS server. This entry is optional and used only if the primary DNS server is not responding.

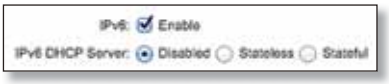
• **Relay** Relays DHCP messages between DHCP clients and DHCP servers on different IP networks.

- **DHCP Server IP** Specify the IP address of the DHCP server that should get the DHCP messages.
- **Agent-ID** Specify the identifier of the DHCP relay agent.

UPnP Allows the use of Universal Plug-and-Play (UPnP) network protocol for gaming, videos, chat, conferencing, and other applications.

Add LAN (Available in *Advanced* view.) Select an interface, and then click **Add**.

IPv6 Disabled by default. Select **IPv6** if you want to use IPv6 addressing.



• **IPv6 DHCP Server** The built-in DHCPv6 server assigns IPv6 addresses to clients connected to the wireless interface and LAN interface while the device is operating in *Access Point* or *AP-Repeater* wireless mode. The built-in DHCP server assigns IPv6 addresses to clients connected to the LAN interface while the device is operating in *Station* mode.

- **Disabled** The device does not assign local IPv6 addresses and other network settings.

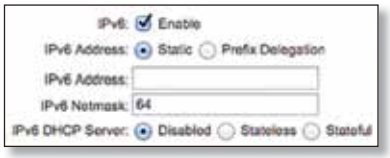
- **Stateless** The DHCP clients select their own IPv6 addresses (also known as SLAAC). (The DHCPv6 server assigns network settings except for the IP addresses to DHCP clients.) A /64 mask on the LAN is required.
  - **DNS Proxy** If *Stateless* or *Stateful* is selected, then *DNS Proxy* is enabled by default. The Domain Name System (DNS) proxy server forwards the DNS requests from the hosts on the local network to the DNS server.

  - **Preferred DNS** If *DNS Proxy* is disabled, then specify the IP address of the preferred DNS server.
- **Stateful** The DHCPv6 server assigns IPv6 addresses and other network settings to DHCP clients.
  - **DNS Proxy** If *Stateless* or *Stateful* is selected, then *DNS Proxy* is enabled by default. The Domain Name System (DNS) proxy server forwards the DNS requests from the hosts on the local network to the DNS server.

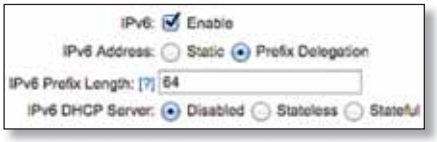
  - **Preferred DNS** If *DNS Proxy* is disabled, then specify the IP address of the preferred DNS server.

• **IPv6 Address** (Available if *DHCPv6* is enabled for *IPv6* in the *WAN Network Settings*.) Select the appropriate addressing method, **Static** or **Prefix Delegation**:

- **Static** Select **Static** to manually define the IPv6 settings of the device. Complete the following:
  - **IPv6 Address** Enter the IPv6 address of the device.
  - **IPv6 Netmask** Enter the IPv6 netmask of the device. The default is *64*.
  - **IPv6 DHCP Server** Refer to the *IPv6 DHCP Server* description in the previous column.



- **Prefix Delegation** Select this option to delegate a pool of IPv6 addresses. Then configure the following:
  - **IPv6 Prefix Length** Enter the delegated prefix length provided by the DHCPv6 server and typically specified by the WISP. The default is *64*.
  - **IPv6 DHCP Server** Refer to **"IPv6 DHCP Server" on page 39**.



DHCP Address Reservation

(Available in *SOHO Router* or *Router* mode with the DHCP server enabled)

The DHCP server assigns dynamic IP addresses to its DHCP clients; however, you can map a static IP address to a specific DHCP client using its unique MAC address. Click the + button to display the *DHCP Address Reservation* section.

Enabled Enables the specific DHCP address reservation.

Interface Select the appropriate interface.

MAC Address Enter the MAC address of the DHCP client.

IP Address Enter the IP address that should be assigned.

Comment You can enter a brief description of the purpose for the DHCP address reservation.

Action You have the following options:

- **Add** Add a DHCP address reservation.
- **Edit** Make changes to a DHCP address reservation. Click **Save** to save your changes.
- **Del** Delete a DHCP address reservation.

Port Forwarding

(Available in *Router* or *SOHO Router* mode only)

Port forwarding allows specific ports of the hosts on the local network to be forwarded to the external network (WAN). This is useful for a number of applications (such as FTP servers, VoIP, gaming) that require different host systems to be seen using a single common IP address/port. Click the + button to display the *Port Forwarding* section.

Enabled Enables the specific port forwarding rule. All the added port forwarding rules are saved in the system configuration file; however, only the enabled port forwarding rules are active on the device.

Interface Select the appropriate interface.

Private IP The IP address of the local host that needs to be accessible from the external network.

Private Port The TCP or UDP port of the application running on the local host. The specified port will be accessible from the external network.

Type The Layer 3 protocol (IP) type that needs to be forwarded from the local network.

Source IP/mask The IP address and netmask of the source device.

Public IP/mask The public IP address and netmask of the device that will accept and forward the connections from the external network to the local host.

Public Port The TCP or UDP port of the device that will accept and forward the connections from the external network to the local host.

Comment Enter a brief description of the port forwarding functionality, such as FTP server, web server, or game server.

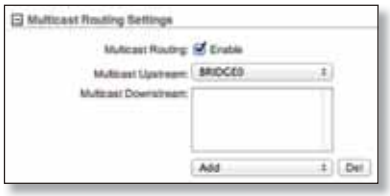
Action You have the following options:

- **Add** Add a port forwarding rule.
- **Edit** Make changes to a port forwarding rule. Click **Save** to save your changes.
- **Del** Delete a port forwarding rule.

Multicast Routing Settings

(Available in *Router* or *SOHO Router* mode only)

With a multicast design, applications can send one copy of each packet and address it to a group of computers that want to receive it. This technique addresses packets to a group of receivers rather than to a single receiver. It relies on the network to forward the packets to the hosts that need to receive them. Common routers isolate all the broadcast (thus multicast) traffic between the local and external networks; however, the device provides multicast traffic pass-through functionality.



Multicast Routing Enables multicast packet pass-through between local and external networks while the device is operating in *Router* mode. Multicast intercommunication is based on Internet Group Management Protocol (IGMP).

Multicast Upstream Specify the source of multicast traffic.

Multicast Downstream Specify the destination(s) of multicast traffic.

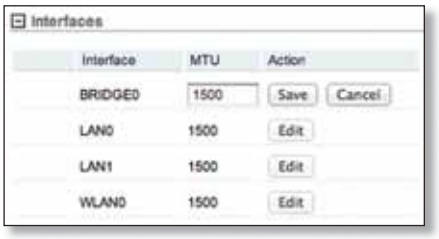
Add Add a destination.

Del Delete a destination.

Interfaces

(Available in *Advanced* view.) The Maximum Transmission Unit (MTU) is the maximum frame size (in bytes) that a network interface can transmit or receive. You can configure a different *MTU* value for each of the interfaces.

Click the + button to display the *Interfaces* section.



Interface Displays the name of the interface.

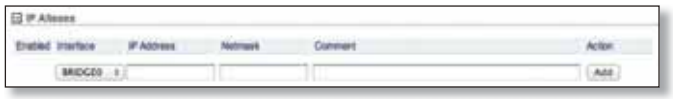
MTU Limited by the hardware capabilities of the specific product, the maximum *MTU* value is typically 2024. The default is *1500*.

Action Click **Edit** to change the MTU. Then click **Save** to apply your change.

IP Aliases

(Available in *Advanced* view.) You can configure IP aliases for the network interfaces for management purposes. For example, you may need multiple IP addresses (one private IP address and one public IP address) for a single device. If a CPE uses PPPoE, the CPE obtains a public PPPoE address, but the network administrator assigns an internal IP alias to the device. This way the network administrator can manage the device internally without going through the PPPoE server.

Click the + button to display the *IP Aliases* section.



Enabled Enables the specific IP alias. All the added IP aliases are saved in the system configuration file; however, only the enabled IP aliases are active on the device.

Interface Select the appropriate interface.

IP Address The alternative IP address for the interface. This can be used for routing or device management purposes.

Netmask The network address space identifier for the IP alias.

Comment You can enter a brief description of the purpose for the IP alias.

Action You have the following options:

- **Add** Adds a IP alias.
- **Edit** Make changes to an IP alias. Click **Save** to save your changes.
- **Del** Delete an IP alias.

VLAN Network

(Available in *Advanced* view.) You can create multiple Virtual Local Area Networks (VLANs). Click the + button to display the *VLAN Network* section.

Enabled Enables the specific VLAN. All the added VLANs are saved in the system configuration file; however, only the enabled VLANs are active on the device.

Interface Select the appropriate interface.

VLAN ID The *VLAN ID* is a unique value assigned to each VLAN at a single device; every *VLAN ID* represents a different VLAN. The *VLAN ID* range is 2 to 4094.

Comment You can enter a brief description of the purpose for the VLAN.

Action You have the following options:

- **Add** Add a VLAN.
- **Edit** Make changes to a VLAN. Click **Save** to save your changes.
- **Del** Delete a VLAN.

Note: A VLAN cannot be deleted if it is selected as the management interface.

Bridge Network

(Available in *Advanced* view.) You can create one or more bridge networks if you need complete Layer 2 transparency. This is similar to using a switch – all traffic flows through a bridge, in one port and out another port, regardless of VLANs or IP addresses. For example, if you want to use the same IP subnet on both sides of a device, then you create a bridge network. There are many different scenarios that could require bridged interfaces, so the *Bridge Network* section is designed to allow flexibility.

Click the + button to display the *Bridge Network* section.

Enabled Enables the specific bridge network. All the added bridge networks are saved in the system configuration file; however, only the enabled bridge networks are active on the device.

Interface The interface is automatically displayed.

STP Multiple interconnected bridges create larger networks using IEEE 802.1d Spanning Tree Protocol (STP), which is used for finding the shortest path within a network and eliminating loops from the topology.

If enabled, the device bridge communicates with other network devices by sending and receiving Bridge Protocol Data Units (BPDU). *STP* should be disabled (default setting) when the device is the only bridge on the LAN or when there are no loops in the topology, as there is no need for the bridge to use STP in this case.

Ports Select the appropriate ports for your bridge network. (Virtual ports are available if you have created VLANs.)

- **Add** Select a port.
- **Del** Delete a port.

Comment You can enter a brief description of the purpose for the bridge network.

Action You have the following options:

- **Add** Add a bridge network.
- **Del** Delete a bridge network.

Note: A bridge network cannot be deleted if it is selected as the management interface.

Firewall

(Available in *Advanced* view.) You can configure firewall rules for the network interfaces. Click the + button to display the *Firewall* section.

Enable Enables firewall functionality.

Enabled Enables the specific firewall rule. All the added firewall rules are saved in the system configuration file; however, only the enabled firewall rules are active on the device.

Target To allow packets to pass through the firewall unmodified, select **ACCEPT**. To block packets, select **DROP**.

Interface Select the appropriate interface where the firewall rule is applied. To apply the firewall rule to all interfaces, select **ANY**.

IP Type Sets which specific Layer 3 protocol type (IP, ICMP, TCP, UDP, P2P) should be filtered.

! Can be used to invert the *Source IP/Mask*, *Source Port*, *Destination IP/Mask*, and/or *Destination Port* filtering criteria. For example, if you enable *!* (Not) for the specified *Destination Port* value 443, then the filtering criteria will be applied to all the packets sent to any *Destination Port* except port 443, which is commonly used by HTTPS.

Source IP/Mask Specify the source IP of the packet (specified within the packet header). Usually it is the IP of the host system that sends the packets. The mask is in CIDR or slash notation. For example, if you enter 192.168.1.0/24, you are entering the range of 192.168.1.0 to 192.168.1.255.

Source Port Check the box and specify the source port of the packet (specified within the packet header). Usually it is the port of the host system application that sends the packets.

Destination IP/Mask Specify the destination IP of the packet (specified within the packet header). Usually it is the IP of the system which the packet is addressed to. The mask is in CIDR or slash notation. For example, if you enter 192.168.1.0/24, you are entering the range of 192.168.1.0 to 192.168.1.255.

Destination Port Specify the destination port of the packet (specified within the packet header). Usually it is the port of the host system application which the packet is addressed to.

Comment You can enter a brief description of the purpose for the firewall rule.

In *Bridge* mode, all active firewall entries are stored in the FIREWALL chain of the ebtables filter table. (Ebtables is a transparent link-layer filtering tool used on bridge interfaces; this allows the filtering of network traffic passing through a bridge.)

In *Router* or *SOHO Router* mode, all active firewall entries are stored in the FIREWALL chain of the iptables filter table.

Action You have the following options:

- **Add** Add a firewall rule.
- **Edit** Make changes to a firewall rule. Click **Save** to save your changes.
- **Del** Delete a firewall rule.

Note: Packets are processed by sequentially traversing the firewall rules.

IPv6 Firewall

(Available in *Advanced* view.) You can configure IPv6 firewall rules for the local and external network interfaces. Click the + button to display the *IPv6 Firewall* section.

Enable Enables firewall functionality.

Enabled Enables the specific firewall rule. All the added firewall rules are saved in the system configuration file; however, only the enabled firewall rules are active on the device.

Target To allow packets to pass through the firewall unmodified, select **ACCEPT**. To block packets, select **DROP**.

Interface Select the appropriate interface where the firewall rule is applied. To apply the firewall rule to all interfaces, select **ANY**.

IP Type Sets which specific Layer 3 protocol type (IP, ICMP, TCP, UDP) should be filtered.

! Can be used to invert the *Source IP/Mask*, *Source Port*, *Destination IP/Mask*, and/or *Destination Port* filtering criteria. For example, if you enable *!* (Not) for the specified *Destination Port* value 443, then the filtering criteria will be applied to all the packets sent to any *Destination Port* except port 443, which is commonly used by HTTPS.

Source IP/Mask Specify the source IP of the packet (specified within the packet header). Usually it is the IP of the host system that sends the packets. The mask is in CIDR or slash notation. For example, if you enter 2001:db8::/64, you are entering the range of 2001:0db8:0000:0000:0000:0000:0000:0000 to 2001:0db8:0000:0000:ffff:ffff:ffff:ffff.

Source Port Specify the source port of the packet (specified within the packet header). Usually it is the port of the host system application that sends the packets.

Destination IP/Mask Specify the destination IP of the packet (specified within the packet header). Usually it is the IP of the system which the packet is addressed to. The mask is in CIDR or slash notation. For example, if you enter 2001:db8::/64, you are entering the range of 2001:0db8:0000:0000:0000:0000:0000:0000 to 2001:0db8:0000:0000:ffff:ffff:ffff:ffff.

Destination Port Specify the destination port of the packet (specified within the packet header). Usually it is the port of the host system application which the packet is addressed to.

Comment You can enter a brief description of the purpose for the firewall rule.

All active firewall entries are stored in the FIREWALL6 chain of the ebtables filter table.

Action You have the following options:

- **Add** Add a firewall rule.
- **Edit** Make changes to a firewall rule. Click **Save** to save your changes.
- **Del** Delete a firewall rule.

Static Routes

(Available in *Advanced* view.) You can manually add static routing rules to the system routing table; you can set a rule that a specific target IP address (or range of IP addresses) passes through a specific gateway. Click the + button to display the *Static Routes* section.

Enabled Enables the specific static route. All the added static routes are saved in the system configuration file; however, only the enabled static routes are active on the device.

Target Network IP Specify the IP address of the destination.

Netmask Specify the netmask of the destination.

Gateway IP Specify the IP address of the gateway.

Comment You can enter a brief description of the purpose for the static route.

Action You have the following options:

- **Add** Add a static route.
- **Edit** Make changes to a static route. Click **Save** to save your changes.
- **Del** Delete a static route.

IPv6 Static Routes

(Available in *Router* or *SOHO Router* mode only)

(Available in *Advanced* view.) You can manually add IPv6 static routing rules to the system routing table; you can set a rule that a specific target IP address (or range of IP addresses) passes through a specific gateway. Click the + button to display the *IPv6 Static Routes* section.

Enabled Enables the specific static route. All the added static routes are saved in the system configuration file; however, only the enabled static routes are active on the device.

Target Network IP Specify the IP address of the destination.

Netmask Specify the netmask of the destination. The mask is in CIDR or slash notation. For example, if you enter 2001:db8::/64, you are entering the range of 2001:0db8:0000:0000:0000:0000:0000:0000 to 2001:0db8:0000:0000:ffff:ffff:ffff:ffff.

Gateway IP Specify the IP address of the gateway.

Comment You can enter a brief description of the purpose for the static route.

Action You have the following options:

- **Add** Add a static route.
- **Edit** Make changes to a static route. Click **Save** to save your changes.
- **Del** Delete a static route.

Traffic Shaping

(Available in *Advanced* view.) Traffic Shaping controls bandwidth from the perspective of the client. In *Station* mode only, bursting allows fast downloads when a user downloads small files (for example, viewing different pages of a website), but prevents a user from using excessive bandwidth when downloading large files (for example, streaming a movie).

As Layer 3 QoS, you can limit the traffic at the device at the interface level, based on a rate limit you define. Each interface has two types of traffic:

- **Ingress** traffic entering the interface
- **Egress** traffic exiting the interface

We recommend using Traffic Shaping to control egress traffic, because it is more efficient in the egress direction. When an interface accepts ingress traffic, it cannot control how quickly the traffic arrives – the sending device controls that traffic. However, when an interface sends out egress traffic, it can control how quickly the traffic exits.

Bursting allows the bandwidth to spike higher than the maximum bandwidth you configure in the *Ingress* and *Egress Rate* settings – for a short period of time. Once the *Ingress* or *Egress Burst* (volume of data) is used up, the throughput drops back down to the corresponding *Ingress* or *Egress Rate* setting (maximum bandwidth) you have set.

For example, you have the following conditions:

- *Egress Burst* is set to 2048 kBytes.
- *Egress Rate* is set to 512 kbit/s.
- Actual maximum bandwidth is 1024 kbit/s.

Bursting allows 2048 kBytes to pass at 1024 kbit/s before throttling down to 512 kbit/s.

Enable Enables bandwidth control on the device.

Enabled Enables the specific rule. All the added rules are saved in the system configuration file; however, only the enabled rules are active on the device.

Interface Select the appropriate interface.

Ingress

- **Enable** Enables the ingress values.
- **Rate, kbit/s** Specify the maximum bandwidth value (in kilobits per second) for traffic entering the specified interface.
- **Burst, kBytes** Specify the data volume (in kilobytes) that is allowed before the ingress maximum bandwidth applies.

Egress

- **Enable** Enables the egress values.
- **Rate, kbit/s** Specify the maximum bandwidth value (in kilobits per second) for traffic exiting the specified interface.
- **Burst, kBytes** Specify the data volume (in kilobytes) that is allowed before the egress maximum bandwidth applies.

Action You have the following options:

- **Add** Add a rule.
- **Edit** Make changes to a traffic shaping rule. Click **Save** to save your changes.
- **Del** Deletes a traffic shaping rule.

Chapter 6: Advanced

The *Advanced* page handles advanced routing and wireless settings. Only technically advanced users who have sufficient knowledge about WLAN technology should use the advanced wireless settings. These settings should not be changed unless you know the effects the changes will have on the device.

Change To save or test your changes, click **Change**.

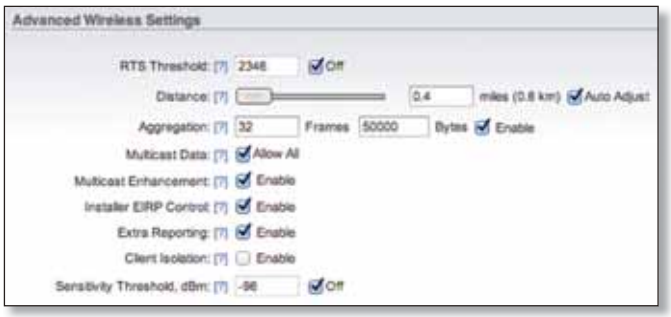
A new message appears. You have three options:

- **Apply** To immediately save your changes, click **Apply**.
- **Test** To try the changes without saving them, click **Test**. To keep the changes, click **Apply**. If you do not click *Apply* within 180 seconds (the countdown is displayed), the device times out and resumes its earlier configuration.
- **Discard** To cancel your changes, click **Discard**.

Advanced Wireless Settings

The table displays the available 802.11n data rates:

Chains	Data Rates
1x1	MCS 0, MCS 1, MCS 3, MCS 4, MCS 5, MCS 6, MCS 7
2x2	MCS 8, MCS 9, MCS 10, MCS 11, MCS 12, MCS 13, MCS 14, MCS 15

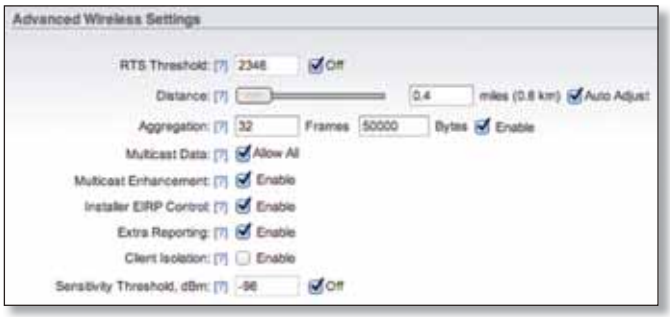


RTS Threshold (If airMAX is enabled, *RTS Threshold* is not required.) Determines the packet size of a transmission and, through the use of an AP, helps control traffic flow. The range is 0-2346 bytes. The default setting is the value *2346*; this means that RTS is disabled.

Note: As an alternative, you can select **Off** to disable this option.

The 802.11 wireless networking protocol uses the 802.11 wireless networking Request to Send (RTS)/Clear to Send (CTS) mechanisms to reduce frame collisions introduced by the hidden terminal problem. The RTS/CTS packet size threshold is 0-2346 bytes. If the packet size that the device wants to transmit is larger than the threshold, then the RTS/CTS handshake is triggered. If the packet size is equal to or less than the threshold, then the data frame is sent immediately.

The system uses RTS/CTS frames for the handshake; this reduces collisions for APs with hidden stations. The station sends an RTS frame first; the AP responds with a CTS frame. After the handshake with the AP is completed, the station sends data. CTS collision control management has a time interval defined; during this interval, all other stations do not transmit and wait until the requesting station finishes transmission.



Distance To specify the distance value in miles (or kilometers), use the slider or manually enter the value. The signal strength and throughput fall off with range. Changing the distance value will change the ACK (Acknowledgement) timeout value accordingly.

Auto Adjust We recommend enabling the *Auto Adjust* option. Every time the station receives a data frame, it sends an ACK frame to the AP (if transmission errors are absent). If the station does not receive an ACK frame from the AP within the set timeout, then it re-sends the frame. If too many data frames are re-sent (whether the ACK timeout is too short or too long), then there is a poor connection, and throughput performance drops.

The device has a new auto-acknowledgement timeout algorithm, which dynamically optimizes the frame acknowledgement timeout value without user intervention. This critical feature is required for stabilizing long-distance 802.11n outdoor links.

If two or more stations are located at considerably different distances from the AP they are associated with, the distance to the farthest station should be set on the AP side.

Aggregation A part of the 802.11n standard that allows sending multiple frames per single access to the medium by combining frames together into one larger frame. It creates the larger frame by combining smaller frames with the same physical source, destination end points, and traffic class (QoS) into one large frame with a common MAC header.

- **Frames** Determines the number of frames combined in the new larger frame.
- **Bytes** Determines the size (in bytes) of the larger frame.
- **Enable** Check the box to use the *Aggregation* option.

Multicast Data Allows multicast packets to pass through. By default this option is enabled.

Multicast Enhancement (Available in *Access Point* or *AP-Repeater* mode only.) If clients do not send IGMP (Internet Group Management Protocol) messages, then they are not registered as receivers of your multicast traffic. Using IGMP snooping, the *Multicast Enhancement* option isolates multicast traffic from unregistered clients and allows the device to send multicast traffic to registered clients using higher data rates. This lessens the risk of traffic overload on PtMP links and increases the reliability of multicast traffic since packets are transmitted again if the first transmission fails. If clients do not send IGMP messages but should receive multicast traffic, then you may need to disable the *Multicast Enhancement* option. By default this option is enabled.

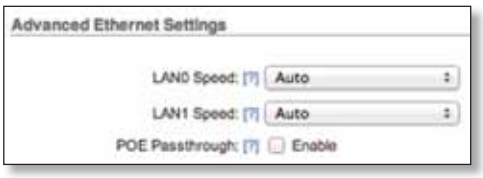
Installer EIRP Control (Not available for US products with fixed antennas.) Allows you to control the *Calculate EIRP Limit* setting on the *Wireless* page.

Extra Reporting Reports additional information, such as device name, in the 802.11 management frames. This information is commonly used for system identification and status reporting in discovery utilities and router operating systems.

Client Isolation (Available in *Access Point* or *AP-Repeater* mode only.) Allows packets to be sent only from the external network to the CPE and vice versa. If Client Isolation is enabled, wireless stations connected to the same AP will not be able to interconnect on both the Layer 2 (MAC) and Layer 3 (IP) levels. This also affects associated stations and WDS peers as well.

Sensitivity Threshold, dBm Defines the minimum client signal level accepted by the AP for the client to connect. If the client signal level subsequently drops, the client remains connected to the AP.

Advanced Ethernet Settings



LAN0/1 Speed By default, the option is **Auto.** The device automatically negotiates transmission parameters, such as speed and duplex, with its counterpart. In this process, the networked devices first share their capabilities and then choose the fastest transmission mode they both support.

To manually specify the maximum transmission link speed and duplex mode, select one of the following options: **100 Mbps-Full**, **100 Mbps-Half**, **10 Mbps-Full**, or **10 Mbps-Half.** If you are running extra long Ethernet cables, a link speed of *10* Mbps could help to achieve better stability.

Full-duplex mode allows communication in both directions simultaneously. Half-duplex mode allows communication in both directions, but not simultaneously and only in one direction at a time.

POE Passthrough (Availability is device-specific.) When enabled, the device allows Power over Ethernet (PoE) power to pass from the main port to the secondary port, thereby powering an additional device, such as a compatible IP camera.

Signal LED Thresholds

(This feature is not available on all devices.) You can configure the LEDs on the device to light up when received signal levels reach the values defined in the following fields. This allows a technician to easily deploy an airOS CPE without logging into the device (for example, for antenna alignment operation).

Signal (Available if the device supports GPS.) The type of signal, such as wireless or GPS.

Thresholds, dBm The number of LEDs is device-specific, and the default values vary depending on the number of LEDs. The specified LED will light up if the signal strength reaches the value set in the field.

For example, if the device has four LEDs and the signal strength (on the *Main* page) fluctuates around -63 dBm, then the LED threshold values can be set to the following: -70, -65, -62, and -60.

Note: The "-" character is outside of the field and should not be used for the signal strength value specification.

The following tables list the default threshold values for devices with two, three, four, or six LEDs.

Two LEDs

LED	Default Threshold Value
1	-94 dBm
2	-65 dBm

Three LEDs

LED	Default Threshold Value
1	- 94 dBm
2	-77 dBm
3	-65 dBm

Four LEDs

LED	Default Threshold Value
1	-94 dBm
2	-80 dBm
3	-73 dBm
4	-65 dBm

Six LEDs

LED	Default Threshold Value
1	-94 dBm
2	-88 dBm
3	-82 dBm
4	-77 dBm
5	-71 dBm
6	-65 dBm

Chapter 7: Services

The *Services* tab configures system management services: Ping Watchdog, SNMP, servers (web, SSH, Telnet), NTP, DDNS, system log, and device discovery.

Change To save or test your changes, click **Change**.

A new message appears. You have three options:

- **Apply** To immediately save your changes, click **Apply**.
- **Test** To try the changes without saving them, click **Test**. To keep the changes, click **Apply**. If you do not click *Apply* within 180 seconds (the countdown is displayed), the device times out and resumes its earlier configuration.
- **Discard** To cancel your changes, click **Discard**.

Ping Watchdog

Ping Watchdog sets the device to continuously ping a user-defined IP address (it can be the Internet gateway, for example). If it is unable to ping under the user-defined constraints, then the device will automatically reboot. This option creates a kind of "fail-proof" mechanism.

Ping Watchdog is dedicated to continuous monitoring of the specific connection to the remote host using the Ping tool. The Ping tool works by sending ICMP echo request packets to the target host and listening for ICMP echo response replies. If the defined number of replies is not received, the tool reboots the device.

Ping Watchdog Enables use of Ping Watchdog.

- **IP Address To Ping** Specify the IP address of the target host to be monitored by Ping Watchdog.
- **Ping Interval** Specify the time interval (in seconds) between the ICMP echo requests that are sent by Ping Watchdog. The default value is *300* seconds.
- **Startup Delay** Specify the initial time delay (in seconds) until the first ICMP echo request is sent by Ping Watchdog. The default value is *300* seconds.

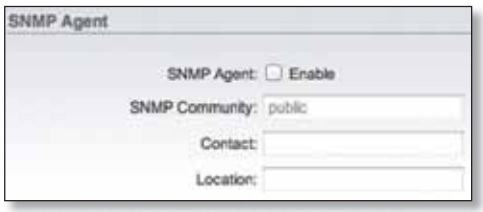
  The Startup Delay value should be at least 60 seconds as the network interface and wireless connection initialization takes a considerable amount of time if the device is rebooted.
- **Failure Count to Reboot** Specify the number of ICMP echo response replies. If the specified number of ICMP echo response packets is not received continuously, Ping Watchdog will reboot the device. The default value is *3*.
- **Save Support Info** This generates a support information file in case Ping Watchdog reboots the device.

SNMP Agent

Simple Network Management Protocol (SNMP) is an application layer protocol that facilitates the exchange of management information between network devices. Network administrators use SNMP to monitor network-attached devices for issues that warrant attention.

The device contains an SNMP agent, which does the following:

- Provides an interface for device monitoring using SNMP
- Communicates with SNMP management applications for network provisioning
- Allows network administrators to monitor network performance and troubleshoot network problems

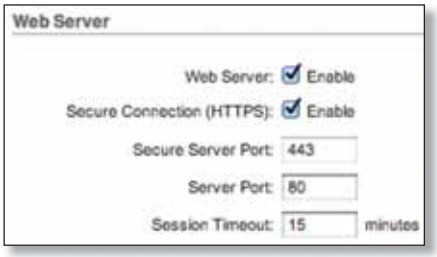


For the purpose of equipment identification, configure the SNMP agent with contact and location information:

SNMP Agent Enables the SNMP agent.

- **SNMP Community** Specify the SNMP community string. It is required to authenticate access to Management Information Base (MIB) objects and functions as an embedded password. The device supports a read-only community string; authorized management stations have read access to all the objects in the MIB except the community strings, but do not have write access. The device supports SNMP v1. The default SNMP Community is *public*.
- **Contact** Specify the contact who should be notified in case of emergency.
- **Location** Specify the physical location of the device.

Web Server



The following *Web Server* parameters can be set:

Web Server By default, HTTP service is enabled.

Secure Connection (HTTPS) By default, the web server uses secure HTTPS mode.

- **Secure Server Port** If secure HTTPS mode is used, specify the TCP/IP port of the web server. The default is *443*.

Server Port If HTTP mode is used, specify the TCP/IP port of the web server. The default is *80*.

Session Timeout Specifies the maximum timeout before the session expires. Once a session expires, you must log in again using the username and password. The default is *15* minutes.

SSH Server

The following *SSH Server* parameters can be set:

SSH Server This option enables SSH access to the device.

- **Server Port** Specify the TCP/IP port of the SSH server.
- **Password Authentication** If enabled, you must authenticate using administrator credentials to grant SSH access to the device; otherwise, an authorized key is required.

- **Authorized Keys** Click **Edit** to import a public key file for SSH access to the device instead of using an admin password.

  - **Choose File** Click **Choose File** to locate the new key file. Select the file and click **Open**.
  - **Import** Imports the file for SSH access.
  - **Enabled** Enables the specific key. All the added keys are saved in the system configuration file; however, only the enabled keys are active on the device.
  - **Type** Displays the type of key.
  - **Key** Displays the key.
  - **Comment** You can enter a brief description of the key.
  - **Action** You have the following option:
    - **Remove** Removes a public key file.
  - **Save** Saves your changes.
  - **Close** Discards your changes.

Telnet Server

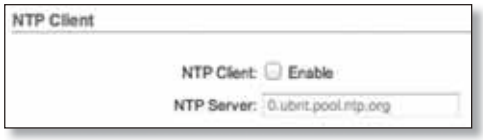
The following *Telnet Server* parameters can be set:

Telnet Server This option activates Telnet access to the device.

- **Server Port** Specify the TCP/IP port of the Telnet server.

NTP Client

Network Time Protocol (NTP) is a protocol for synchronizing the clocks of computer systems over packet-switched, variable-latency data networks. You can use it to set the system time on the device. If the *System Log* option is enabled, then the real system time is reported next to every log entry that registers a system event.

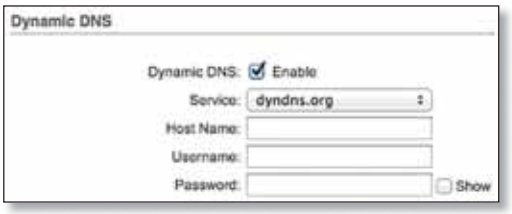


NTP Client Enables the device to obtain the system time from a time server on the Internet.

- **NTP Server** Specify the IP address or domain name of the NTP server.

Dynamic DNS

Domain Name System (DNS) translates domain names to IP addresses; each DNS server on the Internet holds these mappings in its respective DNS database. Dynamic Domain Name System (DDNS) is a network service that notifies the DNS server in real time of any changes in the device's IP settings. Even if the device's IP address changes, you can still access the device through its domain name.



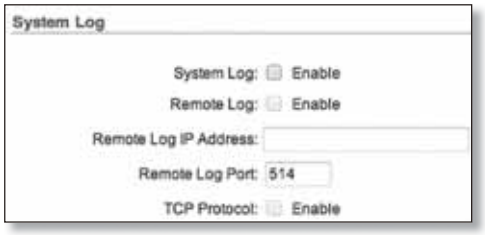
Dynamic DNS If enabled, the device allows communications with the DDNS server.

- **Service** Select the appropriate service from the drop-down menu:
  - *dyndns.org* (default)
  - **changeip.com**
  - **zoneedit.com**
  - **free.editdns.net**
  - **no-ip.com**
  - **noip.com**
  - **freedns.afraid.org**
  - **dnsmax.com**
  - **thatip.com**
  - **he.net**
  - **dnsdynamic.org**
  - **dnsexit.com**
  - **ovh.com**
  - **dnsomatic.com**
  - **3322.org**
  - **namecheap.com**
  - **easydns.com**
- **Host Name** Enter the host name of the device to update it on the DDNS server.
- **Username** Enter the user name of the DDNS account.
- **Password** Enter the password of the DDNS account.
- **Show** Check the box to display the password characters.

System Log

Every logged message contains at least the system time and name of the specific service that generates the system event.

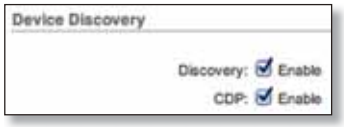
Messages from different services have different contexts and different levels of detail. Usually error, warning, or informational system service messages are reported; however, more detailed debug level messages can also be reported. The more detailed the system messages reported, the greater the volume of log messages generated.



System Log This option enables the registration routine of system log (syslog) messages. By default it is disabled.

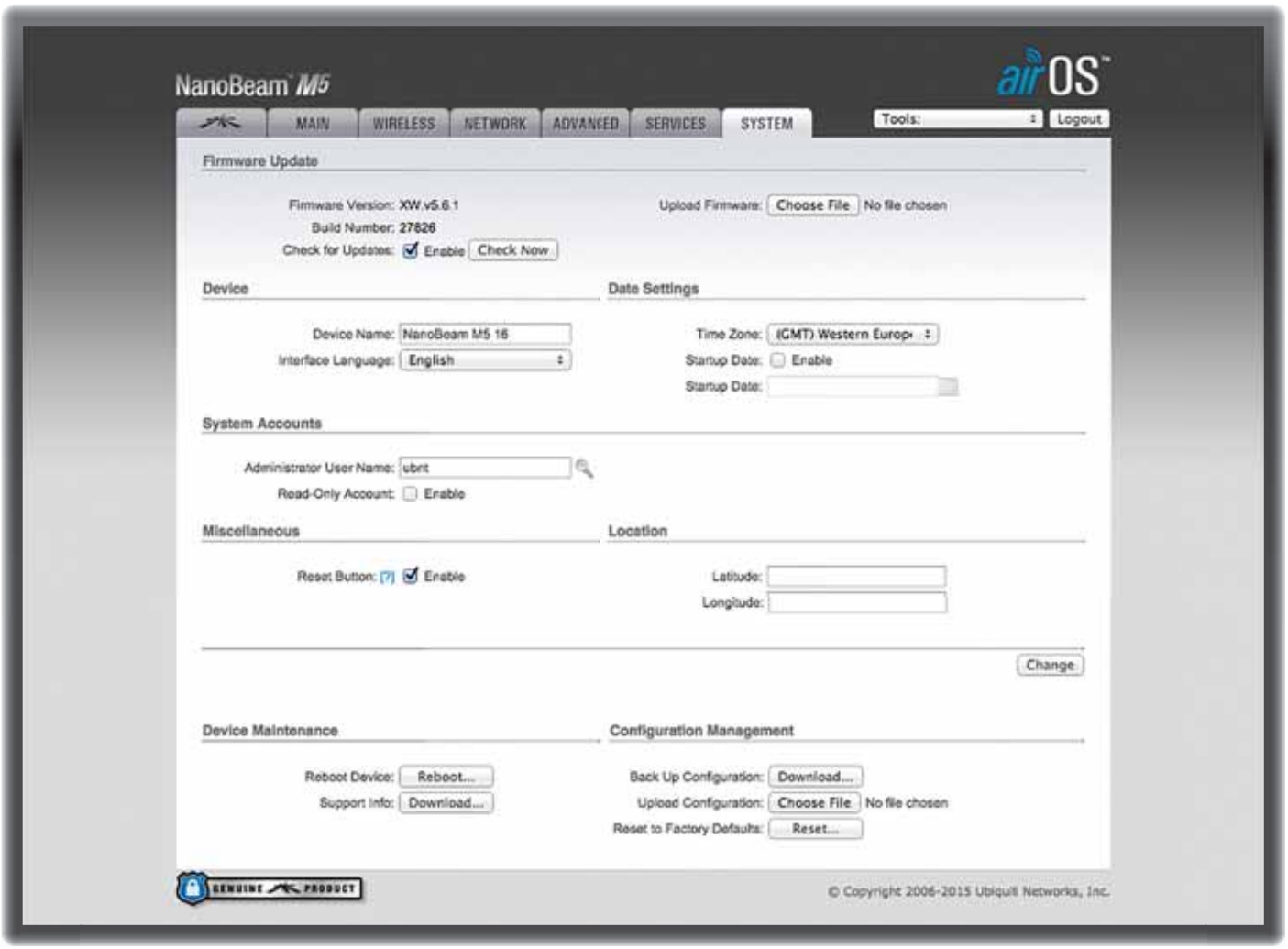
- **Remote Log** Enables the syslog remote sending function. System log messages are sent to a remote server, which is specified in the *Remote Log IP Address* and *Remote Log Port* fields.
  - **Remote Log IP Address** The host IP address that receives syslog messages. Properly configure the remote host to receive syslog protocol messages.
  - **Remote Log Port** The TCP/IP port that receives syslog messages. *514* is the default port for the commonly used system message logging utilities.
  - **TCP Protocol** Send the system log messages using the TCP protocol.

Device Discovery



Discovery Enables device discovery, so the device can be discovered by other Ubiquiti devices through the *Device Discovery* tool available through the airOS Configuration (refer to **"Discovery" on page 58**) or as a separate download at: **downloads.ubnt.com**

CDP Enables Cisco Discovery Protocol (CDP) communications, so the device can send out CDP packets to share its information.



Chapter 8: System

The *System* page contains administrative options. This page enables the administrator to reboot the device, reset it to factory defaults, upload new firmware, back up or update the configuration, and configure the administrator account.

Change To save or test your changes, click **Change**.

A new message appears. You have three options:

- **Apply** To immediately save your changes, click **Apply**.
- **Test** To try the changes without saving them, click **Test**. To keep the changes, click **Apply**. If you do not click *Apply* within 180 seconds (the countdown is displayed), the device times out and resumes its earlier configuration.
- **Discard** To cancel your changes, click **Discard**.

Firmware Update

This section manages the firmware maintenance.

Firmware Version Displays the current firmware version.

Build Number Displays the build number of the firmware version.

Check for Updates By default, the firmware automatically checks for updates. To manually check for an update, click **Check Now**.

Upload Firmware Click this button to update the device with new firmware.

The device firmware update is compatible with all configuration settings. The system configuration is preserved while the device is updated with a new firmware version. However, we recommend that you back up your current system configuration before updating the firmware.

This is a three-step procedure:

1. Click **Choose File** to locate the new firmware file. Select the file and click **Open**.
2. Click **Upload** to upload the new firmware to the device.
3. The Uploaded Firmware Version is displayed. Click **Update** to confirm.

If the firmware update is in process, you can close the firmware update window, but this does not cancel the firmware update. Please be patient, as the firmware update routine can take three to seven minutes. You cannot access the device until the firmware update routine is completed.

Note: Do not power off, do not reboot, and do not disconnect the device from the power supply during the firmware update process as these actions will damage the device!

Device

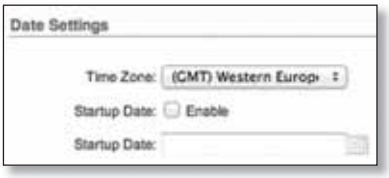
The Device Name (host name) is the system-wide device identifier. The SNMP agent reports it to authorized management stations. The Device Name will be used in popular router operating systems, registration screens, and discovery tools.

Device Name Specifies the host name.

Interface Language Allows you to select the language displayed in the web management interface. *English* is the default language.

You may upload additional language profiles. Refer to our wiki page at the following URL:
http://wiki.ubnt.com/How_to_import_Language_Profile

Date Settings



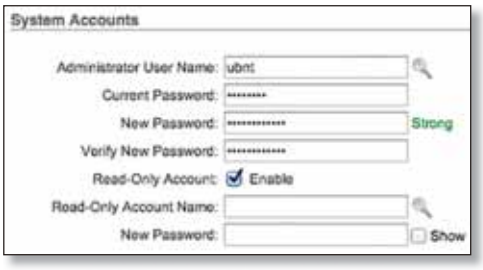
Time Zone Specifies the time zone according to Greenwich Mean Time (GMT).

Startup Date When enabled, you are able to change the device's startup date.

- **Startup Date** Specifies the device's startup date. Click the **Calendar** icon or manually enter the date in the format determined by the browser locale.

System Accounts

You can change the administrator password to protect your device from unauthorized changes. We recommend that you change the default administrator password on the very first system setup:



Administrator User Name Specifies the name of the administrator.

Key button Click this button to change the administrator password.

- **Current Password** Enter the current password for the administrator account. It is required to change the *Password* or *Administrator User Name*.
- **New Password** Enter the new password for the administrator account. airOS will indicate that the password is *Too Short* (text color: brown) if it has fewer than four characters. As you enter the new password, airOS will indicate its strength: *Weak* (red), *Normal* (orange), or *Strong* (green).

Note: The password length is 4 characters minimum and 63 characters maximum; we recommend using at least 8 characters.

- **Verify New Password** Re-enter the new password for the administrator account.

Read-Only Account Check the box to enable the read-only account, which can only view the *Main* page. Configure the username and password to protect your device from unauthorized changes.

- **Read-Only Account Name** Specifies the name of the system user.
- **Key button** Click this button to change the read-only password.
  - **New Password** Enter the new password for the read-only account.
  - **Show** Check the box to display the read-only password characters.

Miscellaneous

Reset Button To allow use of the reset button, check the box. To prevent an accidental reset to default settings, uncheck the box (this also disables the remote POE reset functionality).

Note: You can reset the device to default settings through *System* > *Reset to Defaults*.

UNII-2 Band This option is available if DFS (Dynamic Frequency Selection) frequencies in the UNII-2 band (5.25 - 5.725 GHz) should be available for your device but are locked. To unlock the DFS frequencies, follow these instructions:

1. Visit **www.ubnt.com/fcclabelrequest** and follow the online instructions to request the activation key and FCC labels.
2. After you have received your activation key and FCC labels, check the box next to *UNII-2 Band*.
3. In the *Company Name* field, enter the company name you provided when you requested the activation key.
4. In the *Key* field, enter the activation key.
5. Apply the FCC labels to the appropriate device(s).

airMAX Technology Features (Available on the *System* page if the *Ubiquiti logo* page is not displayed.) airMAX is Ubiquiti's proprietary Time Division Multiple Access (TDMA) polling technology. airMAX offers better tolerance against interference and increases the maximum number of users that can associate with an AP that is airMAX-capable.

After you have enabled this setting on the *System* page, the *Ubiquiti logo* page appears. For more information, see **"airMAX Settings" on page 15**.

Location

Latitude and longitude define the device's coordinates; they are used to automatically update the device's location for airOS management.

Latitude The latitude of the device's location is displayed. Valid values for latitude are -90 to +90.

Longitude The longitude of the device's location is displayed. Valid values for longitude are -180 to +180.

Device Maintenance

The controls in this section manage the device maintenance routines: reboot and support information reports.

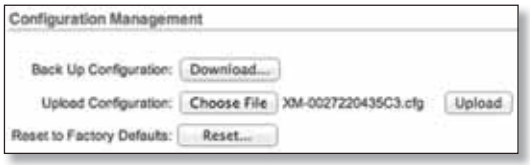
Reboot Device Initiates a full reboot cycle of the device. Reboot is the same as the hardware reboot, which is similar to the power-off and power-on cycle. The system configuration stays the same after the reboot cycle completes. Any changes that have not been applied are lost.

Support Info This generates a support information file that the Ubiquiti support engineers can use when providing customer support. This file only needs to be generated at their request.

Configuration Management

The controls in this section manage the device configuration routines and the option to reset the device to factory default settings.

The device configuration is stored in plain text file (cfg file). You can back up, restore, or update the system configuration file:



Back Up Configuration Click **Download** to download the current system configuration file.

Note: We strongly recommend that you save the configuration file in a secure location. The configuration file includes confidential information, such as WPA keys in plain text.

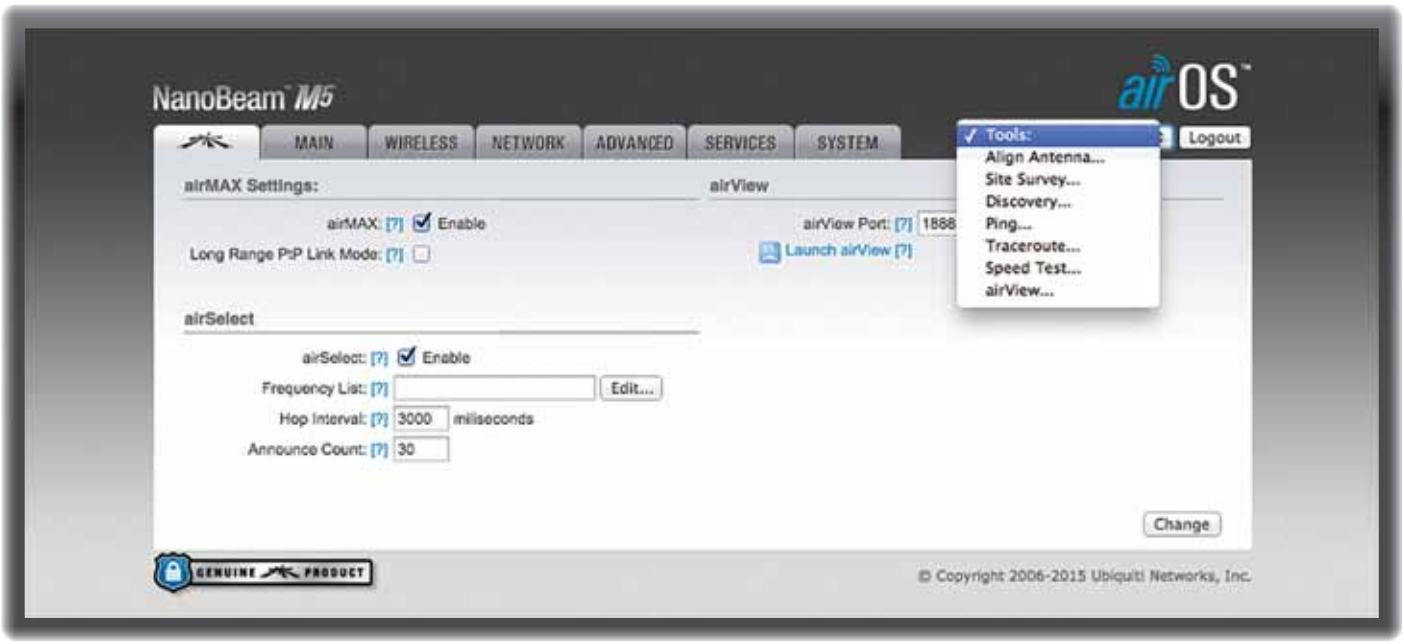
Upload Configuration Click **Choose File** to locate the new configuration file. Select the file and click **Open**. We recommend that you back up your current system configuration before uploading the new configuration.

Note: Use only configuration files for the same type of the device. Behavior may be unpredictable if you mix configuration files from different types of devices. (For example, upload a RocketM5 configuration file to a RocketM5; do NOT upload a BulletM5 configuration file to a RocketM5.)

Upload Click this button to upload the new configuration file to the device. Click **Apply** to confirm.

After the device reboots, the settings of the new configuration are displayed in the *Wireless*, *Network*, *Advanced*, *Services*, and *System* tabs of the web management interface.

Reset to Factory Defaults Resets the device to the factory default settings. This option will reboot the device, and all factory default settings will be restored. We recommend that you back up your current system configuration before resetting the device to its defaults.

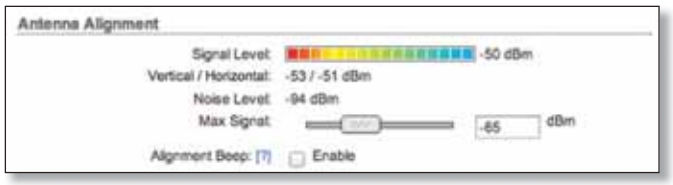


Chapter 9: Tools

Each page of the airOS interface contains network administration and monitoring tools. Click the **Tools** drop-down list at the top right corner of the page.

Align Antenna

Use the *Align Antenna* tool to point and optimize the antenna in the direction of maximum link signal. The *Antenna Alignment* window reloads every second.



Signal Level Displays the signal strength of the last received packet.

Vertical/Horizontal Displays the wireless signal level (in dBm) of each polarity, if there is more than one polarity. (The number of polarities is device-specific.)

Noise Level Displays the background noise level (in dBm) when the wireless signal is received.

Max Signal Displays the maximum signal strength (in dBm). Use the slider to adjust the range of the *Signal Level* meter to be more sensitive to signal fluctuations (it changes an offset of the maximum indicator value).

Alignment Beep You can enable the audio option so a technician can easily align the antenna of an airMAX device without looking at the airOS Configuration Interface. The higher the pitch, the stronger the signal strength. Each rise in pitch correlates to an increase in the received signal level, which is represented by a color in the airOS Configuration Interface:

- Red (weakest received signal level)
- Yellow
- Green
- Blue (strongest received signal level)

Site Survey

The *Site Survey* tool searches for wireless networks in range on all supported frequencies.

Scanned Frequencies In *Station* mode, you can change the frequency list; for details, see **"Frequency Scan List, MHz" on page 26**.

After the search is completed, the *Site Survey* tool reports the following for each result:

MAC Address Displays the MAC address of the wireless interface of the device.

SSID Displays the wireless network name.

Device Name Displays the host name or identifier of the device.

Radio Mode Displays the technology used by the device.

Encryption Displays the encryption method used by the device (if any).

Signal/Noise, dBm Displays the signal strength and noise levels, in dBm.

Frequency, GHz/Channel Displays the frequency in GHz and channel in use.

To refresh the window, click **Scan**.

Discovery

The *Device Discovery* tool searches for all Ubiquiti devices on your network.

Search As you enter keywords, the *Search* field automatically filters devices containing specified names or numbers.

After the search is completed, the *Discovery* tool reports the following for each result:

MAC Address Displays the MAC address or hardware identifier of the device.

Device Name Displays the host name or identifier of the device.

Mode Displays the operating mode of the wireless device, *AP* or *STA* (Station). If the device is not wireless (for example, a UniFi Video Camera), then "-" is displayed.

SSID Displays the wireless network name.

Product Displays the product name or type of the device.

Firmware Displays the version number of the firmware.

IP Address Displays the IP address of the device. To access a device configuration through its web management interface, click the device's IP address.

To refresh the window, click **Scan**.

Ping

You can ping other devices on the network directly from the device. The *Ping* tool uses ICMP packets to check the preliminary link quality and packet latency estimation between two network devices.

Network Ping

Select Destination IP You have two options:

- Select a remote system IP from the drop-down list, which is generated automatically.
- Select **specify manually** and enter the IP address in the field displayed below.

Packet Count Enter the number of packets to send for the ping test.

Packet Size Specify the size of the packet.

Start Click this button to start the test.

After the test is completed, the *Ping* tool reports the following information for each packet sent:

Host Displays the host name or identifier.

Time Displays the round-trip time.

TTL Displays the Time To Live (TTL), the number of hops allowed before the ping test fails.

The *Ping* tool reports packet loss statistics and round-trip time evaluation:

Packets Received Displays the number of packets received.

Loss Displays the percentage of packets lost.

Min. Displays the minimum round-trip time in milliseconds.

Avg. Displays the average round-trip time in milliseconds.

Max. Displays the maximum round-trip time in milliseconds.

Traceroute

The *Traceroute* tool traces the hops from the device to a specified IP address. Use this tool to find the route taken by ICMP packets across the network to a specified destination host name or IP address.

Destination Host Enter the host name or IP address of the destination host.

Resolve IP Addresses Select this option to resolve the hop addresses symbolically rather than numerically.

Start Click this button to start the test.

After the test is completed, the *Traceroute* tool reports the following information for each hop:

Displays the hop number.

Host Displays the host name, identifier, or IP address of the hop host.

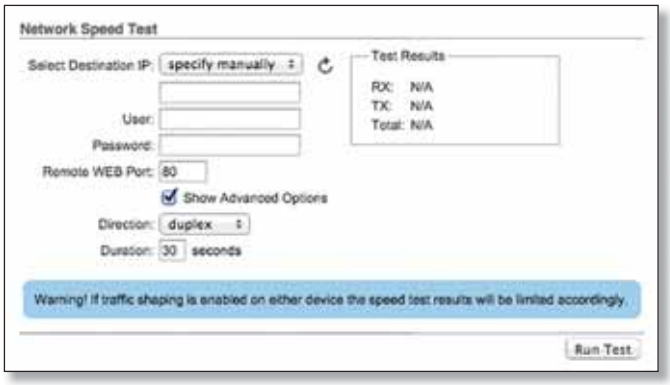
IP Displays the IP address of the hop host.

Responses Displays the round-trip times from the device to the hop host. There are three packets sent per hop, so there should be three round-trip times displayed. If there is no response from the hop host within the timeout interval of 5 seconds, then "*" is displayed.

Speed Test

This utility allows you to test the connection speed between two airOS devices that are using firmware version 5.2 or above. You can use Speed Test to estimate a preliminary throughput between two network devices.

Note: If traffic shaping is enabled on either device, then the Speed Test results will be limited accordingly.



Select Destination IP You have two options:

- Select a remote system IP from the drop-down list, which is generated automatically.
- Select **specify manually** and enter the IP address in the field displayed below.

User Enter the administrator username.

Note: Enter the remote system access credentials required for communication between two airOS devices. Administrator username and password are required to establish the TCP/IP-based throughput test.

Password Enter the administrator password.

Remote WEB port Enter the remote web port of the airOS device to establish a TCP/IP-based throughput test (for example, specify port 443 if HTTPS is enabled in the remote device). The default is *80*.

Show Advanced Options Enables additional Speed Test utility options.

Direction Select one of three directions:

- **duplex** Estimates the incoming (RX) and outgoing (TX) throughput at the same time.
- **receive** Estimates the incoming (RX) throughput.
- **transmit** Estimates the outgoing (TX) throughput.

Duration Enter the number of seconds the test should last. The default is *30* seconds.

Run Test Click this button to start the test.

Test Results Displays three result categories:

- **RX** Displays the estimated incoming throughput.
- **TX** Displays the estimated outgoing throughput.
- **Total** Displays the aggregate throughput.

airView

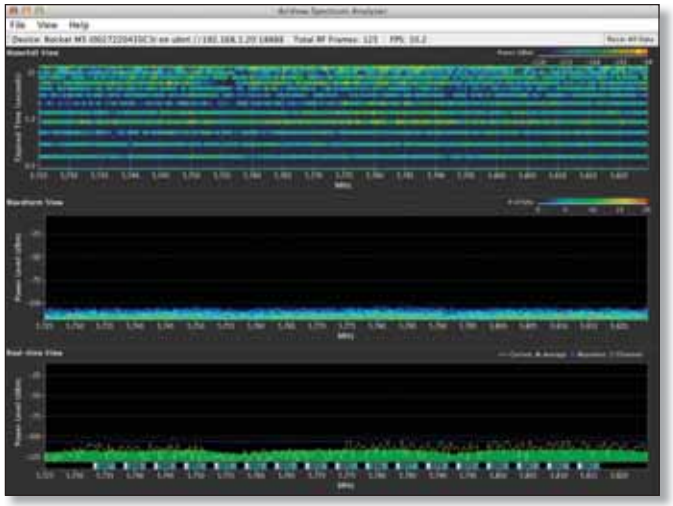
Use the airView Spectrum Analyzer to analyze the noise environment of the radio spectrum and intelligently select the optimal frequency to install a PtP airMAX link.

There are two system requirements for the airView Spectrum Analyzer:

- Your system is connected to the device via Ethernet. Launching airView will terminate all wireless connections on the device.
- Java Runtime Environment 1.6 (or above) is required on your client machine to use airView.

On first use, the following window appears.

- **Do NOT warn me about this in the future** Check the box to bypass this window in future launches of the airView Spectrum Analyzer.
- **Launch airView** Click **Launch airView** to download the Java Network Launch Protocol (jnlp) file and complete the launch of airView.



Main View

Device Displays the device name, MAC (Media Access Control) address, and IP address of the device running airView.

Total RF Frames Displays the total number of Radio Frequency (RF) frames gathered since the start of the airView session or since the *Reset All Data* button was last clicked.

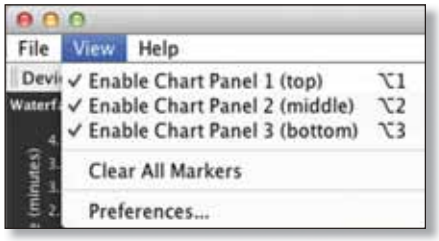
FPS Displays the total number of frames per second (FPS) gathered since the start of the airView session or since the *Reset All Data* button was last clicked. The wider the interval amplitude, the fewer the FPS will be gathered.

Reset All Data Click to reset all gathered data. Use this option to analyze the spectrum for another location or address.

File Menu

Click **Exit** to end the airView session.

View Menu



Enable Chart Panel 1 (top) Displays the Waterfall or Channel Usage chart in Chart Panel 1, depending on which option you have selected in *Preferences*. This time-based graph shows the aggregate energy collected or channel usage for each frequency since the start of the airView session.

Enable Chart Panel 2 (middle) Displays the Waveform chart in Chart Panel 2. This time-based graph shows the RF signature of the noise environment since the start of the airView session. The energy color designates its amplitude. Cooler colors represent lower energy levels (with blue representing the lowest levels) in that frequency bin, and warmer colors (yellow, orange, or red) represent higher energy levels in that frequency bin.

Enable Chart Panel 3 (bottom) Displays the Real-time chart (traditional spectrum analyzer) in Chart Panel 3. Energy (in dBm) is shown in real time as a function of frequency.

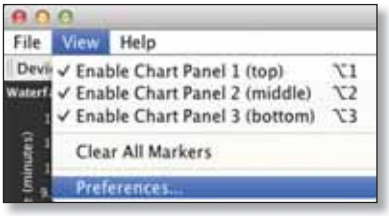
Note: Energy is the power ratio in decibels (dB) of the measured power referenced to one milliwatt (mW).

Clear All Markers Resets all previously assigned markers. Markers are assigned by clicking a point, which corresponds with a frequency on the Real-time chart.

Preferences Changes airView settings, such as enabling or disabling charts and traces, or specifying the frequency interval.

Preferences

Select **View** > **Preferences** to display the *Preferences - airView Spectrum Analyzer* window.



Charts

Enable top chart Check the box to enable the top chart. Select the desired chart to display in the top chart panel on the main view. There are two options:

- **Waterfall** This time-based graph shows the aggregate energy collected for each frequency since the start of the airView session. The energy color designates its amplitude. Cooler colors represent lower energy levels (with blue representing the lowest levels) in that frequency bin, and warmer colors (yellow, orange, or red) represent higher energy levels in that frequency bin.

  The Waterfall View's legend (top-right corner) provides a numerical guide associating the various colors to power levels (in dBm). The low end of that legend (left) is always adjusted to the calculated noise floor, and the high end (right) is set to the highest detected power level since the start of the airView session.

- **Channel Usage** For each Wi-Fi channel, a bar displays a percentage showing the relative "crowdedness" of that specific channel. To calculate this percentage, the airView Spectrum Analyzer analyzes both the popularity and strength of RF energy in that channel since the start of an airView session.

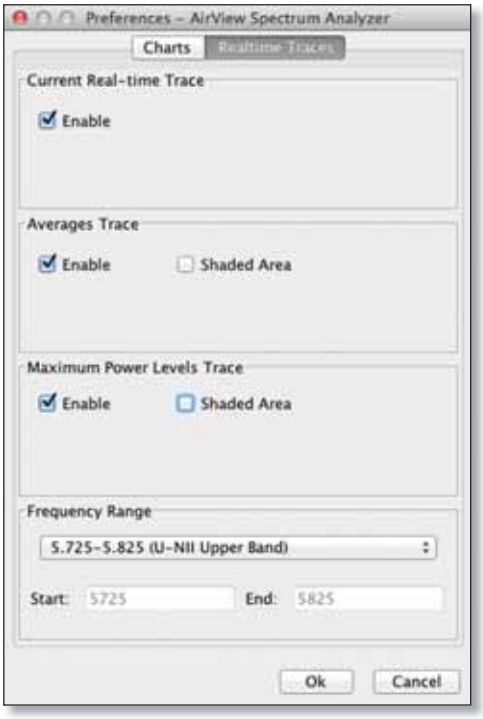
Enable Waveform chart (middle) Check the box to enable the middle chart. This time-based graph shows the RF signature of the noise environment since the start of the airView session. The energy color designates its amplitude. Cooler colors represent lower energy levels (with blue representing the lowest levels) in that frequency bin, and warmer colors (yellow, orange, or red) represent higher energy levels in that frequency bin.

The spectral view over time will display the steady-state RF energy signature of a given environment.

Enable Real-time chart (bottom) Check the box to enable the bottom chart. This graph displays a traditional spectrum analyzer in which energy (in dBm) is shown in real time as a function of frequency. There are three traces in this view:

- **Current** (Yellow) Shows the real-time energy seen by the device as a function of frequency.
- **Average** (Green) Shows the running average energy across frequency.
- **Maximum** (Blue) Shows updates and maximum power levels across frequency.

Realtime Traces



The following settings apply only to the *Real-time* chart:

Current Real-time Trace Check the *Enable* box to enable the real-time trace. When enabled, the yellow outline on the *Real-time* chart represents the real-time power level of each frequency. The refresh speed depends on the FPS.

Averages Trace Check the *Enable* box to enable the averages trace. When enabled, the averages trace is represented by the green area on the *Real-time* chart, which displays the average received power level data since the start of the airView session. To enable a shaded green area, check the *Shaded Area* box. To display only a green outline without the shaded area, uncheck the *Shaded Area* box.

Maximum Power Levels Trace Check the *Enable* box to enable the maximum power trace. When enabled, the maximum power trace is represented by the blue area on the *Real-time* chart, which displays the maximum received power level data since the start of the airView session. To enable a shaded blue area, check the *Shaded Area* box. To display only a blue outline without the shaded area, uncheck the *Shaded Area* box.

Frequency Range Select the amplitude of the frequency interval to be scanned from the *Frequency Range* drop-down list. Available frequencies are device-dependent. There are pre-defined ranges for the most popular bands. You can enter a custom range; select **Custom Range** from the *Frequency Range* drop-down list and enter the desired values in the *Start* and *End* fields.

Help

Click **About** to view the version and build number of the airView Spectrum Analyzer.

Appendix A: Contact Information

Ubiquiti Networks Support

Ubiquiti Support Engineers are located around the world and are dedicated to helping customers resolve software, hardware compatibility, or field issues as quickly as possible. We strive to respond to support inquiries within a 24-hour period.

Ubiquiti Networks, Inc.
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San Jose, CA 95131
www.ubnt.com

Online Resources

Support: **support.ubnt.com**

Community: **community.ubnt.com**

Downloads: **downloads.ubnt.com**

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