HP M220 802.11n Access Point Configuration and Administration Guide

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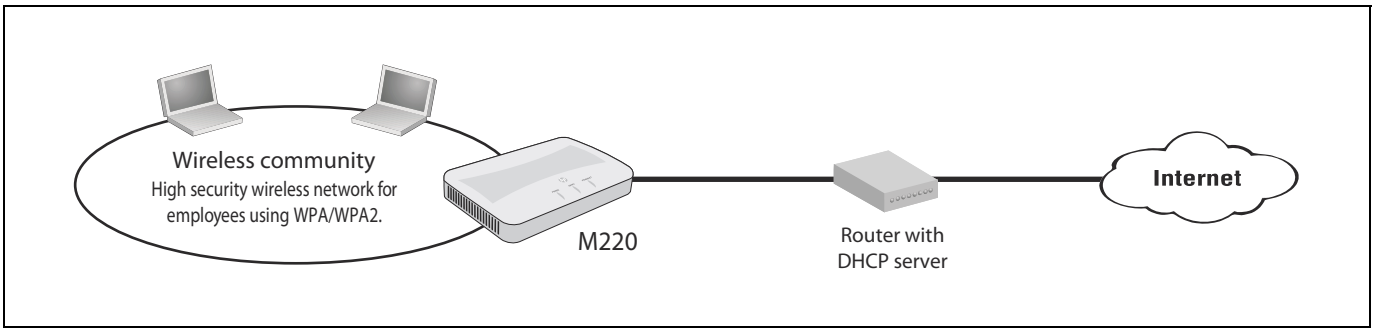
Warranty

WARRANTY STATEMENT: See the warranty information sheet provided in the product box and available online.

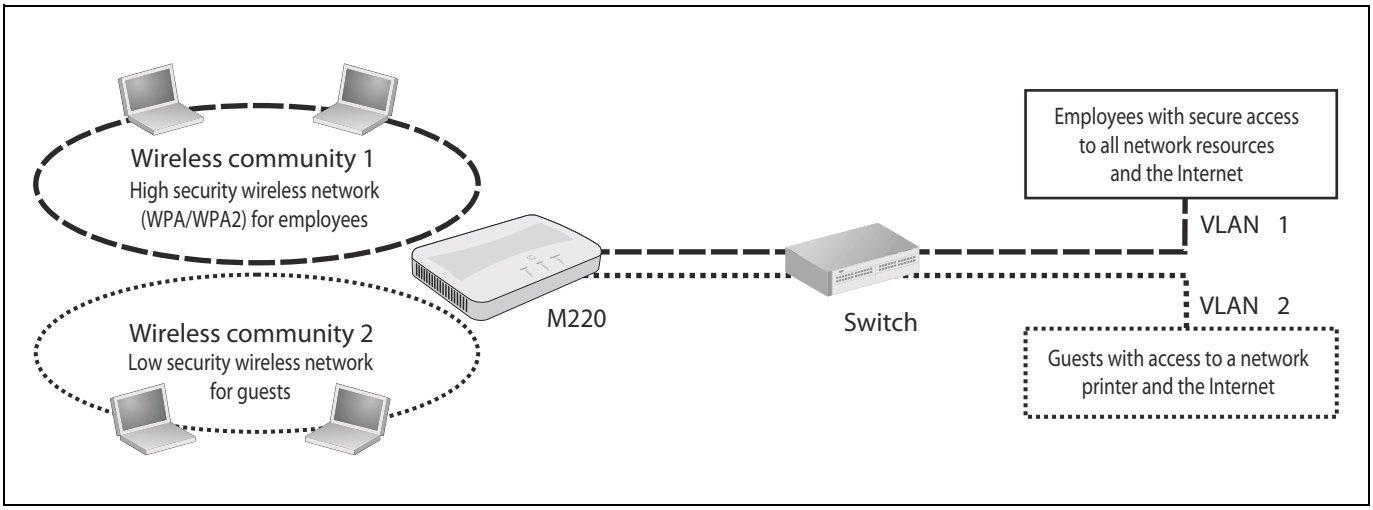
Contents

1 Deploying the M220

In a small office, the M220 can be directly connected to a broadband router (DSL or cable) to provide wireless networking for all employees. In the following scenario, employees can share data and resources with each other and access the Internet at the same time:



With its wireless community feature, the M220 can be configured to provide up to eight separate wireless networks (all on the same wireless channel), each with its own configuration settings for security, VLAN support, and more.



In this scenario, employees connect to wireless community 1, which is protected with WPA/WPA2. All employee traffic exits the M220 on VLAN 1, providing access to private resources on the company network and on the Internet.

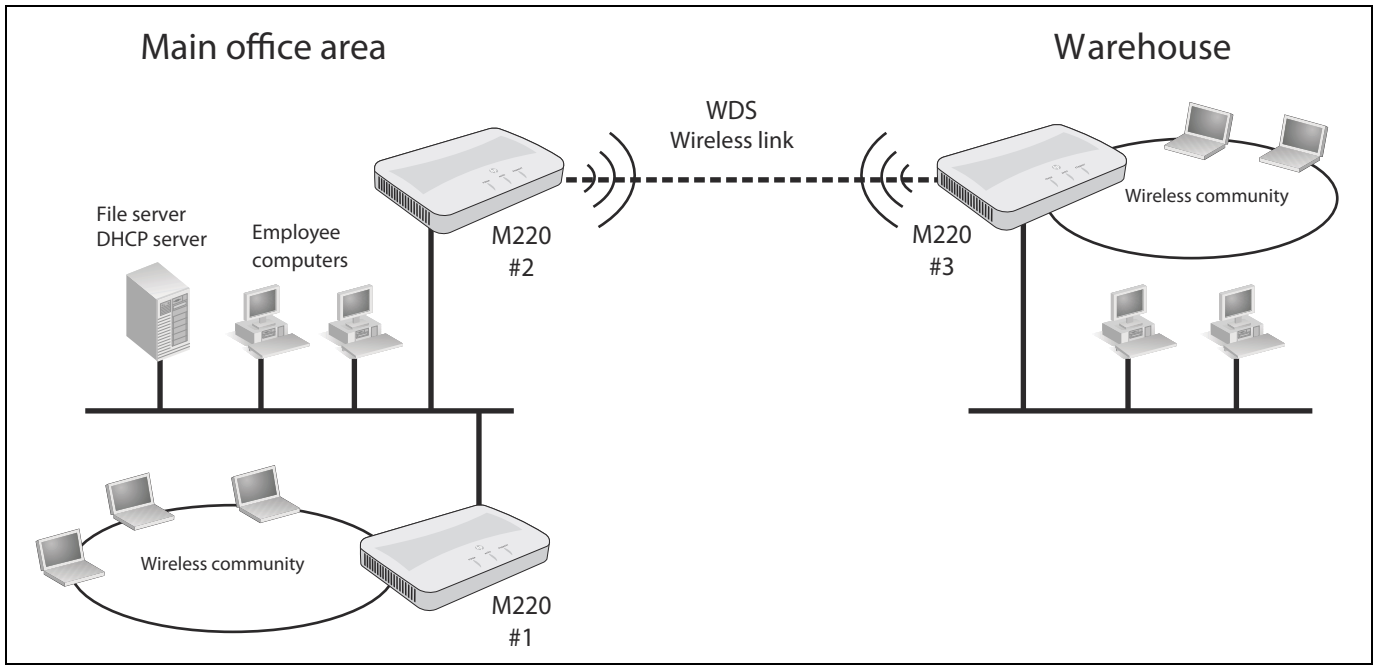
Guests connect to wireless community 2, which is protected with WEP. All guest traffic exits the M220 on VLAN 2, providing access only to the Internet.

Note

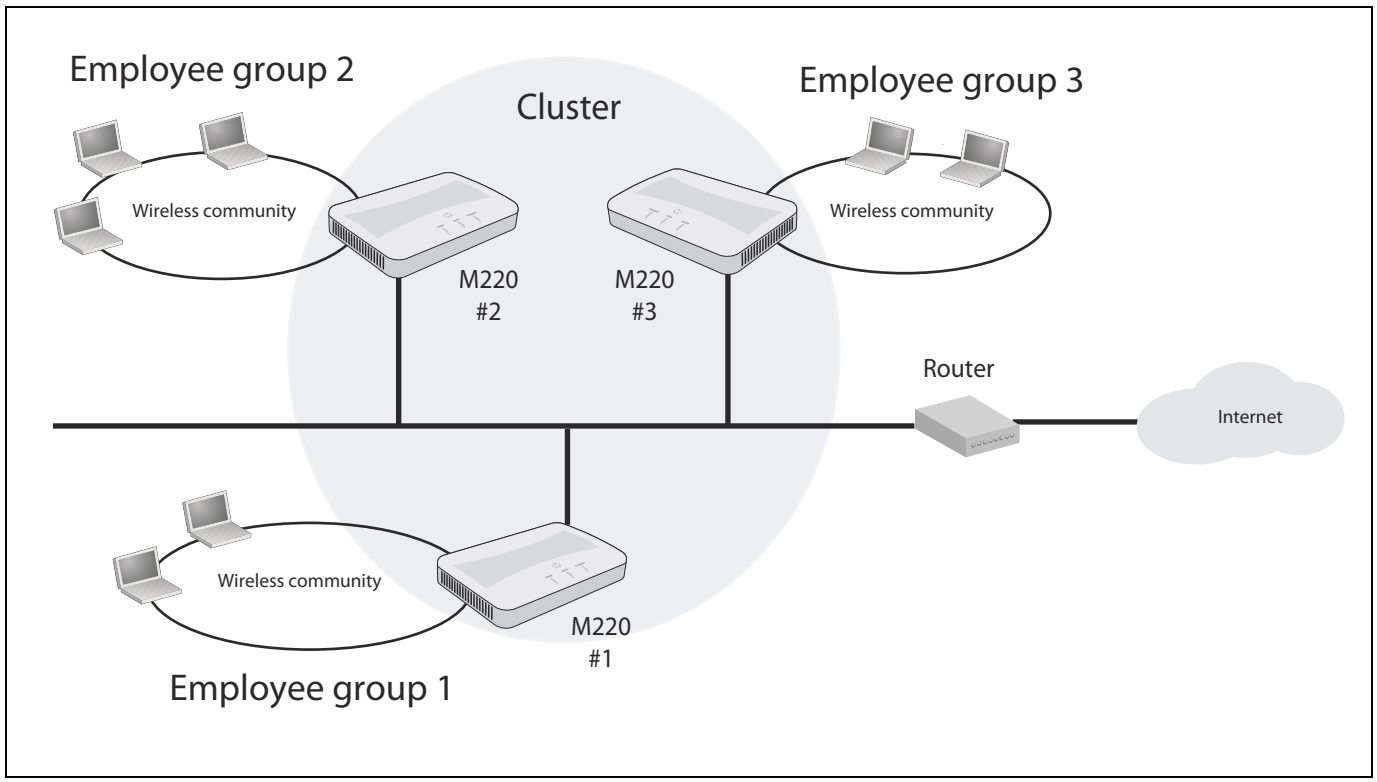
WEP is available only when the radio mode does not support 802.11n.

For offices that already have a wired networking infrastructure, the M220 is easily integrated to provide wireless networking. It can also be used to extend the reach of the network to areas that are difficult or impossible to reach with traditional cabling.

In the following scenario, M220 #1 provides wireless network services to the employees in the main office, while M220 #2 and M220 #3 use the Wireless Distribution System (WDS) to create a wireless link between the main office network and a small network in a warehouse. WDS eliminates the need to run cabling, allowing for fast and easy deployment.



In the following scenario, three M220s provide distinct employee groups access to the Internet through a router on the network. The M220s are joined in a cluster, which enables them to share a single configuration and to be administered as a single unit. Channel planning may be implemented on the cluster to reduce interference and optimize wireless bandwidth usage.



2 Using Quick setup

Overview

Quick setup provides an easy way to quickly configure settings on the M220 for several different networking scenarios. Just pick the scenario that most closely resembles your installation and fill in the appropriate fields.

Automatically running Quick setup the first time you log in

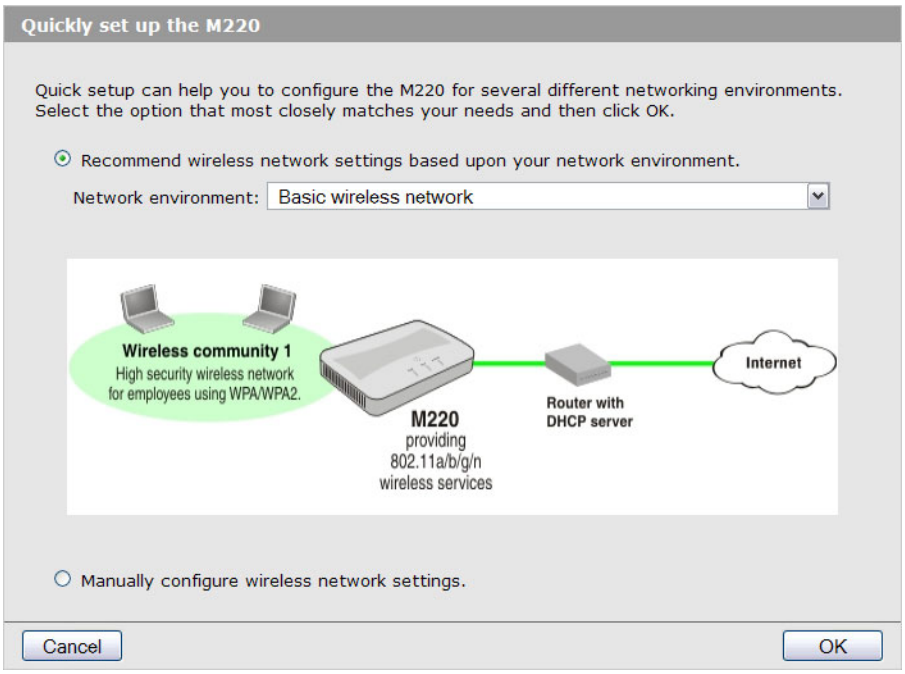
The first time you log in to the management tool (see the *HP M220 802.11n Access Point Quickstart* for first time login procedure), the HP end user license agreement displays. When you accept the agreement, a page displays to enable you to select your country so that wireless radio settings are configured appropriately. Select **Save** to display the first page in the Quick setup wizard.

This page lets you choose one of five configuration scenarios to use as the basis for your setup, as described in the following sections.

Basic wireless network

Choose this option if you want to create a single wireless network to provide wireless connectivity for your users. This option can be used to connect the M220 directly to a broadband router or to an existing wired network, using static IP, DHCP, or IPv6 addressing.

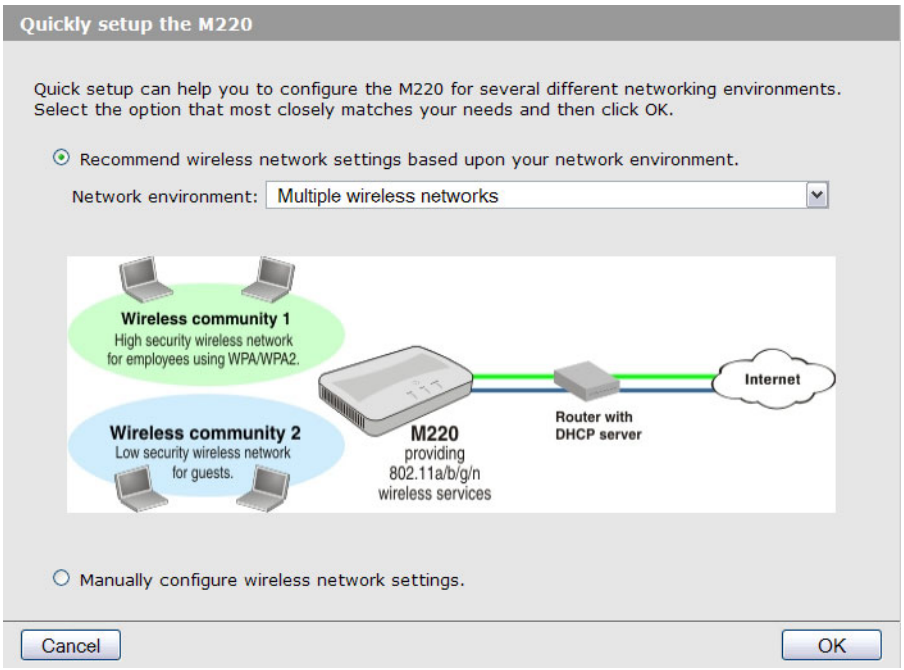
This scenario supports clustering mode, where multiple APs in the network are deployed and administered as a single entity.



Multiple wireless networks

Choose this option if you want to create multiple wireless networks to support users with different networking requirements. For example, you could create two wireless networks, one for employees and one for guests.

This option can be used to connect the M220 to a network using static IP, DHCP, or IPv6 addressing. This scenario also supports clustering mode, where multiple APs in the network are deployed and administered as a single entity.

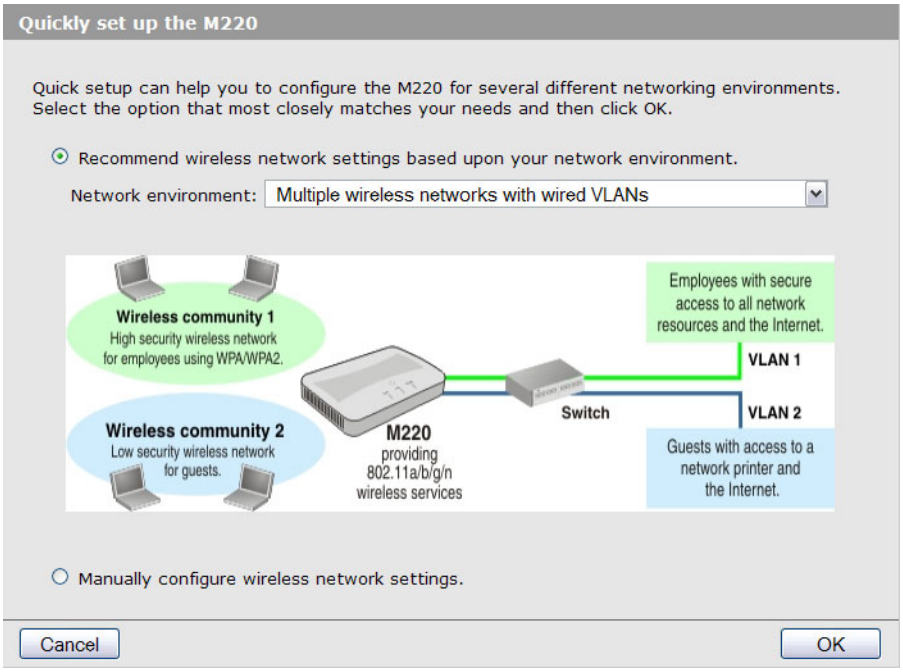


Multiple wireless networks with wired VLANs

Choose this option if you want to:

- Create multiple wireless networks to support users with different requirements.
- Map the traffic from each wireless network to a specific VLAN.

As in Multiple wireless networks mode, this option supports static IP, DHCP, or IPv6 addressing for the network connection, and supports clustering mode.

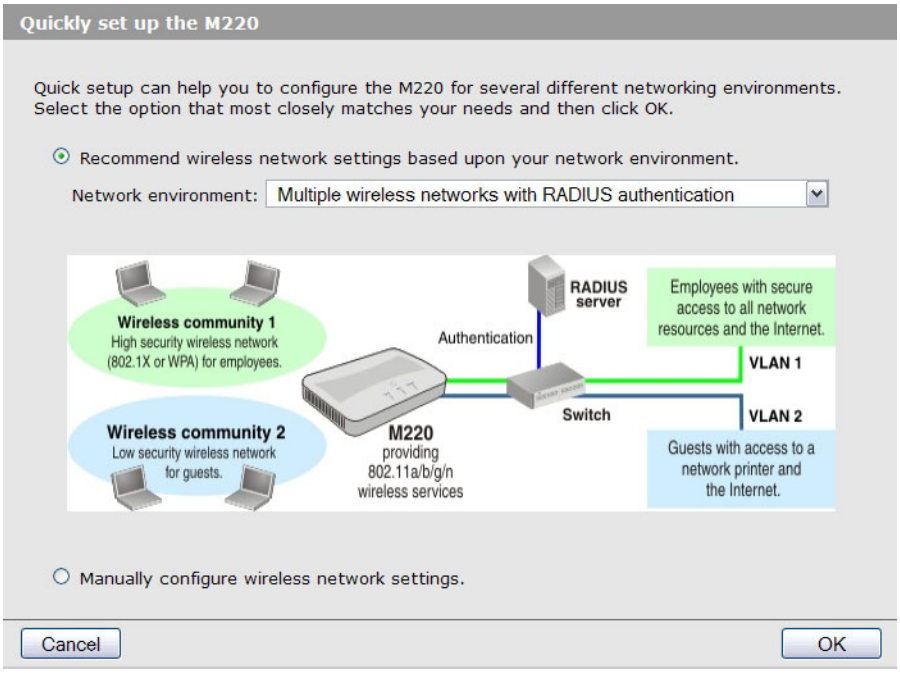


Multiple wireless networks with RADIUS authentication

Choose this option if you want to:

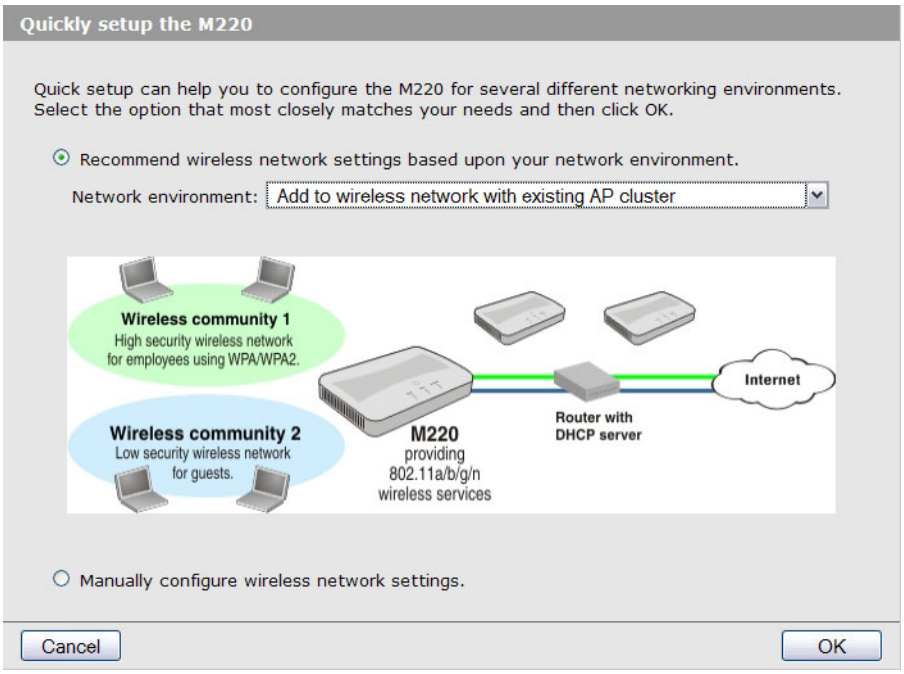
- Create multiple wireless networks to support users with different requirements.
- Map the traffic from each wireless network to a specific VLAN.
- Authenticate user login credentials using a third-party RADIUS server.

This option can be used to connect the M220 to a network using static IP, DHCP, or IPv6 addressing. This scenario also supports clustering mode, where multiple APs in the network are deployed and administered as a single entity.



Add to wireless network with existing AP cluster

Use this option if your network already has a defined cluster of M220 APs and you want this AP to join the cluster.



Accessing Quick setup after your first login

When you log in subsequent to completing or cancelling out of the Quick setup wizard, the *System summary* page displays by default. You can view and configure the Quick setup global settings by selecting **Home** > **Quick setup**. See *Quick setup global settings page on page 24*.

See also the *HP M220 802.11n Access Point Quickstart*, which describes the configuration procedure for a basic wireless network.

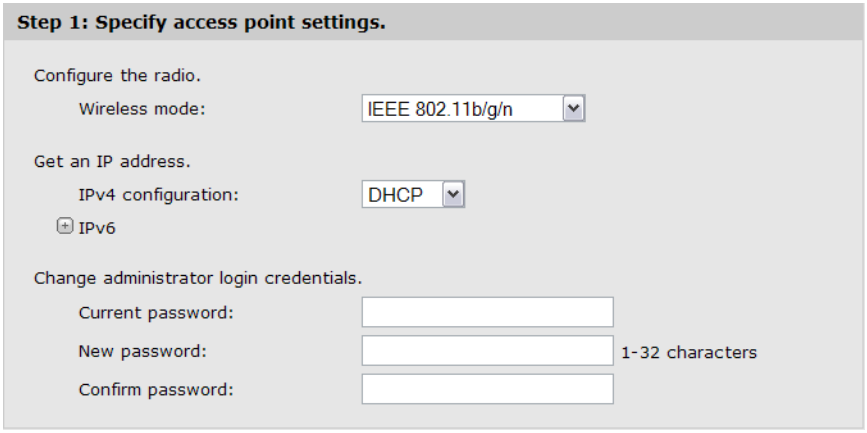
Quick setup wizard

To the Quick setup wizard, select one of the following options for the network environment, as described in the previous sections, and select **OK**:

- *Basic wireless network*
- *Multiple wireless networks*
- *Multiple wireless networks with wired VLANs*
- *Multiple wireless networks with RADIUS authentication*
- *Add to wireless network with existing AP cluster*

Step 1: Specify access point settings

For a complete description of all settings, see the online help.



Configure the radio

Wireless mode

Select a radio mode.

- **IEEE 802.11a:** Up to 54 Mbps in the 5 GHz frequency band.
- **IEEE 802.11b/g:** (Compatibility mode.) Up to 11 Mbps for 802.11b and 54 Mbps for 802.11g in the 2.4 GHz frequency band.
- **IEEE 802.11a/n:** (Compatibility mode.) Up to 300 Mbps for 802.11n and 54 Mbps for 802.11a in the 5 GHz frequency band.
- **IEEE 802.11b/g/n:** (Compatibility mode.) Up to 11 Mbps for 802.11b, 54 Mbps for 802.11g, and 300 Mbps for 802.11n in the 2.4 GHz frequency band. If support for 802.11b/g is not required, it is recommended that you choose one of the 802.11n-only modes.

- **5 GHz IEEE 802.11n:** (Pure 802.11n) Up to 300 Mbps in the 802.11n 5 GHz frequency band.
- **2.4 GHz IEEE 802.11n:** (Pure 802.11n) Up to 300 Mbps in the 802.11n 2.4 GHz frequency band.

Get an IP address

You can use these settings to configure IP addresses and how they are assigned. The **IPv4 configuration** field displays by default. To configure IPv6 settings, click the **+** to the left of **IPv6**.

You can configure addresses for both protocol versions. Only IPv4 supports DHCP.

IPv4 addresses

You can select **DHCP** (the default) so that the IP address will be assigned by a DHCP server on the network. Or, select **Static IP** to statically configure an address, subnet mask, and default gateway.

IPv6 addresses

You can configure a static IPv6 address and enable autoconfigured IPv6 addressing.

Entering a static IPv6 address

Enter a **Static IPv6 address**, specify the **Static IPv6 address prefix length**, and enter the **Default IPv6 gateway** address.

The **Static IPv6 address status** shows the configured address. The possible values are as follows:

- **Operational**: The IP address has been verified as unique on the LAN and is usable on the interface.
- **Tentative**: The M220 initiates a duplicate address detection (DAD) process automatically when a static IP address is assigned. An IPv6 address is in the tentative state while it is being verified as unique on the network. While in this state, the IPv6 address cannot be used to transmit or receive traffic, except to exchange messages with other network nodes to verify the uniqueness of the address.
- **Blank (no value)**: No IP address is assigned or the assigned address is not operational.

The **IPv6 link local address** is used by the local physical link. The link local address is not configurable and is assigned by using the IPv6 Neighbor Discovery process.

Enabling auto configuration

When **IPv6 auto configuration** is enabled, the M220 builds a global IPv6 address by applying an algorithm to the device MAC address and the network prefix that is sent by routers in router advertisements. The autoconfigured addresses display in the **IPv6 autoconfigured global addresses** list.

Change administrator login credentials

The M220 supports one administrator login. Use this section to change the password.

Note

As an immediate first step in securing your wireless network, it is recommended that you change the administrator password from the default.

Current password

The default password is **admin**.

New password and Confirm password

Specify a new password for the M220 administrator account.

The administrator password can be from 1 to 32 alphanumeric characters. Do not use special characters or spaces. For security purposes, it is recommended that the password be at least 6 characters.

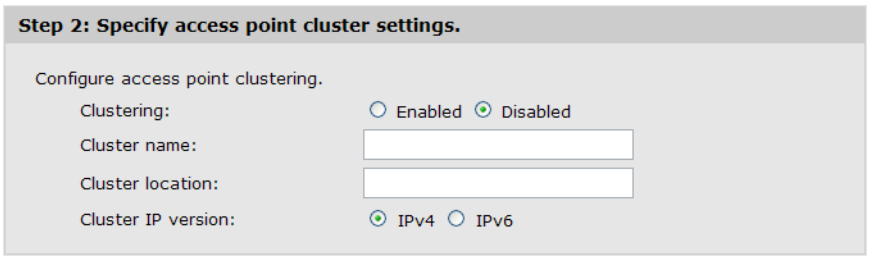
Caution

If you forget the administrator password, the only way to access the administrator account is to reset the M220 to factory default settings. See *Resetting to factory defaults on page 105*.

Step 2: Specify access point cluster settings

Use this section to configure whether this AP functions as a member of a cluster of APs on the network. APs in a cluster have a single point of administration, enabling you to view, deploy, configure, and secure the wireless network as a single entity rather than a series of separate wireless devices. When APs are clustered, you can also configure channel planning, which helps to reduce radio interference and maximize bandwidth on the wireless network.

For more information on clustering, see *Clustering multiple M220s on page 79*.



Clustering

Select to enable clustering on this AP.

Cluster name

Specify the name of the cluster to which the AP belongs. The AP will dynamically form a cluster with other APs on the same subnet that have the same cluster name.

Cluster location

Enter a description of the physical location of this AP.

Clustering IP version

Select the IP version that the APs in the cluster use to communicate with each other.

Note

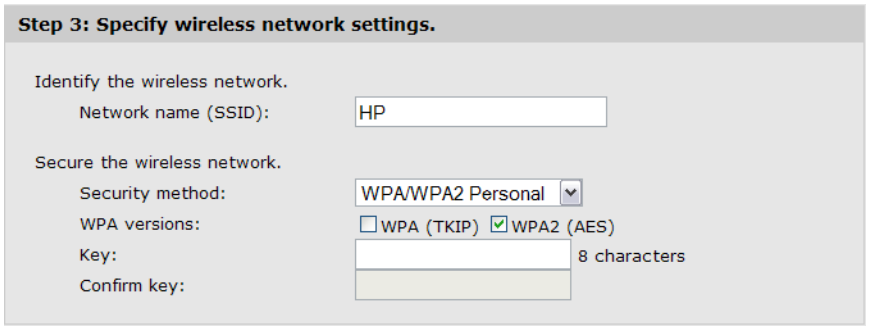
If the selected network environment was **Add to wireless network with existing AP cluster**, then the Quick setup wizard is complete. Select **Save** to have the AP join the cluster.

Step 3: Specify wireless network settings

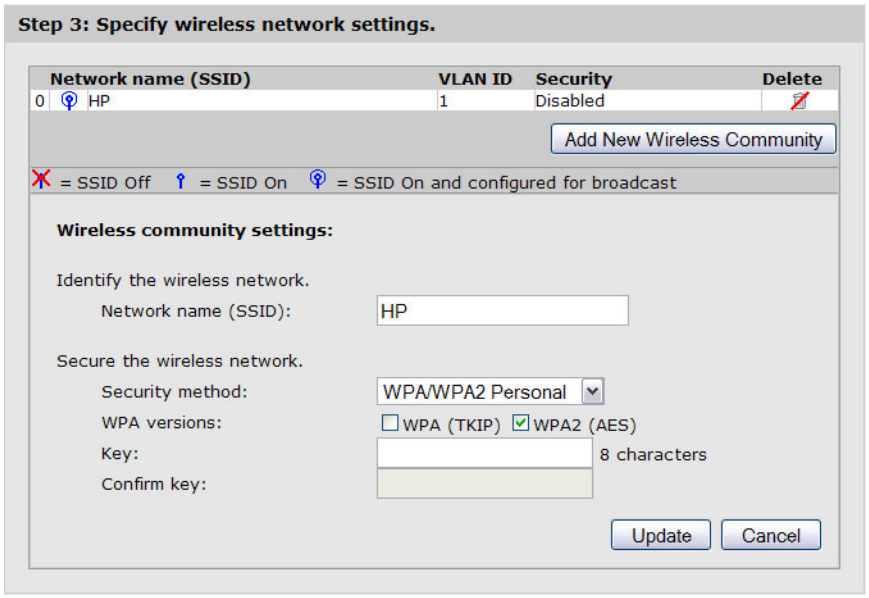
Use this section to define wireless networks and to configure the security settings for client access and encryption.

This section displays different settings depending on the selected network environment.

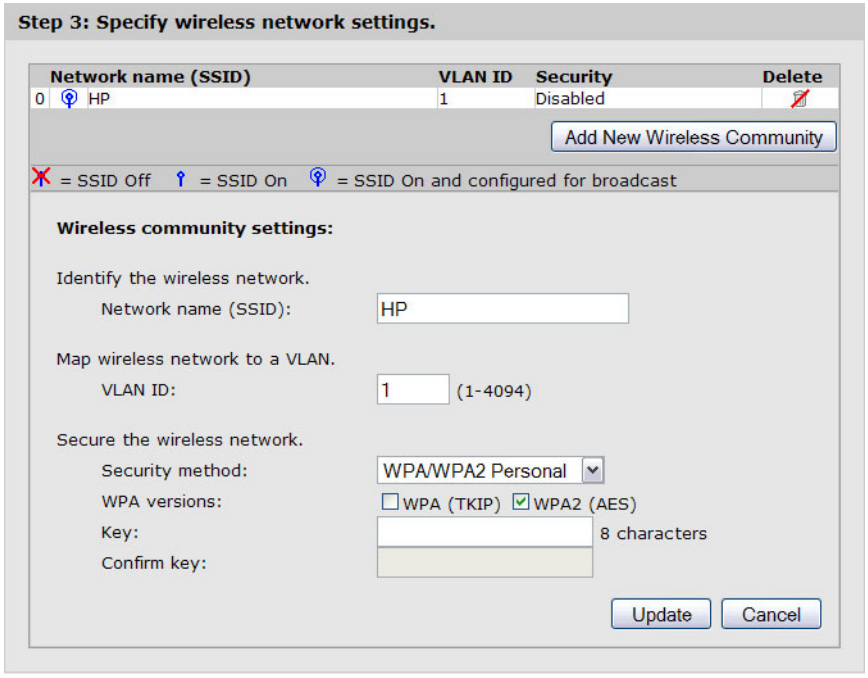
- For a **Basic wireless network**, the page displays fields for configuring the network name (SSID) and security settings:



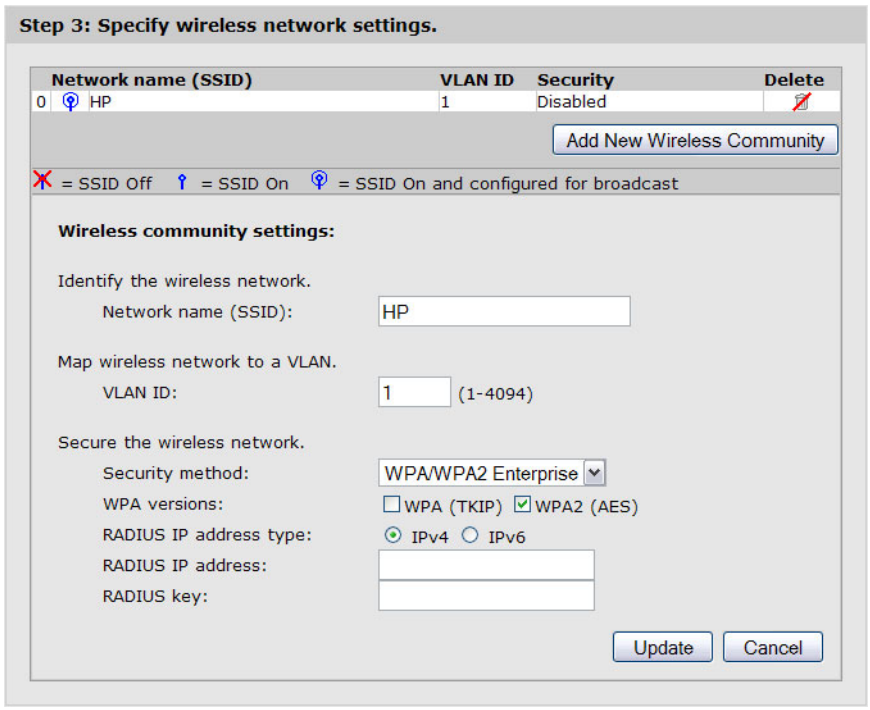
- For a **Multiple wireless networks configuration**, an additional table displays for adding wireless networks.



- For a **Multiple wireless networks with wired VLANs** configuration, an additional field displays to enable associating a VLAN with each wireless community:



- For a **Multiple wireless networks with RADIUS authentication** configuration, an appropriate security method is selected and additional fields display to configure RADIUS server information:



- For an **Add to wireless network with existing AP cluster** configuration, this section does not display, as no security settings or additional wireless communities are needed.

Wireless communities

The M220 allows you to create up to eight wireless communities. Each wireless community defines the settings for a distinct wireless network, with its own network name (SSID), settings for wireless protection, user authentication, VLANs, and more. Radio settings are shared by all wireless communities.

If you selected the **Basic wireless network** environment, you cannot configure additional wireless communities on the *Quick setup* page—this configuration assumes that only one wireless network is needed. You can later configure additional communities on the *Wireless* > *Communities* page.

A default wireless community is defined on the M220. Its name (or SSID) is **HP** and it is assigned to VLAN 1. The settings that initially display in the Wireless community settings pertain to the default community.

Note

Before creating a new community, ensure that the name (SSID), VLAN, and security settings for the default community are configured as needed.

To create a new community:

1. Select **Add New Wireless Community**.

   An additional row displays in the wireless community table. The fields in the **Wireless community settings** area display default values for the new community.

2. Modify the default values, if necessary. See *Wireless community settings* for a description of these fields.

3. Select **Add**.

4. Select **Save** to accept the default settings in the **Wireless community settings** area, or modify the settings and select **Add**, then **Save**.

   If you select **Cancel** before selecting **Add**, the new wireless community will be deleted.

   If you change these settings after saving a new wireless community, select **Update**, then **Save**. You can select **Cancel** before selecting **Update** to undo any changes to these settings.

Wireless community settings

These settings apply to the default wireless community or, if you have created multiple communities, the wireless community selected in the table. After you select **Save**, you can use the *Wireless* > *Communities* page if you want to update these settings.

Identify the wireless network

Use this section to define a name for the wireless community.

Network name (SSID)

Specify a name to uniquely identify the wireless network associated with this community. Each wireless user that wants to connect to this community must use the network name.

By default, the M220 will broadcast this name so that wireless users can see it when they try to connect to the wireless network.

The name is case-sensitive and must include between 2 and 32 alphanumeric characters, including spaces. The following characters are not allowed:

- **?**, **"**, **$**, **[**, \, **]**, and **+**
- only spaces
- **#**, **!**, **;**,and a space as the first character
- a space as the last character

Map wireless network to a VLAN

This option displays only when you select **Multiple wireless networks with wired VLANs** or **Multiple wireless networks with a RADIUS authentication** as the network environment. For the other options, all traffic is associated with VLAN 1 by default, and is forwarded untagged to the wired network.

VLAN ID

Enter a VLAN ID to associate it with the wireless community. If this VLAN ID is set to a value other than the management VLAN ID (which is 1 by default), then packets from this wireless community are tagged with the specified VLAN ID when forwarded to the wired network.

The VLAN ID can be from 1 to 4094.

Secure the wireless network

Use this section to define security settings for the wireless network.

Security method

The available security methods and selected default settings vary depending on the selected network environment. The following table lists the security options available with each environment:

Note

You can also disable security on each network environment. However, this is not recommended.

Network environment	Security methods
Basic Multiple wireless networks Multiple wireless networks with wired VLANs	If the wireless mode includes 802.11n: • WPA/WPA2 Personal (default) If the wireless mode does not include 802.11n: • Static WEP (see note) • WPA/WPA2 Personal (default)

Network environment	Security methods
Multiple wireless networks with RADIUS authentication	If the wireless mode includes 802.11n: • WPA/WPA2 Personal • WPA/WPA2 Enterprise (default) If the wireless mode does not include 802.11n: • Static WEP (see note) • 802.1X/Dynamic WEP (see note) • WPA/WPA2 Personal • WPA/WPA2 Enterprise (default)
Add to wireless network with existing AP cluster	The AP will inherit its security settings from the cluster.
Note: WEP-based security is not available in 802.11n modes due to Wi-Fi security requirements.	

The security methods are defined in the following section. After you select a security method and complete the related settings, the Quick setup wizard is complete.

Security methods

A security method (or no security method) can be associated with the default wireless community and any additional communities you create. This section defines the available security methods as they display in the Quick setup wizard. To modify these settings after you complete the Quick setup wizard, or to access additional configuration options, use the *Wireless* > *Communities* page.

WPA/WPA2 Personal

WPA Personal provides for secure login using a preshared key (PSK) and for data encryption.

WPA versions

The following WPA versions are supported:

Version	Description
WPA	WPA with TKIP encryption. **Note**: If this version is selected and the chosen wireless mode supports 802.11n, then wireless clients that support 802.11n cannot connect at 802.11n transmission rates. They will be connected at legacy rates. If the chosen wireless mode is one of the 802.11n-only modes, then you cannot select this option alone (that is, WPA2 must also be selected).

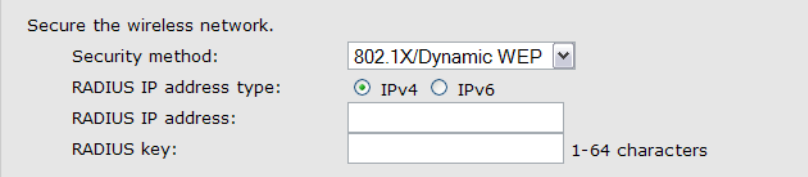
Version	Description
WPA2	WPA2 (802.11i) with AES-based CCMP encryption. If all of your clients support WPA2, select this option for the maximum possible security. If the chosen wireless mode is one of the 802.11n-only modes, then this mode must be selected.
WPA and **WPA2**	You can select both versions at the same time. Some legacy WPA clients may not work if this mode is selected. This mode is slightly less secure than using the pure WPA2 mode.

Key

The M220 uses the key you specify to generate the TKIP or AES keys that are used to encrypt the wireless data stream. Specify a key that is from 8 to 63 alphanumeric characters and re-enter the key in the **Confirm key** box. It is recommended that the preshared key be at least 20 characters long, and be a mix of letters and numbers. Acceptable characters include upper and lower case alphabetic letters, the numeric digits, and special symbols such as @ and #. The key cannot begin with or end with spaces and cannot contain only spaces.

802.1X/Dynamic WEP

Dynamic WEP uses 802.1X to distribute dynamically generated keys from the AP to its clients, providing better security than Static WEP. A RADIUS server provides a WEP key for each client session and regenerates keys at each reauthentication interval.



RADIUS IP address type

Select an IP version for communicating with the RADIUS server.

RADIUS IP or IPv6 address

Enter the IPv4 or IPv6 address for the primary RADIUS server for this wireless community.

If **IPv4** is selected as the **RADIUS IP address type**, enter the IP address of the RADIUS server that all wireless communities use by default, for example 192.168.10.23. If **IPv6** is selected, enter the IPv6 address of the RADIUS server, for example 2001:0db8:1234::abcd.

Note

You can configure only one RADIUS server using the Quick setup wizard. You can, however, configure additional RADIUS servers using the *Wireless* > *Communities* page.

RADIUS key

Enter the RADIUS key in the text box.

The RADIUS key is the shared secret key for the global RADIUS server. You can use up to 63 alphanumeric and special characters. The key is case-sensitive and cannot be all spaces. You must configure the same key on the AP and on your RADIUS server. The text you enter will be displayed as "*" characters to prevent others from seeing the RADIUS key as you type.

WPA/WPA2 Enterprise

This option is available in the Quick setup wizard only when you select the **Multiple wireless networks with RADIUS authentication** network environment.

WPA Enterprise with RADIUS is an implementation of the Wi-Fi Alliance IEEE 802.11i standard, which includes the TKIP and CCMP (AES) mechanisms. The Enterprise mode requires the use of a RADIUS server to authenticate users.

This security mode is backwards compatible with wireless clients that support the original WPA.

WPA versions

Select the types of wireless clients you want to support:

- **WPA (TKIP)**. If all wireless clients on the network support the original WPA but none support the newer WPA2, then select WPA. WPA (TKIP) cannot be used when the radio operating mode supports 802.11n only.
- **WPA2 (AES)**. If all wireless clients on the network support WPA2, we suggest using WPA2, which provides the best security per the IEEE 802.11i standard. If the radio mode is set to one of the 802.11n-only modes, WPA2 is the only supported WPA version.

If you have a mix of clients, some of which support WPA2 and others which support only the original WPA, select both WPA and WPA2. This setting enables both WPA and WPA2 wireless clients to associate and authenticate, but uses the more robust WPA2 for clients that support it. This WPA configuration allows more interoperability, at the expense of some security.

RADIUS IP address type

Select an IP version for communicating with the RADIUS server.

RADIUS IP or IPv6 address

Enter the IPv4 or IPv6 address for the primary RADIUS server for this wireless community.

If **IPv4** is selected as the **RADIUS IP address type**, enter the IP address of the RADIUS server that all wireless communities use by default, for example 192.168.10.23. If **IPv6** is selected, enter the IPv6 address of the RADIUS server, for example 2001:0db8:1234::abcd.

Note

You can configure only one RADIUS server using the Quick setup wizard. You can, however, configure additional RADIUS servers using the *Wireless* > *Communities* page.

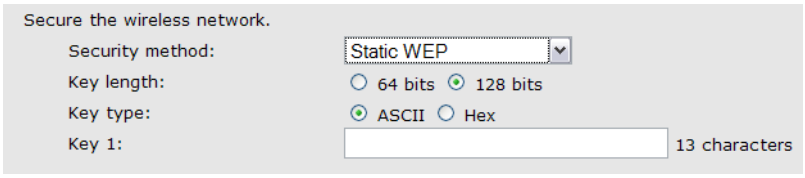
RADIUS key

Enter the RADIUS key in the text box.

The RADIUS key is the shared secret key for the RADIUS server. You can use up to 64 alphanumeric and special characters. The key is case-sensitive, and you must configure the same key on the AP and on your RADIUS server. The text you enter will be displayed as "*" characters to prevent others from seeing the RADIUS key as you type.

Static WEP

This is the least secure method of protecting wireless transmissions. WEP is provided so you can support clients that do not support WPA.



Note

WEP cannot be used when the radio operating mode supports 802.11n.

Key length

Select one of the following values as the length of the encryption key:

- **64 bits**: The key can be 5 ASCII characters or 10 hexadecimal digits.
- **128 bits**: The key can be 13 ASCII characters or 26 hexadecimal digits.

When encryption is enabled, wireless clients that do not support encryption cannot communicate with the M220. The same encryption key must be used on the M220 and all wireless clients.

Key type

Select the format used to specify the encryption key:

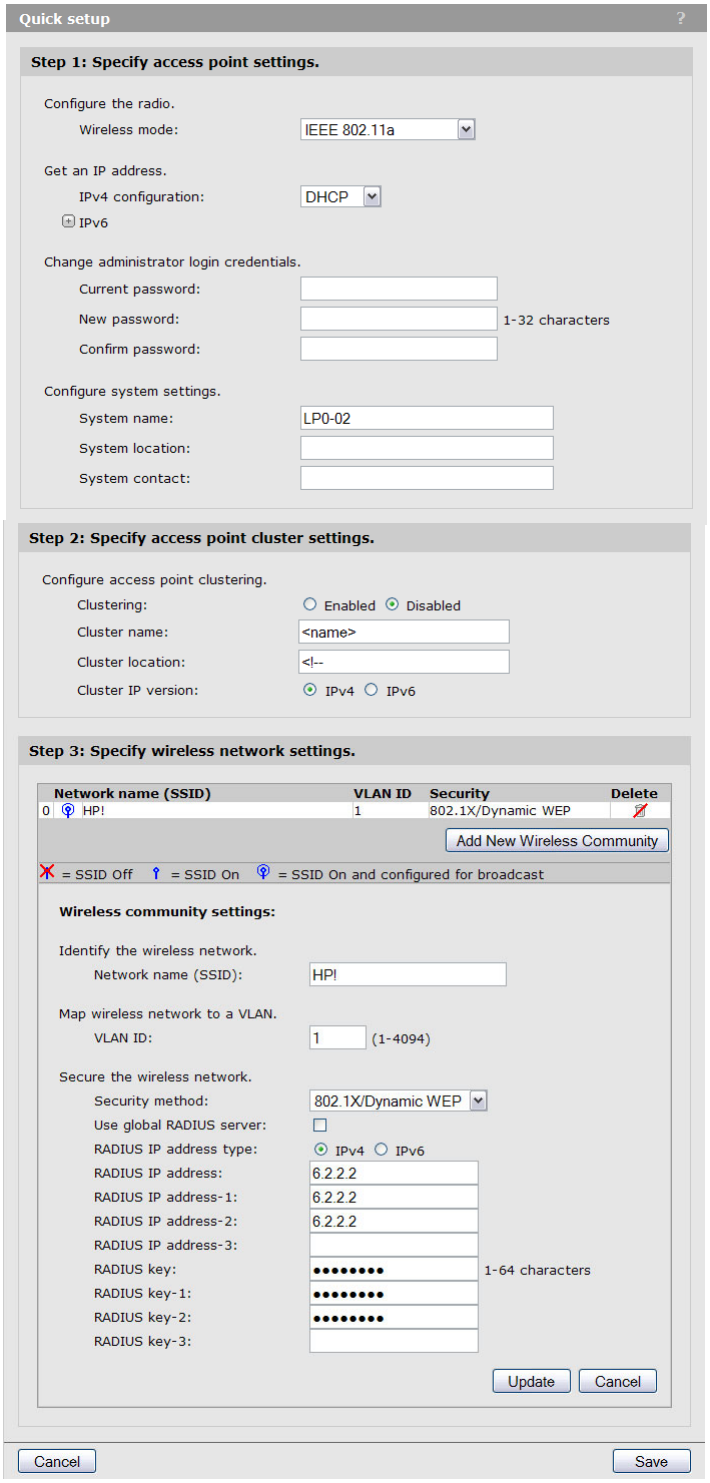
- **ASCII**: ASCII keys are much weaker than carefully chosen hexadecimal keys. You can include ASCII characters from 32 to 126, inclusive, in the key. However, note that not all wireless clients support non-alphanumeric characters such as spaces, punctuation, or special symbols in the key.
- **Hex**: Your keys should only include the following hexadecimal characters: 0-9, a-f, A-F.

Key 1

Enter a key of the specified format and length. The Quick setup wizard allows you to configure one key. You can configure additional keys on the *Wireless* > *Communities* page.

Quick setup global settings page

If you manually launch Quick setup by selecting **Home** > **Quick setup**, you will see the *Quick setup* global settings page. This page will also display if you select **Manually configure wireless network settings** check box on the initial *Quick setup* page.



This page enables you to configure the same settings as available in the Quick setup wizard. See "Quick setup wizard" on page 13 for instructions. In addition, the *Quick setup* global settings page enables you to configure the following settings:

System settings

In the **Configure system settings** area, you can specify information that helps identify the AP:

System name

Specify a name.

System location

Provide a description that identifies where the M220 is physically located.

System contact

Specify a person to contact for administrative purposes.

Multiple RADIUS servers

If you select **802.1X/Dynamic WEP** or **WPA/WPA2 Enterprise** as the **Security method**, you can configure multiple RADIUS servers on this page (in the Quick setup wizard you can configure only one).

System summary

After you complete the Quick setup wizard, when you log into the management tool again, the *System summary* page displays.

This page includes the following information:

IP address

The IP address assigned to the AP. See the *Network* > *IP* page to configure IP information.

Static IPv6 address

The IPv6 address assigned to the AP, if one is configured.

IPv6 autoconfigured global addresses

The global IPv6 address, if one or more has been assigned automatically using the network prefix that is sent by routers in router advertisements.

IPv6 link local address

The link local address, which is derived automatically from the MAC address of the AP and the network prefix that is sent by routers in router advertisements.

MAC address

The MAC address of the AP. This is the address by which the AP is known externally to other networks.

This MAC address applies to the Ethernet port on the AP and to the first (default) wireless community, referred to as wlan0. The MAC address is incremented by 1 for each additional wireless community that you create. For example, if the Ethernet and wlan0 interfaces are assigned MAC address 00:55:9A:3C:7A:00, then the next wireless community you create will be assigned MAC address 00:55:9A:3C:7A:01, and so on.

Software version

The version of software installed on the AP.

Product identifier

The AP hardware model ID number.

Hardware version

The AP hardware version.

Serial number

The AP serial number.

Device description

Information about the product hardware.

3 Managing the M220

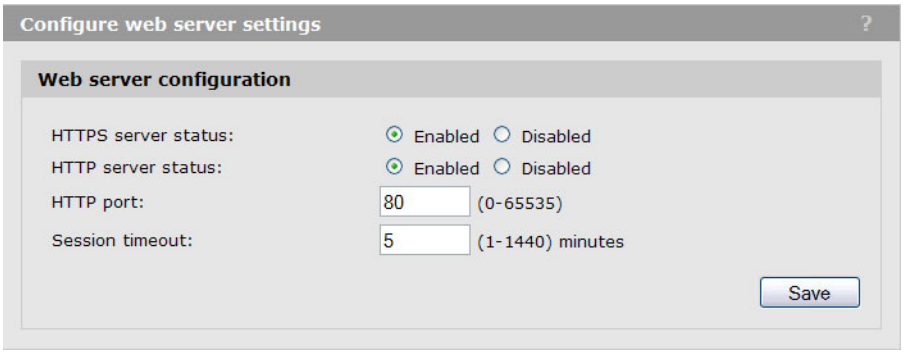
The M220 is managed via its web-based management tool using Microsoft Internet Explorer 8+ or Mozilla Firefox 9+. You can access the M220 management tool using either **http** or **https**. Using **https** is more secure but you will see a security warning until you purchase and install your own certificate. With **https**, it is acceptable to choose the option that allows you to proceed through the security warning.

In a web browser, specify either: **http://192.168.1.1** or **https://192.168.1.1**.

For information on launching the management tool for the first time, see the *HP M220 802.11n Access Point Quickstart*.

Configuring web server settings

Select **Management** > **Management tool** to open the *Configure web server settings* page.



HTTPS server status
HTTP server status

The M220 software includes HTTP and HTTPS functionality to enable communication with your web browser. Unlike HTTP, HTTPS enables secure sessions, using a digital certificate to encrypt data exchanged between the M220 and your web browser. HTTP and HTTPS are both enabled by default.

The M220 supports only one management session at a time via HTTP or HTTPS.

HTTP port

By default, the HTTP server uses the well-known logical port number 80 for communication with clients. You can specify a different port number if port 80 is blocked or used for a different protocol on your network.

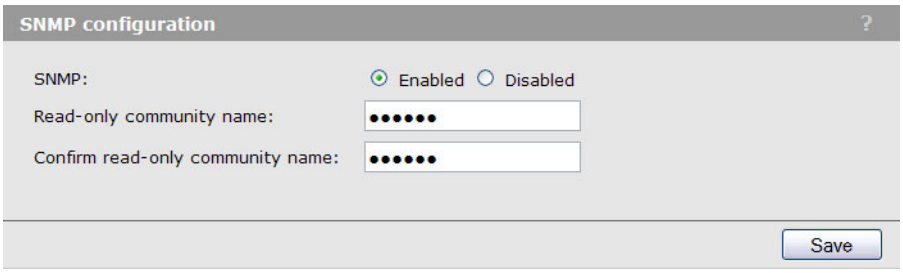
Session timeout

If there is no activity on the management session for the specified time, then the administrator will be automatically logged off.

SNMP configuration

The M220 provides a robust SNMP v1/v2 implementation supporting both industry-standard MIB II objects and HP-specific MIB objects. Read-only access is supported.

Select **Management** > **SNMP** to open the *SNMP configuration* page.



SNMP

Use this checkbox to enable/disable the SNMP agent. By default, the SNMP agent is enabled. If you disable the agent, the M220 will not respond to SNMP requests.

Read-only community name
Confirm read-only community name

This is the password that controls read-only access to SNMP information on the M220. A network management program must supply this name when attempting to get SNMP information from the M220. By default, the name is set to **public**.

Supported MIBs

The M220 supports the following MIBs and MIB objects:

Standard MIBs

The following standard MIBs are supported:

- BRIDGE-MIB (802.1d)
- ENTITY-MIB (RFC 2737)
- IANAifType-MIB
- IEEE802dot11-MIB
- IF-MIB
- INET-ADDRESS-MIB
- RADIUS-ACC-CLIENT-MIB
- RFC1155-SMI
- RFC1213-MIB
- RFC-1215
- SNMP-FRAMEWORK-MIB
- SNMP-NOTIFICATION-MIB
- SNMP-TARGET-MIB
- SNMP-USM-DH-OBJECTS-MIB
- SNMPv2-CONF
- SNMPv2-MIB (RFC 2418)
- SNMPv2-SMI
- SNMPv2-TC
- SNMPv2-TM
- RFC4688
- IP-MIB
- TCP-MIB
- UDP-MIB
- UCD-SNMP-MIB

Private MIBs

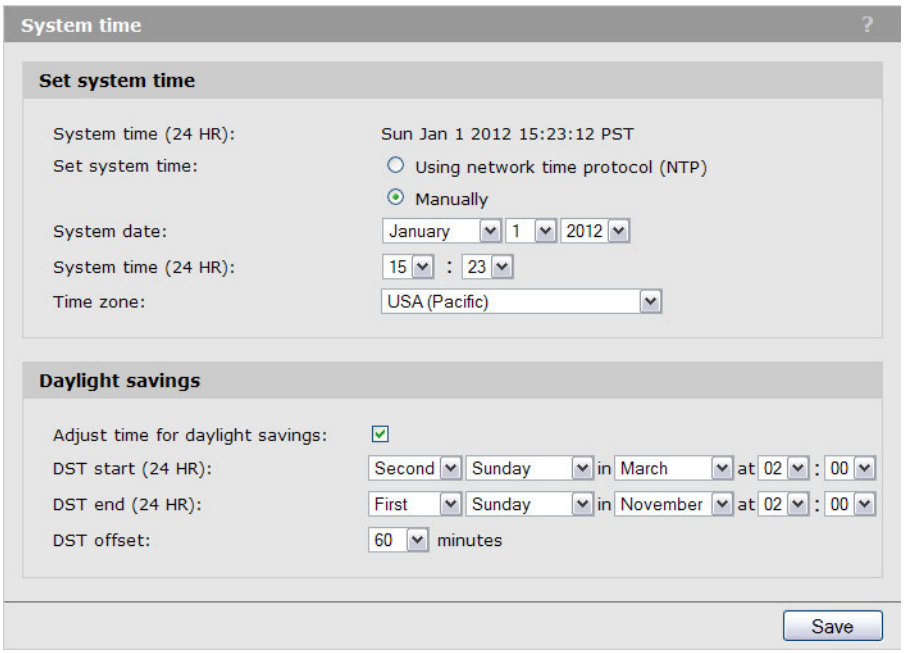
The following private MIBs and MIB objects are supported:

- COLUBRIS-SMI
- COLUBRIS-SYSTEM-MIB. Only the following objects are supported:
  - systemFirmwareRevision
  - systemBootRevision
  - systemSerialNumber
  - systemDeviceIdentification
- HP-WLAN-ACCESS-POINT-MIB

System time

Correct system time is important for proper operation of the M220, especially when using the logs to troubleshoot.

Select **Management** > **System time** to open the *System time* page. This page enables you to configure time server and time zone information.



Set system time

This section displays the current system time. You can configure the time manually or have it automatically configured by a Network Time Protocol (NTP) server.

Manually

Select the date, time (in 24-hour notation), and timezone.

Using network time protocol (NTP)

NTP servers transmit Coordinated Universal Time (UTC, also known as Greenwich Mean Time) to their client systems. NTP sends periodic time requests to servers, using the returned time stamp to adjust its clock. The timestamp is used to indicate the date and time of each event in log messages.

When you select this option, a field displays for you to specify the NTP server. You can specify the NTP hostname or IP address, although using the IP address is not recommended, as these are more likely to change. If you specify a hostname, note the following requirements:

- The length must be from 1 to 63 characters.
- Upper and lower case characters, numbers, and hyphens are accepted.
- The first character must be a letter (a to z or A to Z), and the last character cannot be a hyphen.

A actual NTP server host name, **pool.ntp.org**, is configured by default and will provide the time when the AP is connected to the Internet.

Daylight savings

Use this section to enable support for daylight savings time, if required for your location. When you select **Adjust time for daylight savings**, additional fields display to enable you to configure the starting and ending dates and times, and the DST offset.

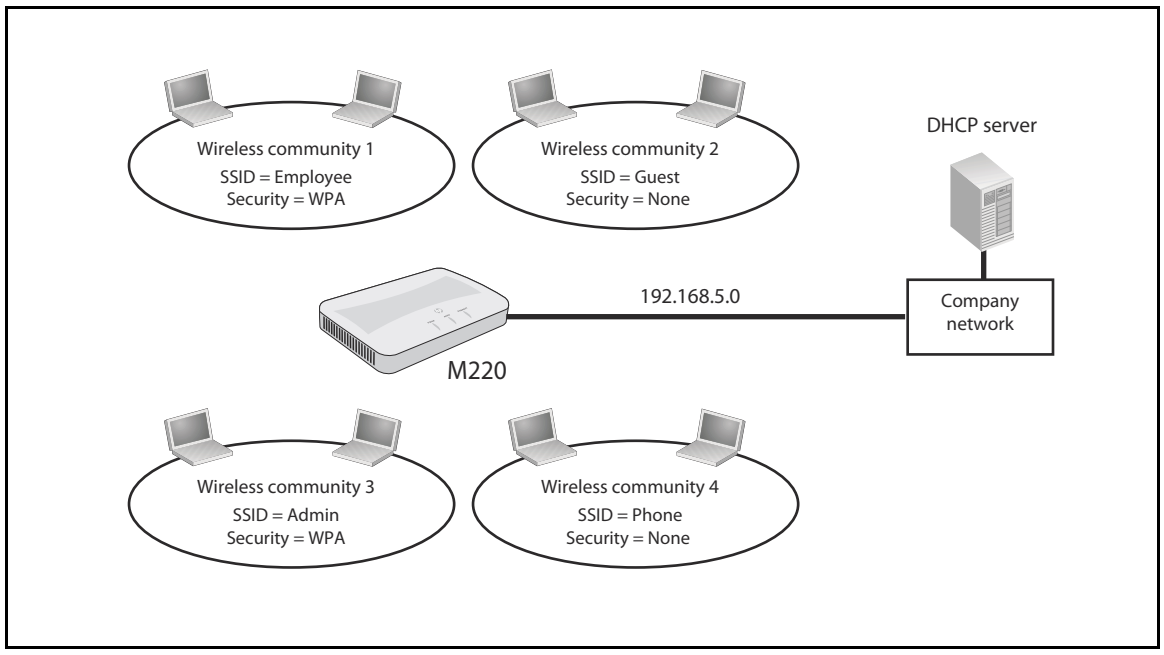
The DST offset specifies how many minutes to move the clock forward or backward.

4 Working with wireless communities and authentication

Overview

The M220 allows you to create up to eight wireless communities. Each wireless community defines the settings for a distinct wireless network, with its own network name (SSID), settings for wireless protection, user authentication, VLANs, and more.

For example, in the following scenario, four wireless communities are defined. Each wireless community is configured with a different wireless network name (SSID).



Even though multiple wireless communities are in use, all wireless users are on the same network (192.168.5.0). This means that all wireless users can reach resources on the corporate network. However, communication between wireless users may or may not be possible, depending on the configuration settings defined for each wireless community.

Configuring global RADIUS servers

M220 communities can use third-party RADIUS servers to validate user login credentials for the WPA enterprise, 802.1X, or MAC-based authentication options.

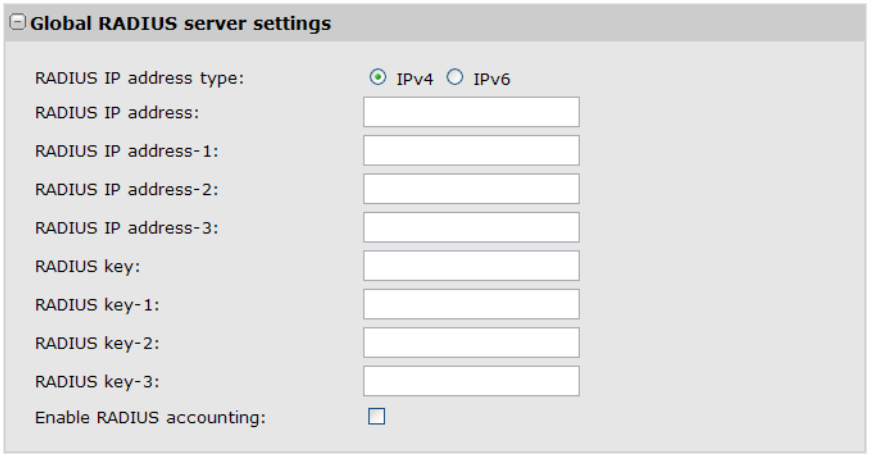
The M220 enables you to define up to four IPv4 or four IPv6 global RADIUS servers, which can be shared by each wireless community.

One server acts as a primary, while the others act as backup servers. The network type (IPv4 or IPv6) and accounting mode are common across all configured global RADIUS servers. For example, you can configure four IPv4 servers or four IPv6 servers, but not a combination of IPv4 and IPv6 servers.

Note

Additional IPv4 or IPv6 RADIUS servers can be configured for each wireless community when 802.1X/Dynamic WEP or WPA-Enterprise is used as the authentication protocol. See *802.1X/Dynamic WEP on page 37* and *WPA Enterprise on page 40*.

Global RADIUS servers are configured on the *Wireless* > *Communities* page. Select **+** to the left of **Global RADIUS server settings**.



RADIUS IP address type

Select **IPv4** or **IPv6**. All configured RADIUS servers must be of the selected type.

RADIUS IP address/1/2/3

Enter up to four server IP addresses of the selected type. The first address is the primary RADIUS server. If it is unavailable, the M220 will attempt to use the others in sequence.

RADIUS key/1/2/3

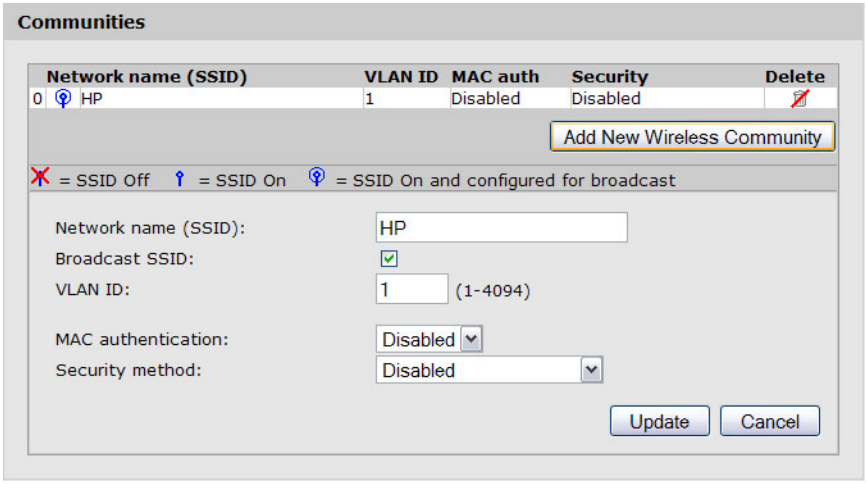
The RADIUS key is the shared secret key for the global RADIUS server. The first key corresponds to the first IP address, and so on. Enter up to 64 alphanumeric and special characters. The key is case-sensitive, and you must configure the same key on the AP and on your RADIUS server.

Enable RADIUS accounting

When selected, the RADIUS server will track and measure the resources a particular user has consumed, such as system time, the amount of data transmitted and received, and so on.

Managing wireless communities

To manage wireless communities, select **Wireless** > **Communities**.



You can define up to eight wireless communities.

- To edit an existing community, select its name in the list. Settings are displayed for the community selected in the communities list. Modify the settings as needed and select **Update**.
- To add a new community, select **Add New Wireless Community**. You can select **Save** to accept the default settings, or modify the settings and select **Add**, then **Save**.

  If you select **Cancel** before selecting **Add**, the new wireless community will be deleted.

  If you change these settings after saving a new wireless community, select **Update**, then **Save**. You can select **Cancel** before selecting **Update** to undo any changes to these settings.

See *Wireless community configuration options on page 34* for details on the settings.

About the default wireless community

By default, a single wireless community is defined. It is named **HP**, which is also its network name (SSID). You can modify settings for the default community, but you cannot delete it. You can create and delete additional communities.

Caution

The default wireless community does not have any security or authentication options enabled by default. To protect the wireless network from malicious third-party wireless users, it is strongly recommended that you enable some form of wireless protection on the default wireless community and on other communities you create.

Wireless community configuration options

You can configure the following settings for each wireless community:

Network name (SSID)

Specify a name to uniquely identify the wireless network associated with this wireless community. Each wireless user that wants to connect to this community must use this name.

The name is case-sensitive and must include between 2 and 32 alphanumeric characters, including spaces. The following characters are not allowed:

- **?**, **"**, **$**, **[**, \, **]**, and **+**
- only spaces
- **#**, **!**, **;**,and a space as the first character
- a space as the last character

Broadcast SSID

This option controls whether the network name (SSID) is broadcast to all wireless users.

- When enabled, the wireless network will be visible to wireless clients. Wireless clients are usually configured to automatically discover APs that broadcast their names and connect to the one with the strongest signal.
- When disabled, the network will not be visible to wireless clients. Wireless users must manually specify the network name (SSID) to successfully connect to the network.

VLAN ID

Use this option to set the default VLAN for traffic from this wireless community on the Ethernet port. All traffic sent/received on the Ethernet port by the wireless community will be assigned to this VLAN.

Note

Depending on the security protocol in use for the wireless community, members may be assigned to a VLAN other than the default (the default VLAN ID is 1). Client VLAN assignments from a RADIUS server override the default VLAN assignment.

MAC authentication

This feature enables you to authenticate wireless users based on the MAC addresses of their wireless devices. Select one of the following authentication methods:

- **Disabled**: Do not use MAC authentication.
- **Local**: Use a MAC authentication list that you configure. If you select this option, you must specify a list of allowed or blocked users on the *MAC authentication* page. See *Local MAC authentication on page 43* for instructions.
- **RADIUS**: Use the MAC authentication list on the external RADIUS server. The M220 uses the RADIUS servers configured for the **Security method** option selected for this wireless community. If no RADIUS servers are defined for the selected security method, the global RADIUS servers are used. See *RADIUS server-based MAC authentication on page 42*.

  By default, no global RADIUS server is defined. To define one or more servers, select **Global RADIUS server settings** and configure the **RADIUS IP address type**, **RADIUS IP address**, and **RADIUS key**.

Security method

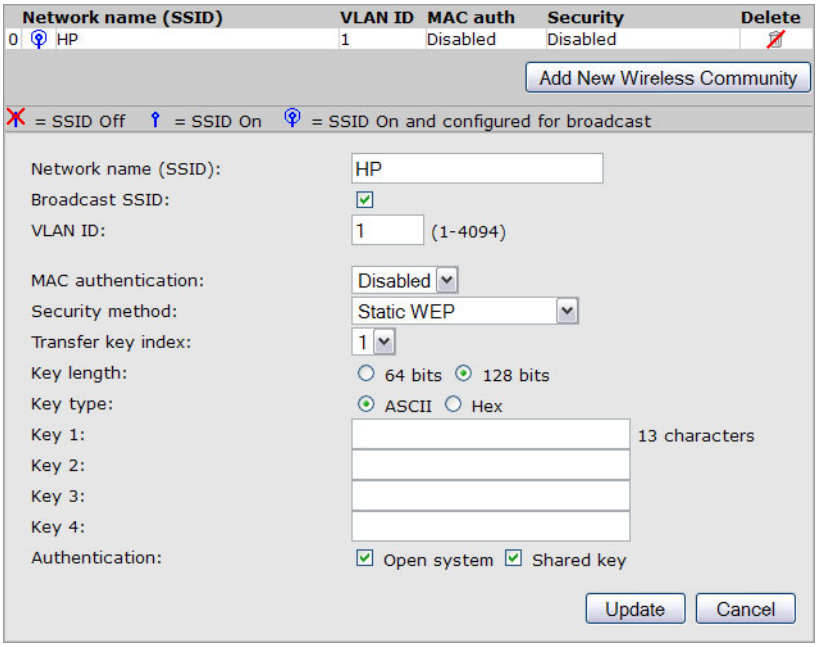
By default, no security is defined for a wireless community. It is strongly recommended to configure a security method to provide encrypted data exchanges between wireless clients and the M220. See *Wireless protection on page 35* for details on the available security methods.

Wireless protection

The M220 provides several methods to protect wireless transmissions from eavesdropping and to safeguard network access by unauthorized users. To choose the method that best meets the needs of your network, refer to the sections that follow.

Static WEP

Static WEP enables you to encrypt wireless transmissions, but does not provide for user authentication. WEP is not as secure as the other security methods available.



Note

WEP cannot be used when the radio operating mode supports 802.11n.

Transfer key index

This value indicates which of the four configured WEP keys the AP uses to encrypt the data it transmits.

Key length

The number of characters you specify for the key determines the level of encryption.

- For 64-bit encryption, specify 5 ASCII characters or 10 hexadecimal digits.
- For 128-bit encryption, specify 13 ASCII characters or 26 hexadecimal digits.

Key type

Select the format used to specify the encryption key. The definition for the encryption key must be the same on the M220 and all wireless clients.

- **ASCII:** ASCII keys are much weaker than carefully chosen hexadecimal keys. You can include ASCII characters from 32 to 126, inclusive, in the key, which includes upper and lower case alphabetic letters, the numeric digits, and special symbols such as @ and #. However, note that not all wireless clients support non-alphanumeric characters such as spaces, punctuation, or special symbols in the key.
- **Hex:** Your keys should only include the following hexadecimal characters: 0-9, a-f, A-F.

Key 1 to Key 4

Specify the key as ASCII or hexadecimal characters.

Authentication

The authentication algorithm defines the method used to determine whether a client is allowed to associate with an AP using WEP.

Choose one of the following options:

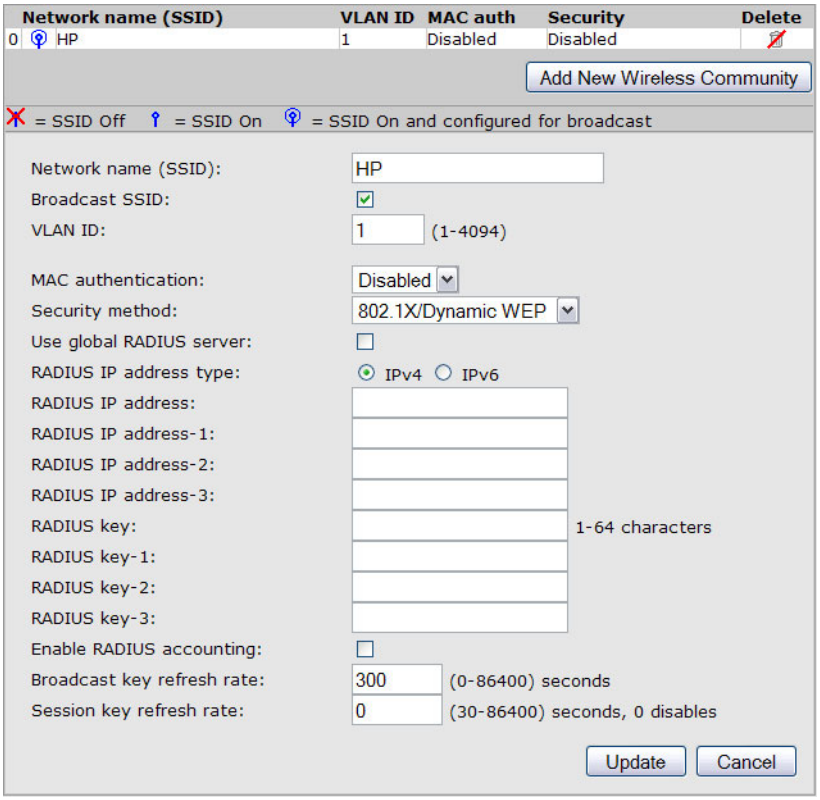
- **Open system**: This method allows any client to associate with the AP whether or not that client has the correct WEP key. It does not ensure, however, that an associated client can exchange traffic with the AP. A client must have the correct WEP key to be able to successfully access and decrypt data from an AP, and to transmit readable data to it.
- **Shared key**: This method requires the client to have the correct WEP key to associate with the AP. A client with an incorrect WEP key will not be able to associate with the AP.
- **Open system and shared key**. This is the default selection. When selected:
  - Wireless clients configured to use WEP in shared key mode must have a valid WEP key to associate with the AP.
  - Wireless clients configured to use WEP as an open system mode (shared key mode not enabled) can associate with the AP even if they do not have the correct WEP key.

Note

Open system authentication or shared key authentication can be used by the client to authenticate with the AP when the AP is configured for 802.11 open authentication. When the AP is configured for 802.11 shared key authentication, however, 802.11 shared key authentication must be used by the client to authenticate with the AP.

802.1X/Dynamic WEP

802.1X enables you to authenticate wireless clients via user accounts stored on a third-party RADIUS server. 802.1X is purely a protocol for user authentication. On the M220, it is paired with Dynamic WEP, which adds WEP encryption based on a set of dynamically generated keys.



Note

Dynamic WEP cannot be used when the radio operating mode supports 802.11n.

Use global RADIUS server

When selected, the wireless community will use the global RADIUS servers defined at the top of the *Communities* page. When not selected, you can configure each wireless community to use a different set of RADIUS servers.

RADIUS IP address type

You can toggle between the address types to configure IPv4 and IPv6 RADIUS server addresses. Note, however, that the AP contacts only the RADIUS server or servers of the address type selected in this field.

RADIUS IP address/RADIUS IPv6 address

Enter the IPv4 or IPv6 address for the primary RADIUS server for this wireless community.

If **IPv4** is selected as the **RADIUS IP address type**, enter the IP address of the RADIUS server that all wireless communities use by default, for example 192.168.10.23. If **IPv6** is selected, enter the IPv6 address of the primary global RADIUS server, for example 2001:0db8:1234::abcd.

RADIUS IP or IPv6 address 1 to 3

Enter up to three IPv4 and/or IPv6 addresses to use as the backup RADIUS servers for this wireless community. The field label is **RADIUS IP address** when **IPv4** is selected as the **RADIUS IP address type**, and **RADIUS IPv6 address** when **IPv6** is selected.

If authentication fails with the primary server, each configured backup server is tried in sequence.

RADIUS key

Enter the RADIUS key in the text box.

The RADIUS key is the shared secret key for the RADIUS server. You can use up to 63 alphanumeric and special characters. The key is case-sensitive, and you must configure the same key on the AP and on your RADIUS server. The text you enter will be displayed as asterisk (*) characters to prevent others from seeing the RADIUS key as you type.

RADIUS key 1 to 3

Enter the RADIUS key associated with the configured backup RADIUS servers. The server at **RADIUS IP address-1** uses **RADIUS key-1**, **RADIUS IP address-2** uses **RADIUS key-2**, and so on.

Enable RADIUS accounting

Select this option to track and measure the resources a particular user has consumed, such as system time, amount of data transmitted and received, and so on.

If you enable RADIUS accounting, it is enabled for the primary RADIUS server and all backup servers.

Broadcast key refresh rate

Enter the interval at which the broadcast (group) key is refreshed for clients associated with this wireless community (the default is 300).

The valid range is 0 to 86400 seconds. Specify a value of 0 to disable the refreshing of broadcast keys.

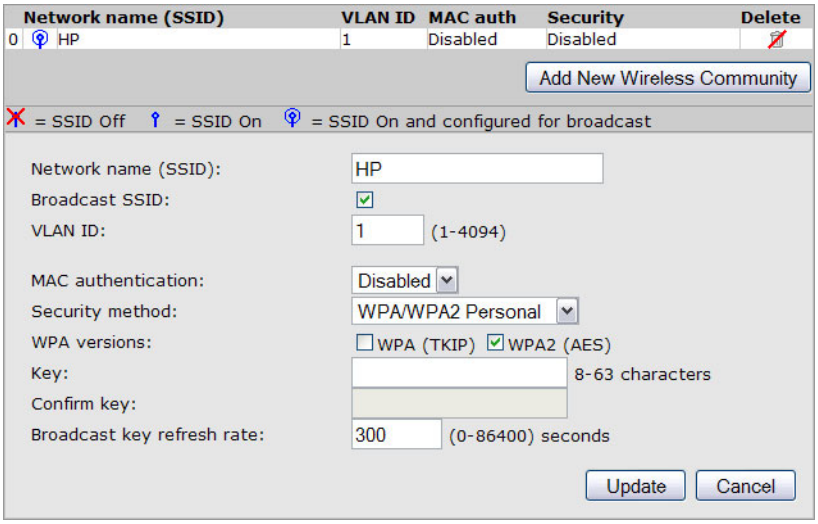
Session key refresh rate

Enter the interval at which the AP will refresh session (unicast) keys for each client associated with the wireless community.

To enable session key refreshing, specify a value in the range of 30 to 86400 seconds. Specify a value of 0 to disable the refreshing of session keys.

WPA Personal

WPA Personal is a Wi-Fi Alliance IEEE 802.11i standard, which includes AES-CCMP and TKIP mechanisms. It employs a preshared key (instead of using IEEE 802.1X and EAP, as is used in the WPA Enterprise mode). The preshared key (PSK) is used for an initial check of credentials only.



WPA versions

Select one of the following options:

- **WPA (TKIP)**: WPA with TKIP encryption. This is the original version of the standard and is still supported by many legacy clients.
- **WPA2 (AES)**: WPA2 (802.11i) with AES encryption. This version is more secure than WPA (TKIP). If all your users have WPA2 client software, select this option for the maximum possible security.
- **WPA** and **WPA2**: When both are selected, both WPA and WPA2 are supported at the same time. Some legacy WPA clients may not work if this mode is selected. This mode is slightly less secure than using the WPA2 (AES/CCMP) mode.

Note

WPA2 (AES) must be selected when the radio mode supports 802.11n. If an 802.11n-only mode is selected, only WPA2 (AES) can be used.

Key

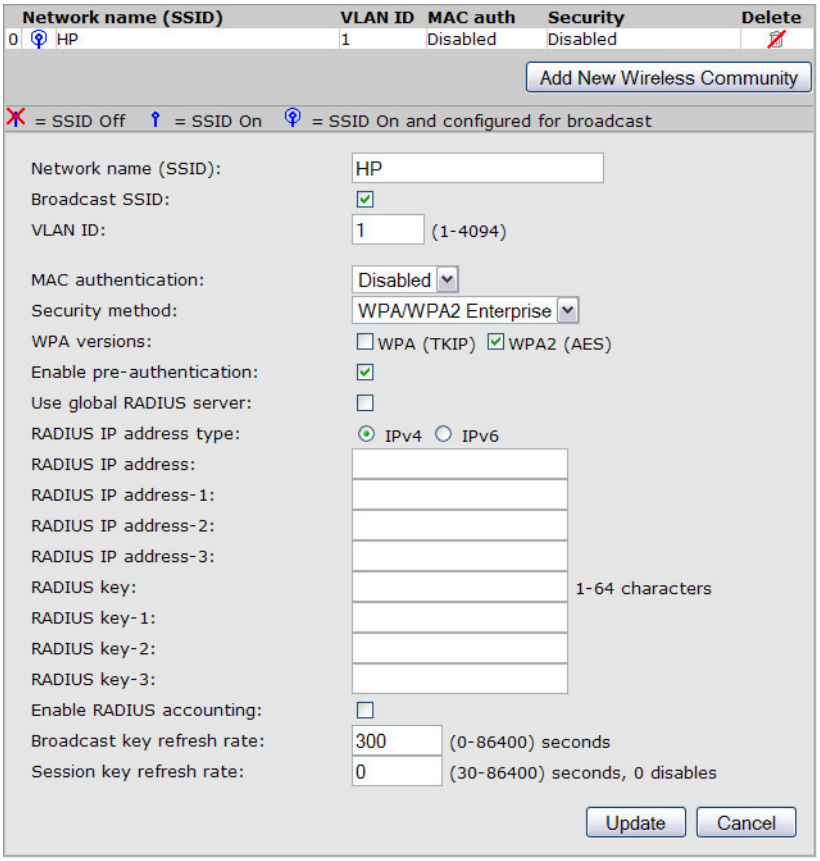
The M220 uses the preshared key (PSK) you specify to generate the WPA (TKIP) or WPA2 (AES) keys that are used to encrypt the wireless data stream. Specify a key that is from 8 to 63 alphanumeric characters in length. It is recommended that the preshared key be at least 20 characters long, and be a mix of letters and numbers. The key cannot begin or end with spaces.

Broadcast key refresh rate

Enter the interval at which the broadcast (group) key is refreshed for clients associated with this wireless community (the default is 300). The valid range is 0 to 86400 seconds. A value of 0 indicates that the broadcast key is not refreshed.

WPA Enterprise

WPA Enterprise with RADIUS is an implementation of the Wi-Fi Alliance IEEE 802.11i standard, which includes the CCMP (AES) and TKIP mechanisms. The Enterprise mode requires the use of a RADIUS server to authenticate users.



WPA versions

Select the types of wireless clients you want to support:

- **WPA (TKIP)**: If all wireless clients on the network support WPA but none support WPA2, then select WPA.
- **WPA2 (AES)**: If all wireless clients on the network support WPA2, we suggest using WPA2, which provides the best security per the IEEE 802.11i standard.

Note

WPA (TKIP) cannot be used when the radio operating mode supports 802.11n.

If you have a mix of clients, some of which support WPA2 and others which support only the original WPA, select both **WPA (TKIP)** and **WPA2 (AES)**. This setting enables both WPA and WPA2 wireless clients to associate and authenticate, but uses the more robust WPA2 for clients who support it. This WPA configuration allows more interoperability, at the expense of some security.

Enable pre-authentication

If for WPA versions you select only **WPA2 (AES)** or both **WPA (TKIP)** and **WPA2 (AES)**, you can enable pre-authentication for WPA2 clients. Enable pre-authentication if you want WPA2 wireless clients to send pre-authentication packets. The pre-authentication information will be relayed from the AP the client is currently using to the target AP. Enabling this feature can help speed up authentication for roaming clients who connect to multiple APs.

This option does not apply if you selected **WPA (TKIP)** because the original WPA does not support this feature.

Use global RADIUS server

When selected, the wireless community will use the global RADIUS servers defined at the top of the *Communities* page. When not selected, you can configure each the wireless community to use a different set of RADIUS servers.

RADIUS IP address type

You can toggle between the address types to configure IPv4 and IPv6 RADIUS server addresses. Note, however, that the AP contacts only the RADIUS server or servers of the address type selected in this field.

RADIUS IP address/RADIUS IPv6 address

Enter the IPv4 or IPv6 address for the primary RADIUS server for this wireless community.

If **IPv4** is selected as the **RADIUS IP address type**, enter the IP address of the RADIUS server that all wireless communities use by default, for example 192.168.10.23. If **IPv6** is selected, enter the IPv6 address of the primary global RADIUS server, for example 2001:0db8:1234::abcd.

RADIUS IP or IPv6 address 1 to 3

Enter up to three IPv4 and/or IPv6 addresses to use as the backup RADIUS servers for this wireless community. The field label is **RADIUS IP address** when **IPv4** is selected as the **RADIUS IP address type**, and **RADIUS IPv6 address** when **IPv6** is selected.

If authentication fails with the primary server, each configured backup server is tried in sequence.

RADIUS key

Enter the RADIUS key in the text box.

The RADIUS key is the shared secret key for the global RADIUS server. You can use up to 63 standard alphanumeric and special characters. The key is case-sensitive, and you must configure the same key on the AP and on your RADIUS server. The text you enter will be displayed as "*" characters to prevent others from seeing the RADIUS key as you type.

RADIUS key 1 to 3

Enter the RADIUS key associated with the configured backup RADIUS servers. The server at **RADIUS IP address-1** uses **RADIUS key-1**, **RADIUS IP address-2** uses **RADIUS key-2**, and so on.

Enable RADIUS accounting

Select this option to track and measure the resources a particular user has consumed, such as system time, amount of data transmitted and received, and so on.

If you enable RADIUS accounting, it is enabled for the primary RADIUS server and all backup servers.

Broadcast key refresh rate

Enter the interval at which the broadcast (group) key is refreshed for clients associated with this wireless community (the default is 300).

The valid range is 0 to 86400 seconds. Specify a value of 0 to disable the refreshing of broadcast keys.

Session key refresh rate

Enter the interval at which the AP will refresh session (unicast) keys for each client associate with the wireless community.

To enable session key refreshing, specify a value in the range of 30 to 86400 seconds. Specify a value of 0 to disable session key refresh.

MAC authentication

You can control access to the wireless network based on the MAC address of a user's wireless device. You can either block access or allow access, depending on your requirements.

For each wireless community, you can select whether to disable MAC authentication, use a MAC authentication list stored locally on the M220, or use a list stored on a RADIUS server (see *Wireless community configuration options on page 34*.

Caution

MAC authentication is vulnerable to MAC address spoofing, where users in the network who are not granted access to the M220 gain access by changing their MAC addresses to an authorized user's address. For better security, administrators should consider using an additional authentication method (WPA Personal, WPA Enterprise, 802.1X/Dynamic WEP, or Static WEP). MAC authentication occurs after other authentication methods are applied.

RADIUS server-based MAC authentication

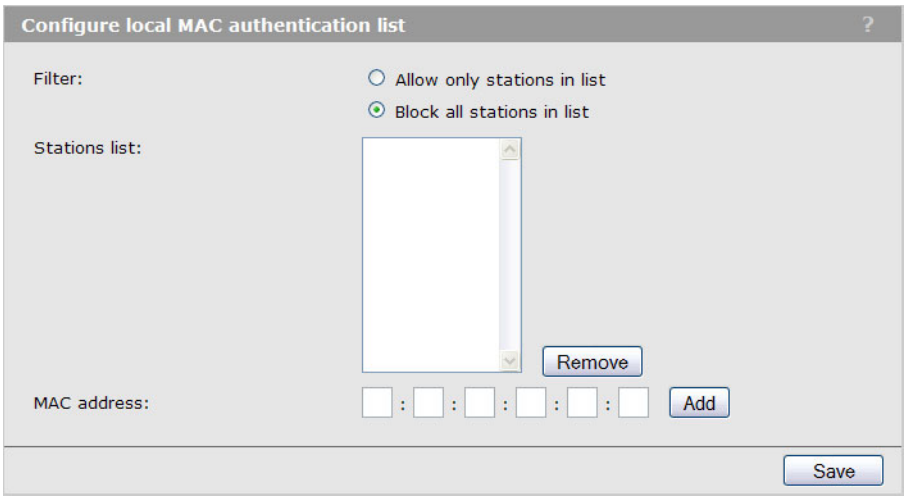
When RADIUS server-based MAC authentication is enabled on a wireless community, a wireless client MAC address is compared to the configured list upon authentication. The globally configured allow or deny action is applied when a MAC address matches an entry in the list. When a client MAC address is not found in the list, the opposite allow or deny action is applied.

The following attributes must be configured on the RADIUS server:

- **User-Name (1)**: Ethernet MAC address of the client.
- **User-Password (2)**: A fixed password used to lookup a client MAC entry. The M220 uses the password "NOPASSWORD".

Local MAC authentication

Select **Wireless** > **MAC authentication** to display the *Configure local MAC authentication list* page. You can use this page to configure a local list, which applies to every wireless community on which local MAC authentication is enabled.



Filter

Select one of the following options:

- **Allow only stations in list**: Only users whose MAC addresses appear in the MAC address list can connect to the wireless network created by this community.
- **Block all stations in list**: Users whose MAC address appear in the MAC address list are blocked from accessing the wireless network created by this community.

Stations list

Up to 512 MAC addresses are supported. To remove an address, select it in the list and select **Remove**.

MAC address

To add a MAC address, specify six pairs of hexadecimal digits separated by colons (for example, 00:00:00:0a:0f:01), and then select **Add**. The added address appears in the Stations list.

5 Wireless configuration

Wireless coverage

As a starting point for planning your network, you can assume that when operating at high power, the M220 radio provides a wireless networking area (also called a wireless cell) of up to 300 feet (100 meters) in diameter. Before creating a permanent installation, you should always perform a site survey to determine the optimal settings and location for the M220.

The following sections provide information on wireless coverage. A tool that can help simplify planning a secure wireless network is the HP RF Planner (available separately). For more information, see the *RF Planner Admin Guide* or contact your HP Partner.

Factors limiting wireless coverage

Wireless coverage is affected by the factors discussed in this section.

Interference

Interference is caused by other APs or devices that operate in the same frequency band as the M220 and can substantially affect throughput. Several tools are available to diagnose interference problems as they occur.

- Select **Wireless** > **Rogue AP** detection to view detailed information about all wireless APs operating in the immediate area so that you can effectively set the operating frequencies. This feature also makes it easy for you to find rogue APs. See *Detecting Rogue APs on page 58*.
- Select **Status** > **Wireless** to view detailed information about packets sent and received, transmission errors, and other low-level events.

Caution

APs that operate in the 2.4 GHz band may experience interference from devices including 2.4 GHz cordless phones and microwave ovens. A smaller but growing number of devices are potential sources of interference in the 5 GHz band.

Physical characteristics of the location

To maximize coverage of an M220, install it in an open area with as few obstructions as possible. Try to choose a location that is central to the area being served.

Radio waves cannot penetrate metal—they are reflected instead. The M220 can transmit through wood or plaster walls and closed windows (although window glazing or thickness may impair penetration). However, the steel reinforcing found in concrete walls and floors may block transmissions or reduce signal quality by creating reflections. This can make it difficult or impossible for a single M220 to serve users on different floors in a concrete building. Such installations require a separate M220 on each floor.

Configuring overlapping wireless APs

When the radio is operating in the 2.4 GHz band and two or more APs may are within transmission range of each other, they may use overlapping channels. This may be under your control (for example, when you use several APs to cover a large location) or out of your control (for example, when your neighbors set up their own wireless networks). In either case, the problems you face are similar.

Note

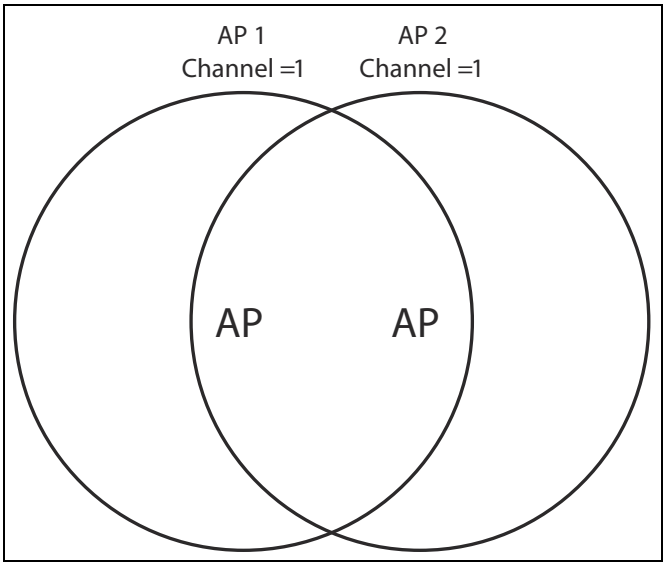
Overlapping channels do not occur when the radio is operating in the 5 GHz band. All 5 GHz channels are non-overlapping.

Performance degradation and channel separation

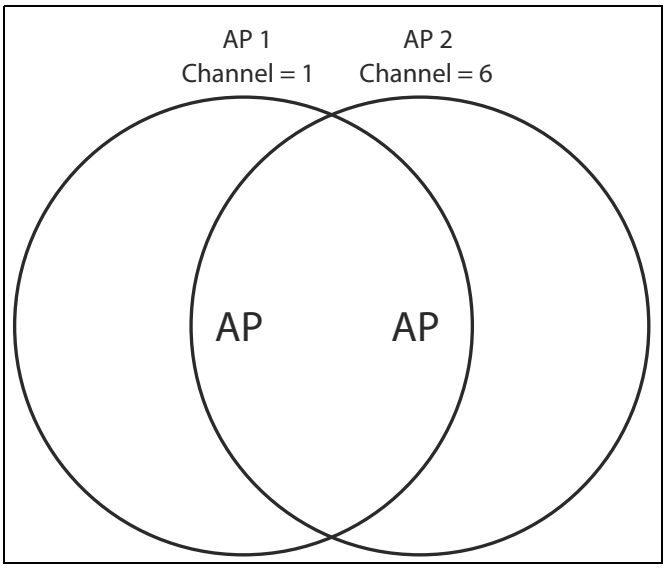
When two wireless APs operating on the same frequency overlap, throughput can be reduced in both APs. Reduced throughput occurs because a wireless user that is attempting to transmit data defers (delays) transmission if another station is transmitting. In a network with many users and much traffic, these delayed transmissions can severely affect performance, because wireless users may defer several times before the channel becomes available. If a wireless user is forced to delay transmission too many times, data can be lost.

Delays and lost transmissions can severely reduce throughput on a network. To view this information about your network, select **Status** > **Wireless**.

The following example shows two overlapping wireless APs operating on the same frequency. Since the APs are within range of each other, the number of deferred transmissions can be large.



The solution to this problem is to set the two networks to different channels with as great a separation as possible in their operating frequencies. This reduces crosstalk and enables wireless clients connected to each M220 to transmit at the same time.



Selecting channels

For optimal performance when operating in the 2.4 GHz band, select an operating frequency that is different by at least 25 MHz from the frequency used by neighboring APs.

Two channels with the minimum 25 MHz frequency separation always perform *worse* than two channels that use maximum separation. It is always best to use the greatest separation possible between overlapping networks.

With the proliferation of wireless networks, it is very possible that the areas of coverage of APs outside your control overlap your intended area of coverage. To choose the best operating frequency, select **Wireless** > **Rogue AP** detection to generate a list of all APs that operate near you and their operating frequencies.

The number of non-overlapping channels available to you varies by geographical location, which affects how you set up your network when multiple APs are present.

Sample channel selections

For example, when operating in 802.11b mode, the M220 supports the following 14 channels in the 2.4 GHz band:

Channel	Frequency
1	2412
2	2417
3	2422
4	2427
5	2432
6	2437
7	2442

Channel	Frequency
8	2447
9	2452
10	2457
11	2462
12	2467
13	2472
14	2477

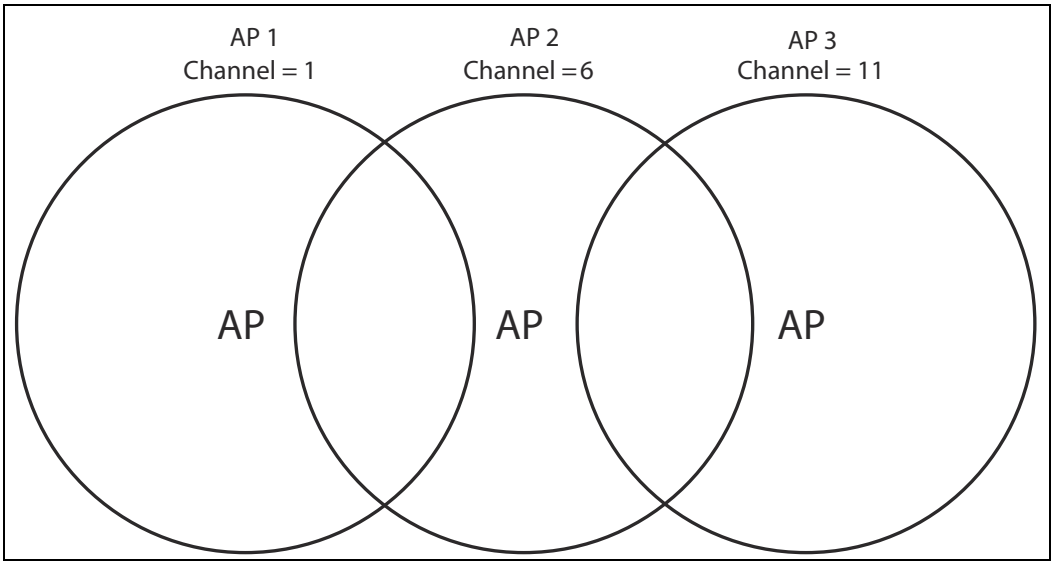
However, the number of channels available for use in a particular country are determined by regional regulations. The following table shows the number of channels that are available in North America and Europe:

Region	Available channels
North America	1 to 11
Europe	1 to 13

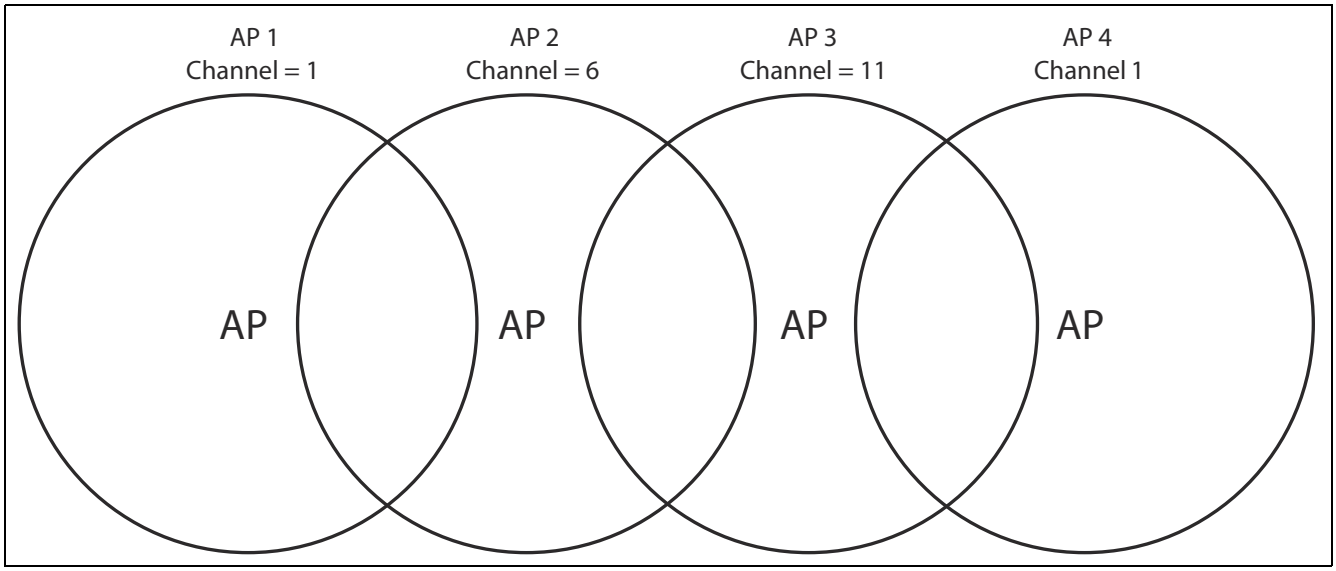
Since the minimum recommended separation between overlapping channels is 25 MHz (in other words, they must be at least five channels apart) the recommended maximum number of overlapping APs you can have in most regions is three. The following table gives examples relevant to North America and Europe for channels in the 2.4 GHz band:

North America	Europe
• AP 1 on channel 1 • AP 2 on channel 6 • AP 3 on channel 11	• AP 1 on channel 1 • AP 2 on channel 7 • AP 3 on channel 13

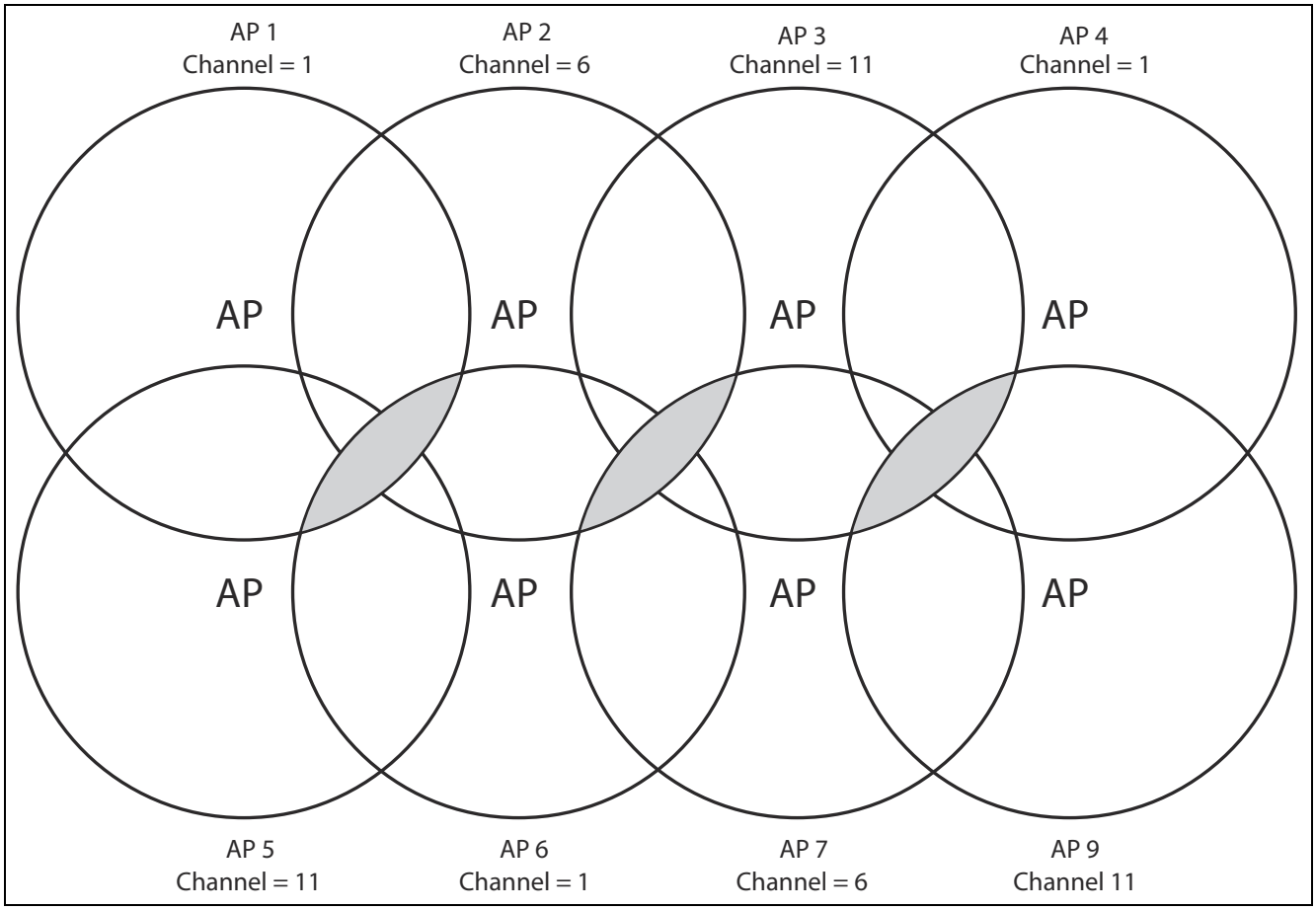
In North America, you can reduce transmission delays by using different operating frequencies, as shown in the following figure:



Alternatively, you can stagger APs to reduce overlap and increase channel separation, as shown in the following figure:



This strategy can be expanded to cover an even larger area using three channels, as shown in the following figure:



802.11n best practices

This section provides recommendations on how to best use 802.11n wireless technology, especially when legacy (a/b/g) clients must also be supported.

Supporting legacy wireless clients

The 802.11n standard is very similar to the 802.11g standard, in that both provide mechanisms to support older wireless standards. In the case of 802.11g, protection mechanisms were created to allow 802.11b and 802.11g wireless devices to co-exist on the same frequencies despite using different signal modulation schemes. Since older 802.11b-only clients cannot detect the newer 802.11g modulation scheme, 802.11g clients must "protect" their transmissions by first sending a signal that alerts 802.11b clients to not attempt to transmit for a specified period of time.

If protection is not used, 802.11b clients may transmit while an 802.11g frame is already being sent. This leads to a collision and both devices need to re-transmit. If there are enough devices in the network, the collision rate will grow exponentially and prevent any useful throughput from the wireless network.

802.11n clients face the same problem as described for 802.11g clients. Legacy a/b/g clients cannot detect the High Throughput (HT) rates that 802.11n uses. To avoid causing excessive collisions, 802.11n clients must use the same protection mechanisms when a legacy client is present. Even the most efficient protection mechanism (CTS-to-self) causes a substantial decline in throughput. Performance can decline by as much as 50 percent. The 802.11n clients can achieve maximum data rates only when the legacy clients are not present.

Compatibility modes

See *Basic settings on page 53* for a list of supported modes.

Modes that support multiple 802.11 standards are referred to as compatibility modes. IEEE 802.11b/g/n is the default mode.

For compatibility modes that support 802.11n clients, the M220 advertises protection in its beacon frames when legacy clients are associated or operating on the same channel. This alerts the associated 802.11n clients to use protection when transmitting. The M220 also uses protection when necessary while sending HT data.

Compatibility modes should be used when legacy clients are present in the network. HP recommends IEEE 802.11a/n or IEEE 802.11 b/g/n as the typical operating mode. Both modes allow for all wireless clients to connect and they use protection to avoid causing interference.

IEEE 802.11n (5 GHz) and IEEE 802.11n (2.4 GHz)

HP refers to these two modes as Pure-n. When the M220 radio is in either of these modes, it will not allow non-802.11n clients to associate. Legacy clients can see the M220, and may attempt to associate, but they will be rejected. The M220 makes this determination based on information on supported capabilities that the client presents during its association request. If the client does not indicate support for 802.11n capabilities, it is not allowed to associate.

In these modes, the M220 will not use protection when sending HT frames to associated clients. If legacy APs or clients are using the same channel, this may lead to collisions. In the 5 GHz band, this will probably not be a common problem since the band is not heavily used. In the 2.4 GHz band, however, this mode may cause serious performance deterioration for everyone on the channel (both the 802.11b/g and 802.11n clients).

The M220 will still signal associated clients to use protection when they send data. The M220 does this via a field in the beacons that it sends. So clients sending data to the M220 will use protection, but data sent from the M220 will not be protected.

Note

Some people may refer to this mode as Greenfield, which is not correct. Greenfield is an 802.11n-specific preamble. The M220 does not support this preamble and therefore does not support Greenfield mode.

The Pure-n modes can be used when there is no legacy wireless traffic present in or around the premises on the channels that will be used. All client devices must support 802.11n.

Channel width

When operating in an 802.11n mode, the M220 enables you to use the standard channel width of 20 MHz or a double width of 40 MHz. A width of 40 MHz is achieved by using two adjacent channels to send data simultaneously. The advantage of using a 40 MHz wide channel is that the available bandwidth is doubled, leading to much higher throughput for clients operating in that mode. A disadvantage is that fewer channels are available for use by all clients.

When the channel width is set to **20 MHz**, channel usage is the same as in legacy mode.

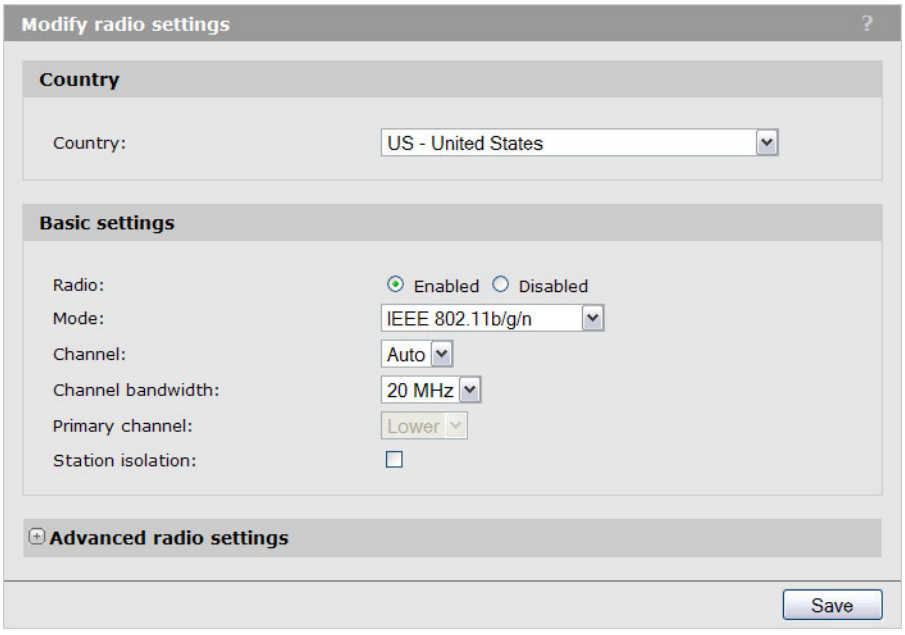
When **Auto (20/40)** is selected, the M220 radio uses a 40 MHz channel width. However, both 20 and 40 MHz clients can associate. The channel selected on the *Modify radio settings* page is the primary channel and the secondary (or extension) channel is located adjacent to it. The secondary channel is either above or below depending on which channel was selected as the primary. In 5 GHz IEEE 802.11n mode, the channels are paired: for example, channels 36 and 40 are always used together, 44 and 48 are always used together, etc.

Note

If the **Country** setting identifies a regulatory domain that does not support the 40 MHz channel bandwidth, this setting will not apply.

Radio configuration

To define configuration settings for the M220 radio, select **Wireless > Radio**. The *Modify radio settings* page displays.



This page enables you to configure the country in which the M220 will operate, basic radio settings such as the radio mode and channel, and advanced radio features.

Country

The country of operation, also known as the regulatory domain, determines the availability of certain wireless settings on the M220.

Once the country has been set, the M220 automatically limits the available wireless channels and channel width, and adjusts the radio power level in accordance with the regulations of the selected country.

Caution

Incorrectly selecting the country may result in illegal operation and may cause harmful interference to other systems. Please ensure that the M220 is operating in accordance with channel, power, indoor/outdoor restrictions, and license requirements for the intended country. If you fail to heed this caution, you may be held liable for violating the local regulatory compliance.

Basic settings

Radio

The wireless radio is enabled by default. If you disable the radio, no wireless clients can connect.

Mode

Select the mode that best supports the wireless clients at your location.

Supported wireless modes are determined by the regulatory domain (country). Available options may include one or more of the following:

- **IEEE 802.11a:** Up to 54 Mbps for 802.11a in the 5 GHz frequency band.
- **IEEE 802.11b/g:** (Compatibility mode.) Up to 11 Mbps for 802.11b and 54 Mbps for 802.11g in the 2.4 GHz frequency band. Use this setting only when support for 802.11b is necessary and support for 802.11n is not desired.
- **IEEE 802.11a/n:** (Compatibility mode.) Up to 54 Mbps for 802.11a and 300 Mbps for 802.11n in the 5 GHz frequency band.
- **IEEE 802.11b/g/n:** (Compatibility mode.) Up to 300 Mbps for 802.11n, 54 Mbps for 802.11g, and 11 Mbps for 802.11b in the 2.4 GHz frequency band. Use this setting when support for 802.11b and 802.11n is necessary.
- **IEEE 802.11n (5 GHz):** (Pure 802.11n) Up to 300 Mbps in the 802.11n 5 GHz frequency band.
- **IEEE 802.11n (2.4 GHz):** (Pure 802.11n) Up to 300 Mbps in the 802.11n 2.4 GHz frequency band.

Note

In **802.11n (2.4 GHz)** and **802.11n (5 GHz)** modes, the M220 does not permit non-802.11n clients to associate. Also in this mode, the M220 does not use protection mechanisms (RTS/CTS or CTS-to-self) to enable legacy APs to operate on the same frequency. This can potentially cause problems with legacy (802.11a/b/g) APs operating on the same channel, but provides the best throughput for the M220 and its 802.11n clients.

In **802.11a/n**, and **802.11b/g/n** modes, the M220 permits both 802.11n and legacy clients (802.11a/b/g) to associate. The M220 uses protection mechanisms (RTS/CTS or CTS-to-self) when sending 802.11n data to prevent disruption to legacy (802.11a/b/g) clients associated on the same channel. For more information, refer to *802.11n best practices on page 50*.

Channel

Select the channel for wireless services. The range of available channels is determined by the mode of the radio interface and the country code setting.

- Automatic channel selection

  If you select **Auto** for the channel setting, the AP randomly selects a channel from the list of valid channels for the country and radio mode.

  The channel defines the portion of the radio spectrum the radio uses for transmitting and receiving. Each mode offers a number of channels, depending on how the spectrum is licensed by national and transnational authorities such as the Federal Communications Commission (FCC) or the International Telecommunication Union (ITU-R).

- Manual channel selection

  If setting the channel manually, for optimal performance when operating in 2.4 GHz modes, select a channel that is different by at least five channel numbers (25 MHz) from the channels used on wireless APs that have overlapping coverage areas. For example, if another AP is operating on channel 1, set the M220 to channel 6 or higher. Select **Wireless** > **Rogue AP detection** to view a list of APs currently operating in your area.

  When operating in 802.11a or 5 GHz 802.11n modes, all channels are non-overlapping, so you can configure APs to operate on adjacent channels.

Note

Channel selection for APs in a cluster: When automatic channel assignment is enabled on the *Cluster* > *Channel planning* page, the channel policy for the radio is automatically set to static mode, and the **Auto** option is not available for the Channel setting. This configuration allows the automatic channel feature to set the channels for the radios in the cluster.

Channel bandwidth

(Only applicable when **Wireless mode** includes some type of 802.11n support.)

Select the **Channel width** that will be used for 802.11n users.

- **20 MHz**: Sets channel width to 20 MHz.
- **Auto 20/40 MHz**: Under most conditions, this can double throughput by bonding adjacent channels to form a 40 MHz channel. This option reduces the number of unoccupied channels available to neighboring APs.

Note

Although some 802.11n clients only support 20 MHz channels, they can still associate with a M220 configured for **Auto 20/40 MHz**.

Primary channel (802.11n modes only)

This setting can be changed only when the channel bandwidth is set to 40 MHz. A 40-MHz channel can be considered to consist of two 20-MHz channels that are contiguous in the frequency domain. These two 20-MHz channels are often referred to as the Primary and Secondary channels. The Primary channel is used for 802.11n clients that support only a 20 MHz channel bandwidth and for legacy clients.

Select one of the following options:

- **Upper**: The Primary Channel is the upper 20-MHz channel in the 40-MHz band.
- **Lower**: The Primary Channel is the lower 20-MHz channel in the 40-MHz band.

Current channel

This field displays the currently assigned channel.

Station isolation

When enabled, the M220 prevents communication between wireless clients associated with the same wireless community. Clients can still communicate with the wired network, across a WDS link, and with other wireless clients associated with a different wireless community. This selection is applied to all wireless communities on the AP.

Advanced radio settings

When you select the **+** next to **Advanced radio settings**, the following settings display:

Multidomain regulatory mode

This mode causes the AP to broadcast, as a part of its beacons and probe responses, the country in which it is configured for operation. This allows wireless clients to operate in any country without reconfiguration.

Disabling this feature prevents the country code setting from being broadcast in the beacons. However, this applies only to radios configured to operate in the 802.11g band (2.4 GHz). For radios operating in the 802.11a band (5 GHz), the AP software configures support for the IEEE standard 802.11h. When 802.11h is supported, the country code information is broadcast in the beacons.

Short guard interval supported

This setting is available only if the selected radio mode includes 802.11n.

The guard interval is the dead time, in nanoseconds, between symbols (or characters) transmitted by the AP. The guard interval helps distinguish where one symbol transmission stops and another starts, thereby reducing inter-symbol interference (ISI). The 802.11n mode allows for a reduction in this guard interval from the 802.11a and 802.11g definition of 800 nanoseconds to 400 nanoseconds. Enabling the short guard interval (SGI) is recommended, as it can yield a 10% improvement in data throughput.

Note

If SGI is enabled on the M220 but a wireless client does not support SGI, the client will be able to communicate with M220 at a data rate that is about 10% slower than SGI-enabled clients.

Select one of the following options:

- **Yes** (default): AP transmits data using a 400 ns guard interval when communicating with clients that also support the short guard interval.
- **No**: The AP transmits data using an 800 ns guard interval.

STBC mode

This setting is available only if the selected radio mode includes 802.11n.

Space Time Block Coding (STBC) is an 802.11n technique that improves the reliability of data transmissions. The data stream is transmitted on multiple antennas so the receiving system has a better chance of detecting at least one of the data streams. Enabling STBC results in a lower but more stable throughput.

Select one of the following options:

- **On**: AP transmits the same data stream on multiple antennas at the same time.
- **Off**: The AP does not transmit the same data on multiple antennas.

Protection

The protection feature provides rules to guarantee that 802.11n and 802.11g transmissions do not cause interference with legacy stations or applications. By default, these protection mechanisms are enabled (**Auto**). With protection enabled, protection mechanisms will be invoked if legacy devices are within range of the AP.

You can disable these protection mechanisms (**Off**). When protection is off, however, legacy clients or APs within range can be affected by 802.11n transmissions. Protection is also available when the mode is 802.11b/g. When protection is enabled in this mode, it protects 802.11b clients and APs from 802.11g transmissions.

Note

This setting does not affect the ability of the client to associate with the AP.

Beacon interval

Beacon frames are transmitted by an AP at regular intervals to announce the existence of the wireless network. The default behavior is to send a beacon frame once every 100 milliseconds (10 per second).

Enter a value from 20 to 2000 milliseconds.

DTIM period

Specify a DTIM period from 1 to 255 beacons.

The Delivery Traffic Information Map (DTIM) message is an element included in some beacon frames. It indicates which wireless clients, currently sleeping in low-power mode, have data buffered on the AP awaiting pickup.

The DTIM period you specify indicates how often the clients served by this AP should check for buffered data still on the AP awaiting pickup.

The measurement is in beacons. For example, if you set this field to 1, clients will check for buffered data on the AP at every beacon. If you set this field to 10, clients will check on every 10th beacon.

Fragmentation threshold

Specify a number from 256 to 2,346 to set the frame size threshold in bytes.

The fragmentation threshold is a way of limiting the size of frames transmitted over the network. If a frame exceeds the fragmentation threshold you set, the fragmentation function is activated and the frame is sent as multiple 802.11 frames.

If the frame being transmitted is equal to or less than the threshold, fragmentation is not used.

Setting the threshold to the largest value (2,346 bytes) effectively disables fragmentation.

Fragmentation involves more overhead because it requires the extra work of dividing up and reassembling frames and it increases message traffic on the network. However, fragmentation can help improve network performance and reliability if properly configured.

Sending smaller frames (by using lower fragmentation threshold) might help with some interference problems; for example, with microwave ovens.

By default, fragmentation is off. HP recommends not using fragmentation unless you suspect radio interference. The additional headers applied to each fragment increase the overhead on the network and can greatly reduce throughput.

RTS threshold

Specify a Request to Send (RTS) threshold value from 0 to 2347.

The RTS threshold indicates the number of octets in an MPDU below which an RTS/CTS handshake is not performed.

Changing the RTS threshold can help control traffic flow through the AP, especially one with many clients. If you specify a low threshold value, RTS packets will be sent more frequently. This will consume more bandwidth and reduce packet throughput on the AP. On the other hand, sending more RTS packets can help the network recover from interference or collisions that might occur on a busy network or on a network experiencing electromagnetic interference.

Transmit power

Enter a percentage value for the transmit power level for this AP.

The default value, which is 100%, can be more cost-efficient than a lower percentage, since it gives the AP a maximum broadcast range and reduces the number of APs needed to cover an area.

To increase the capacity of the network, place APs closer together and reduce the value of the transmit power. This helps reduce overlap and interference among APs. A lower transmit power setting can also keep your network more secure because weaker wireless signals are less likely to propagate outside of the physical location of your network.

Fixed multicast rate

This value sets a fixed transmission rate in Mbps for broadcast and multicast packets. This setting can be useful in an environment where wireless multicast video streaming occurs, provided the wireless clients are capable of handling the configured rate.

Select **Auto** to have the M220 choose the best rate automatically. The range of valid values is determined by the configured radio mode. The default value is **Auto**.

Bcast/Mcast rate limiting

Enabling multicast and broadcast rate limiting can improve overall network performance by limiting the number of packets transmitted across the network. Note, however, that the performance of client applications that rely on multicast or broadcast traffic may be affected.

By default, this option is disabled. When you enable it, the following fields are editable:

Rate limit

Enter the rate limit you want to set for multicast and broadcast traffic. The limit should be greater than 1 but less than 50 packets per second. Any traffic that falls below this rate limit will always conform and be transmitted to the appropriate destination.

The default and maximum rate limit setting is 50 packets per second.

Rate limit burst

The rate limit burst sets a threshold rate for traffic bursts, above which all traffic is considered to exceed the rate limit. This burst limit allows intermittent bursts of traffic that are above the set **Rate limit**, but below the **Rate limit burst**.

The default and maximum rate limit burst setting is 75 packets per second.

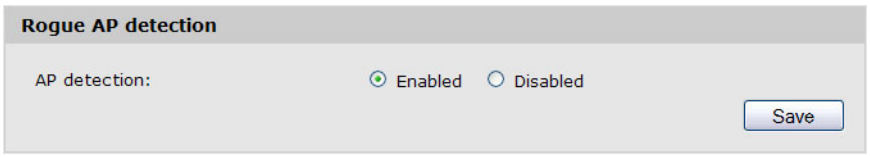
Detecting Rogue APs

You can use the Rogue AP detection feature to scan for other APs operating nearby. Initially, new APs on the network are identified as rogue APs. If you are aware of an AP detected as a rogue AP, and know that its existence on your network is legitimate, you can identify it as a *known AP* so that it will not continue to be detected as a rogue AP. This is useful for monitoring the installation of wireless APs in your company's work areas to ensure that new APs (which could be a security risk if improperly configured) are not deployed without your knowledge.

This feature can also be used to determine the operating frequencies and signal strengths of nearby APs for site planning purposes.

Enabling scanning

Scanning for rogue APs is enabled by default. To disable it, select **Wireless** > **Rogue AP detection**, select **Disabled** next to **AP detection**, and then select **Save**.



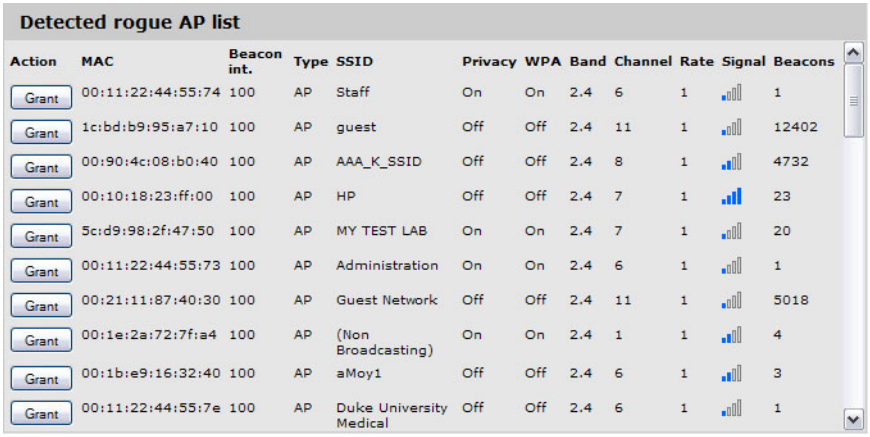
When enabled, the AP initiates a scan on a single channel. Every 60 seconds, the AP scans the next sequential channel. The scan duration is 10 ms per channel.

Note

- Scanning is temporarily disabled when a trace is active (see the *Tools* > *Network trace* page).
- Although the impact of scanning on AP performance is expected is minimal, to obtain the best possible wireless performance (as needed for voice applications, for example), disable scanning.

Detected and Known AP lists

When the M220 discovers an AP during a scan, it compares the MAC address of the AP against the **Known AP list** (a list that you create or import using the capabilities on this page). If the scanned AP does not appear in the list of known APs, it is displayed in the **Detected rogue AP list**.

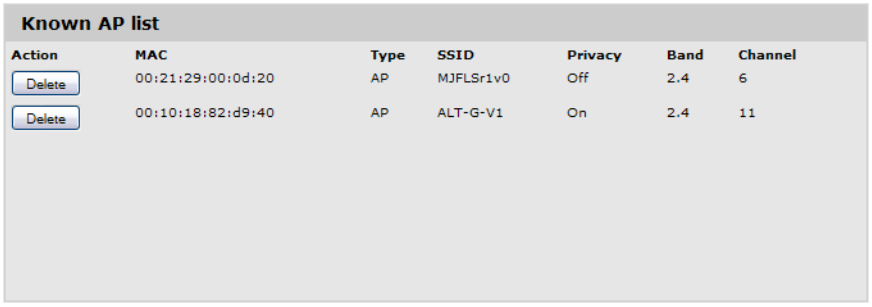


The following information displays for each detected rogue AP:

Field	Description
MAC	The MAC address of the neighboring AP detected during a scan.
Beacon Int.	The Beacon interval being used by this AP. Beacon frames are transmitted by an AP at regular intervals to announce the existence of the wireless network. The default behavior is to send a beacon frame once every 100 milliseconds (10 per second).
Type	The type of device: • **AP** indicates the neighboring device is an AP that supports the IEEE 802.11 Wireless Networking Framework in Infrastructure mode. • **Ad hoc** indicates a neighboring wireless client device running in Ad hoc mode. Devices set to Ad hoc mode communicate with each other directly, without the use of a traditional AP. Ad hoc mode is an IEEE 802.11 Wireless Networking Framework also referred to as *peer-to-peer* mode or an *Independent Basic Service Set* (IBSS).
SSID	The *Service Set Identifier* (SSID) for the AP. The SSID uniquely identifies a wireless LAN and is also referred to as the *Network Name*. It can be up to 32 alphanumeric characters.
Privacy	Whether there is any security on the neighboring device. • **Off** indicates that the Security mode on the neighboring device is set to None (no security). • **On** indicates that the neighboring device has some security in place.

Field	Description
WPA	Whether WPA security is on or off for this AP.
Band	The 802.11 band used on this AP, as follows: • **2.4** indicates 802.11b, 802.11g, or 802.11n mode (or a combination of the modes). • **5** indicates 802.11a or 802.11n mode (or both modes).
Channel	The channel on which the AP is currently broadcasting. The channel defines the portion of the radio spectrum that the radio uses for transmitting and receiving. The channel is set in the Radio settings. (See "Radio configuration" on page 52.)
Rate	The rate (in megabits per second) at which this AP is currently transmitting.
Signal	The detected strength of the radio signal from this AP. If you hover the mouse pointer over the bars, a number appears and shows the strength in decibels (dB).
Beacons	The total number of beacons received from this AP since it was first discovered.

For any AP that is known to you, you can select **Grant** to move the AP to the **Known AP list**.



You can select **Delete** to remove an the AP from the **Known AP list**.

Note

The **Detected rogue AP list** and **Known AP list** provide information only. The M220 does not have control over the APs on these lists and cannot apply any security policies to them.

Working with saved AP lists

You can save the **Known AP list** and import a saved list to the M220. A saved list can show APs that you previously identified as known APs but that may not be showing in the current **Detected rogue AP list** (because they are not currently operational, for example).

To create a list, under **Save AP list**, select **Save** and then save the file to your PC or network.

By default, the filename is *Rogue2.cfg*. You can use a text editor or web browser to open the file and view its contents.

In the **Import AP list** section, you can import a list that was previously saved from this AP or from another M220.

Select one of the following options:

- **Replace**: The imported list will replace the **Known APs list**.
- **Merge**: APs from the imported list are added to the existing **Known APs list**.

Browse to select the file to import, and select **Import**. The new list displays in the **Known AP list**.

Viewing wireless information

The M220 provides several pages where you can view information related to wireless operation.

Viewing all connected wireless clients

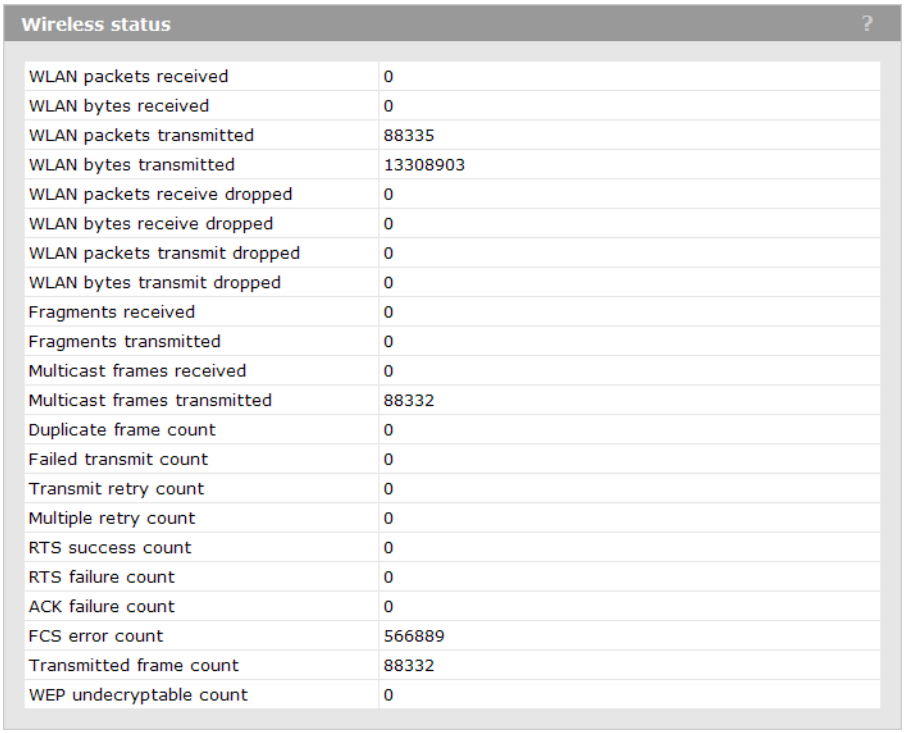
Select **Wireless** > **Client connections**.

The following information is displayed for each client currently connected to the M220:

Field	Description
Network	The wireless community the client is associated with. For example, an entry of wlan0vap2 means the client is associated with wireless community 2.
Station	The MAC address of the associated wireless client.
Status (Auth and Assoc)	The underlying IEEE 802.11 authentication and association status, which is present no matter which type of security the client uses to connect to the AP. This status does not show IEEE 802.1X authentication or association status. Keep the following points in mind with regard to this field: • If the **Security method** is **None** or **Static WEP**, the authentication and association status of clients showing on the *Client associations* page will be in line with what is expected; that is, if a client shows as authenticated to the AP, it will be able to transmit and receive data. (This is because Static WEP uses only IEEE 802.11 authentication.) • If the **Security method** is **IEEE 802.1X**, **WPA Personal**, or **WPA Enterprise**, it is possible for a client to show on this tab as authenticated (via the IEEE 802.11 security) but actually not be authenticated to the AP via the second layer of security.
From station	The number of packets and bytes received from the wireless client and the number of packets and bytes that were dropped after being received.
To station	The number of packets and bytes transmitted from the AP to the wireless client and the number of packets and bytes that were dropped upon transmission.

Viewing wireless statistics for the radio

Select **Status** > **Wireless** to display the *Wireless status* page.



This page displays the following information:

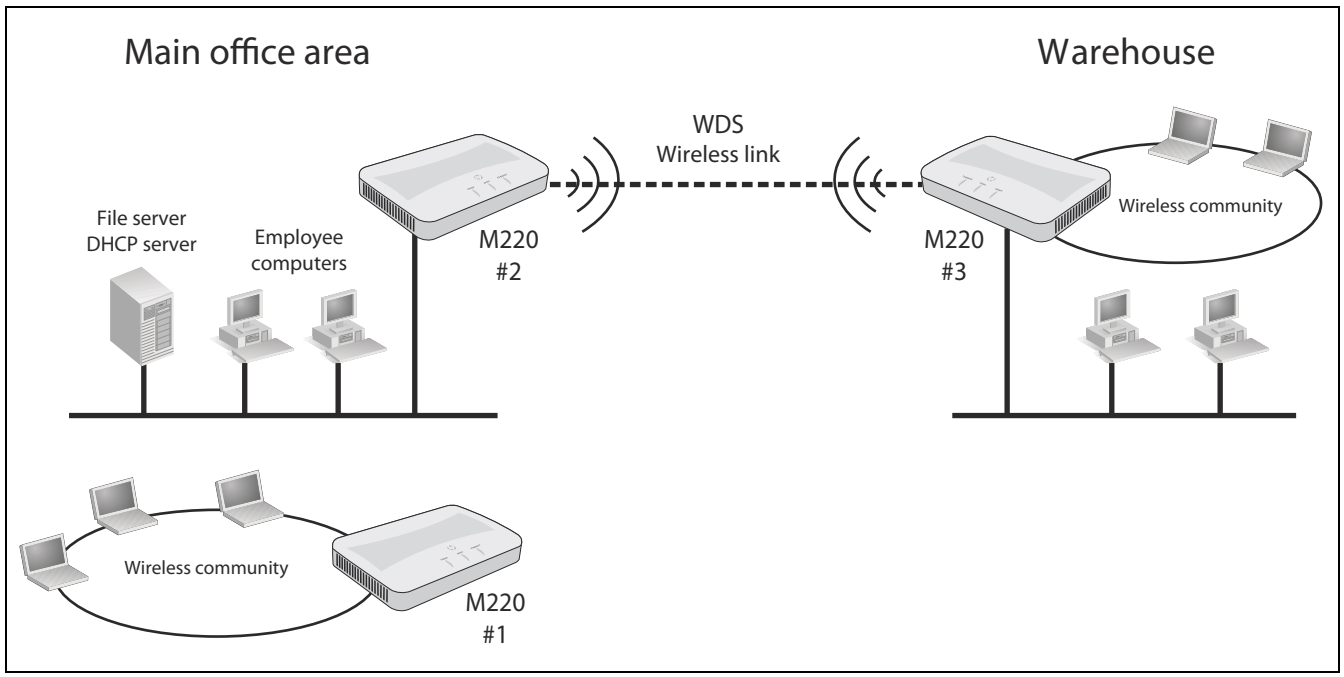
Field	Description
WLAN packets received	Total packets received by the AP.
WLAN bytes received	Total bytes received by the AP.
WLAN packets transmitted	Total packets transmitted by the AP.
WLAN bytes transmitted	Total bytes transmitted by the AP.
WLAN packets receive dropped	Number of packets received by the AP that were dropped.
WLAN bytes receive dropped	Number of bytes received by the AP that were dropped.
WLAN packets transmit dropped	Number of packets transmitted by the AP that were dropped.
WLAN bytes transmit dropped	Number of bytes transmitted by the AP that were dropped.
Fragments received	Count of successfully received MPDU frames of type data or management.

Field	Description
Fragments transmitted	Number of transmitted MPDU with an individual address or an MPDU with a multicast address of type data or management.
Multicast frames received	Count of MSDU frames received with the multicast bit set in the destination MAC address.
Multicast frames transmitted	Count of successfully transmitted MSDU frames where the multicast bit is set in the destination MAC address.
Duplicate frame count	Number of times a frame is received and the Sequence Control field indicates it is a duplicate.
Failed transmit count	Number of times an MSDU is not transmitted successfully due to transmit attempts exceeding either the short retry limit or the long retry limit.
Transmit retry count	Number of times an MSDU is successfully transmitted after one or more retries.
Multiple retry count	Number of times an MSDU is successfully transmitted after more than one retry.
RTS success count	Count of CTS frames received in response to an RTS frame.
RTS failure count	Count of CTS frames not received in response to an RTS frame.
ACK failure count	Count of ACK frames not received when expected.
FCS error count	Count of FCS errors detected in a received MPDU frame.
Transmitted frame count	Count of each successfully transmitted MSDU.
WEP undecryptable count	Count of encrypted frames received and the key configuration of the transmitter indicates that the frame should not have been encrypted or that frame was discarded due to the receiving station not implementing the privacy option.

6 Creating WDS links

Key concepts

The Wireless Distribution System (WDS) feature enables you to create point-to-point wireless links between one or more M220s. These links create a wireless bridge that interconnects the networks connected to the Ethernet port on each M220. For example, in the following figure, M220 #2 and M220 #3 use the WDS to create a wireless link between the main office network and a small network in a warehouse:



WDS links provide an effective solution for extending network coverage in situations where it is impractical or expensive to run cabling. Each M220 can create up to four WDS links.

Note

A network that includes WDS links should be distinguished from a group of clustered APs. WDS enables wirelessly extending the network, whereas clustering is used to simplify AP administration and optimize bandwidth use. See *Clustering multiple M220s on page 79* for more information.

Simultaneous AP and WDS support

The M220 simultaneously supports wireless communities and one or more WDS links. Although this offers flexibility, note that the total available bandwidth on the radio is shared between all WDS links and wireless users. This can result in reduced throughput if high volumes of traffic are being sent by both wireless users and the WDS links.

Using the 5 GHz band for WDS links

When the M220 uses WDS only to extend the network by providing a dedicated link to another M220 (that is, it does not simultaneously act as an AP for wireless clients), it is recommended that, whenever possible, the WDS links use 802.11n or 802.11a in the 5 GHz band. This optimizes throughput and reduces the potential for interference, as follows:

- Most Wi-Fi clients support 802.11b or b/g; therefore, most APs are set to operate in the 2.4 GHz band. This frees the 5 GHz band for other applications such as WDS.
- 802.11a and 802.11n channels in the 5 GHz band are non-overlapping.
- Assuming an optimal implementation, 802.11a supports up to 54 Mbps and 802.11n supports up to 300 Mbps, providing a *fat pipe* for traffic exchange.

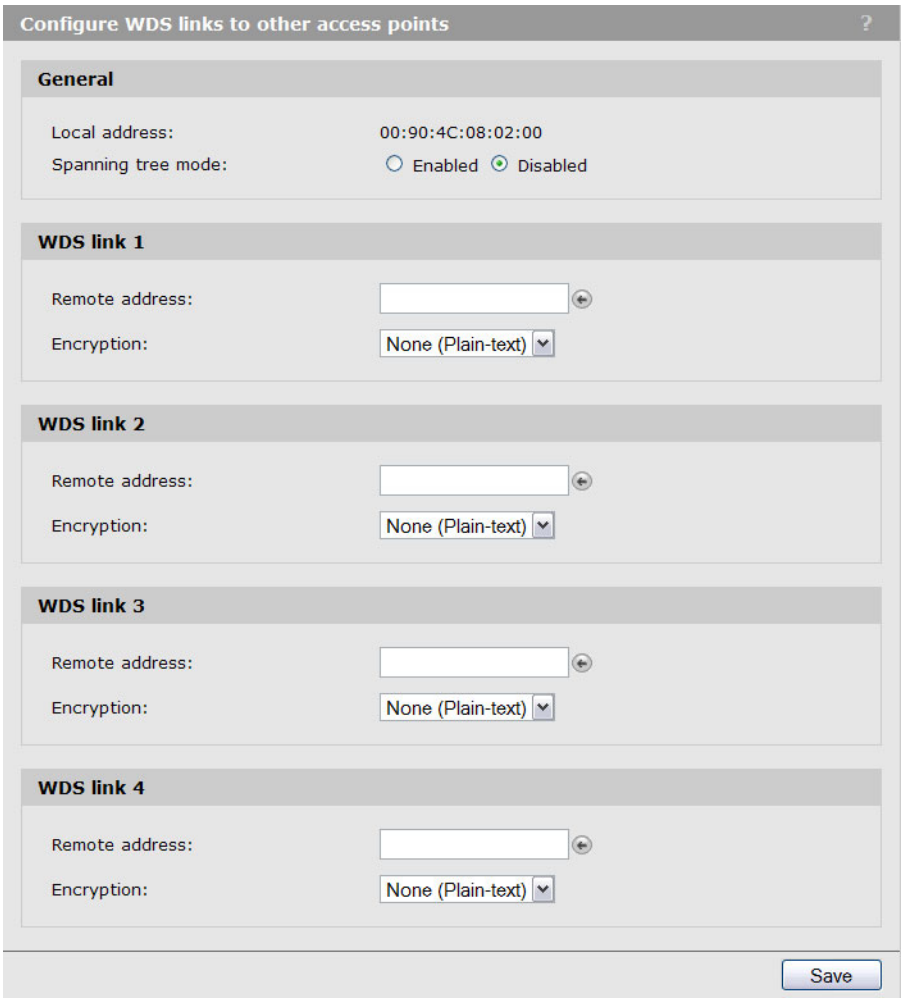
Configuration considerations

The following guidelines apply when you create a WDS link between two or more M220s:

- The 5 GHz band has a shorter reach when compared to the 2.4 GHz band. This could be a factor depending on the distance your WDS link span.
- All radios must be set to the same operating frequency and channel. This means that on the *Wireless* > *Radio* page under **Channel**, you cannot select **Auto**.
- The Ethernet ports for all M220s must be connected to the same subnet, and each M220 must have a unique IP address.
- If WPA (PSK) security is enabled, the same link name and key must be defined on all M220s that are linked by the WDS connection.
- IEEE 802.11n uses frame aggregation, whereby multiple frames are combined into one to reduce overhead and increase throughput. WEP-encrypted frames are not aggregated, however, so enabling WEP security over WDS will result in reduced throughput.
- Although the M220 can support up to four WDS links, only one wireless link can be defined between any two M220s.

WDS configuration

To view or add a WDS link, select **Wireless** > **WDS.**



General

Local address

Shows the MAC address of the wireless port on the M220. This address needs to be entered on the M220 to which this link will connect.

Spanning tree mode

The Spanning-Tree Protocol (STP) can be enabled to prevent undesirable loops from occurring in the network that may result in decreased throughput. Enabling spanning tree is recommended.

WDS link 1/2/3/4

You can link the M220 with up to four other M220 devices. Specify the following settings for each WDS interface:

Remote address

Specify the MAC address of the wireless port on the remote M220 to which this link will connect. Or, click the left arrow next to the text box to select from a list of MAC addresses detected during an AP scan. The MAC address must be in the following format: six pairs of hexadecimal numbers, (including numbers 0 to 9 and letters a to f or A to F), with each pair separated by a colon. For example: 00:03:52:0a:0f:01.

Encryption

Select how traffic exchanged between the two M220s will be encrypted.

The options are as follows:

- **None**: Data is transmitted unencrypted between M220 devices.
- **WEP**: Note that IEEE802.11n uses frame aggregation, whereby multiple frames are combined into one to reduce overhead and increase throughput. WEP-encrypted frames are not aggregated, however, so enabling WEP security over WDS will result in reduced throughput.

  To enable WEP, configure the following settings:

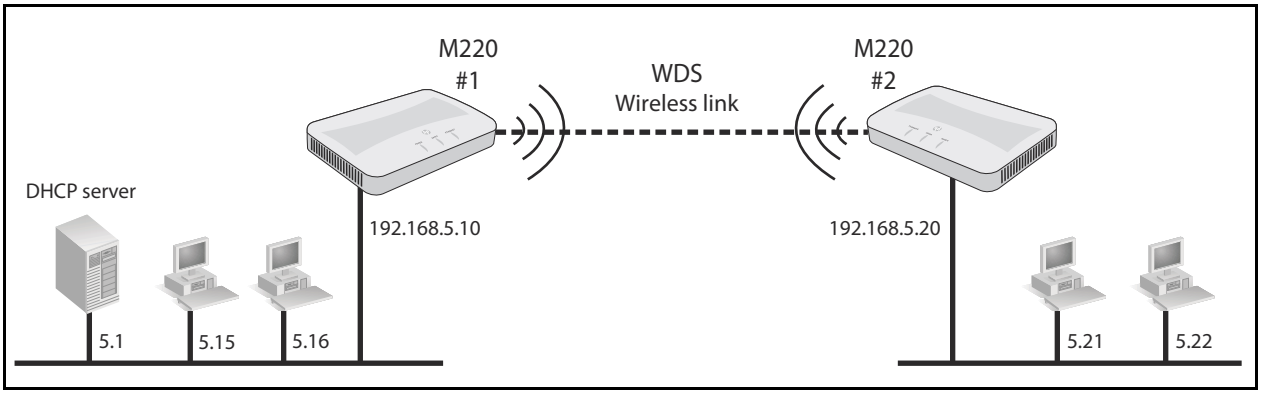
  - **Key length**: Select **64 bits** or **128 bits**.
  - **Key type**: Select **ASCII** or **Hex**.
  - **WEP key**: If you selected **ASCII**, enter any combination of 0 to 9, a to z, and A to Z, and special characters such as @ and #. If you selected **Hex**, enter hexadecimal digits (any combination of 0 to 9 and a to f or A to F). These are the RC4 encryption keys shared with the stations using the AP.
  - **Confirm key**: Re-enter the key.
- **WPA (PSK)**: Configure the following settings:
  - **Link name**: Enter a name for the new WDS link you have created. It is important that the same link name is entered at the other end of the WDS link. If this name is not the same for both APs on the WDS link, they will not be able to communicate and exchange data.

    The name can be any alphanumeric combination.
  - **Key**: Enter a unique shared key for the WDS link. This unique shared key must also be entered for the AP at the other end of the WDS link. If this key is not the same for both APs, they will not be able to communicate and exchange data.

    The WPA-PSK key uses AES encryption. It can be from 8 to 63 characters. Acceptable characters include upper and lower case alphabetic letters, the numeric digits, and special symbols such as @ and #. The key cannot begin with or end with spaces and cannot contain only spaces.
  - **Confirm key**: Re-enter the key.

Sample WDS deployment

This example shows you how to create a wireless link between two physically separate network segments.



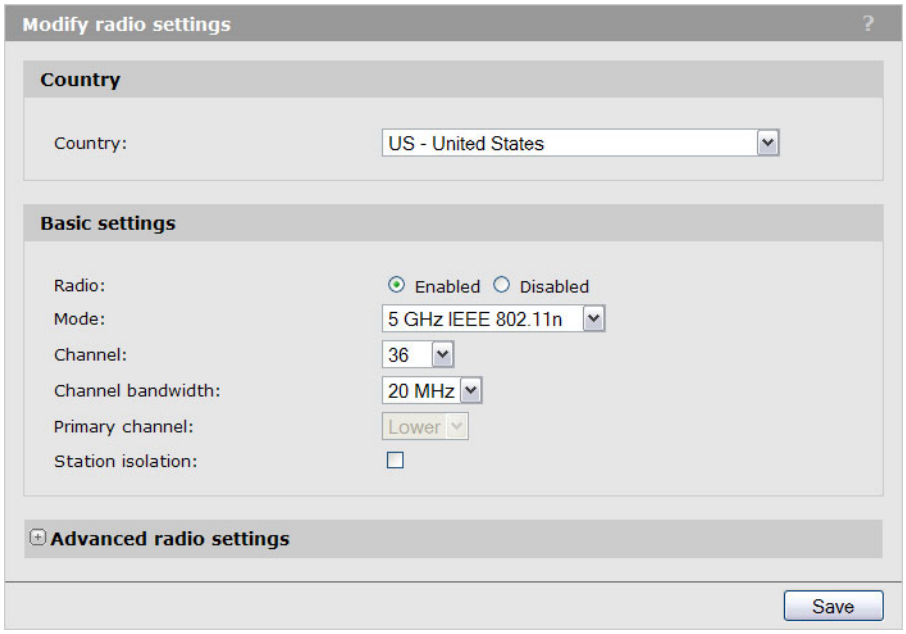
This example assumes that both M220s have their IP addresses set and are connected to their respective networks as shown in the diagram.

A. Obtain the MAC address of M220 #2

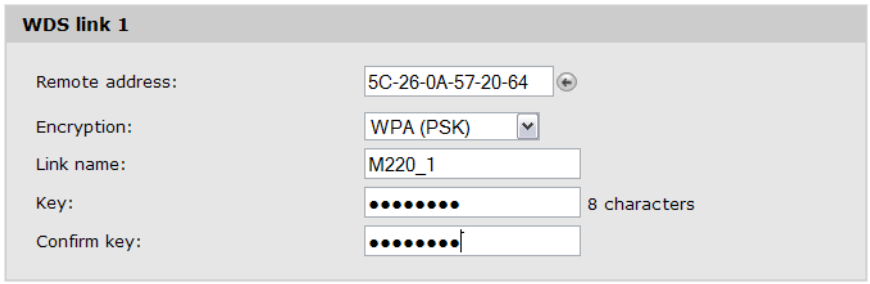
1. Click the left arrow next the **Remote address** text box and select the MAC address of the remote M220. Or, if you cannot identify it in the list, connect to the management tool on M220 #2, open the home page, and write down its MAC address.

B. Set up the WDS link on M220 #1

2. Open the management tool on M220 #1.
3. Select **Wireless** > **Radio** to display the *Modify radio settings* page.
4. In the **Basic settings** area, configure the following:
   - Set **Mode** to **5 GHz IEEE 802.11n**.
   - Set **Channel** to **36**.
5. Select **Save**.



6. Select **Wireless** > **WDS**.
7. Under **WDS link 1**, configure the following settings:
   - If not already selected, set **Remote address** to the MAC address of M220 #2.
   - Set **Encryption** to **WPA (PSK)**.
   - Set the **Link name** to **M220_WDS1**.
   - Set **Key** to **a39xm210**.



8. Select **Save**.

C. Setup the WDS link on M220 #2

Configuration settings on M220 #2 are similar to those defined on M220 #1.

9. Open the management tool on M220 #2.
10. Select **Wireless** > **Radio**.
11. In the **Basic settings** area, configure the following:
    - Set **Mode** to **5 GHz IEEE 802.11n**.
    - Set **Channel** to **36**.
12. Select **Save**.

13. Select **Wireless** > **WDS.**
14. Under **WDS Link 1**, configure the following settings:
    - Set **Remote address** to the MAC address of M220 #2.
    - Set **Encryption** to **WPA (PSK)**.
    - Set **Link name** to the same value you entered for the first M220 (**M220_WDS1)**.
    - Set **Key** to **a39xm210**.
15. Select **Save**.

D.Test the link and make performance adjustments

The WDS link should now be active.

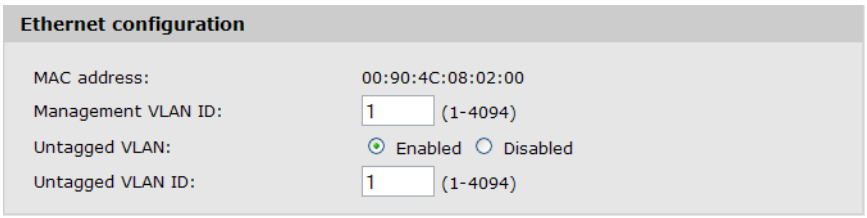
1. Select **Tools** > **Ping** on M220 #1 and ping the address of M220 #2 (192.168.5.20). If the ping succeeds, it means that the WDS link is working.
2. To view the operational status and traffic statistics for the WDS interface on either M220, select **Status** > **Ports**.

7 Configuring Ethernet, IP, and VLAN settings

Ethernet configuration

The M220 connects wireless clients to a wired network through its Ethernet port. You can configure the IP settings for this interface and the VLAN membership required for management access to the M220.

To configure the Ethernet port settings, select **Network** > **IP**.



The **Ethernet configuration** area shows the **MAC address** assigned to the M220 Ethernet port and to the default wireless community (wlan0). The MAC address is also printed on the AP.

This page enables configuring the following settings:

Management VLAN ID

The management VLAN is VLAN 1 by default. If you already have a management VLAN configured on your network with a different VLAN ID, you must change the VLAN ID of the management VLAN on the M220 accordingly. The VLAN ID can be any value from 1 to 4094. Any management traffic received on a different VLAN is ignored.

Untagged VLAN
Untagged VLAN ID

All traffic from wireless clients to the AP is associated with a VLAN ID. The VLAN ID may be assigned by a RADIUS server or determined by the client's association with a wireless community. Traffic between the wired network and the AP, however, might not be associated with a VLAN (that is, the traffic is *untagged*). These settings determine how the AP forwards untagged traffic to the wireless network.

If the **Untagged VLAN** option is enabled and an **Untagged VLAN ID** is specified:

- When the M220 receives traffic from a wireless client and that traffic has a VLAN ID that matches the **Untagged VLAN ID**, it forwards the traffic to the wired network with no VLAN tag.
- If the VLAN ID does not match the **Untagged VLAN ID**, the M220 forwards the traffic to the wired network with the VLAN ID from the wireless client.

If the **Untagged VLAN** option is disabled, all traffic that the M220 receives from a wireless client is forwarded to the wired network with the same VLAN tag it used on the wireless network.

The M220 does not add VLAN tags when forwarding traffic to wireless clients, regardless of whether the traffic was tagged or untagged on the wired network.

By default, this option is enabled and the untagged VLAN ID is 1.

Note

If VLANs are not used on your network, these settings have no effect on the forwarding of traffic.

IPv4 configuration

Use this area to configure the M220 to be assigned an IPv4 address from a DHCP server on your network, or to statically configure an IPv4 address.

Automatically assigning an IP address (default method)

By default, **Connection type** is set to **DHCP** and the M220 operates as a DHCP client. This means that if the network has a DHCP server, the M220 will automatically receive a new IP address in place of its default IP address (192.168.1.1) upon connecting to the network.

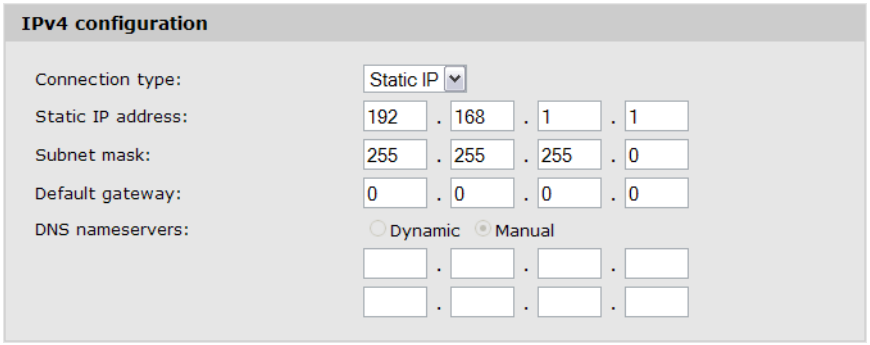
The DHCP server will assign an address from its pool of available addresses. You can find the IP address of the M220 by looking for its Ethernet base MAC address in the DHCP server log. The Ethernet MAC address is printed on the M220 label identified as **Ethernet Base MAC**, or listed on the management tool *IP* page as **MAC address**.

To have the DHCP server assign a specific IP address to the M220, you need to preconfigure the DHCP server to associate the IP address you want to use with the MAC address of the Ethernet port on the M220.

Static IP configuration

You can manually assign an IP address to the Ethernet port. This requires that you also define the address of the default gateway and DNS server that are in use on your network.

To configure a static IP address, select **Network** > **IP** and configure the following fields:



Connection type

Select **Static IP** from the list to manually configure an IPv4 Ethernet address.

IP address

Set an address that is on the same subnet as the network to which the M220 will connect once installed. Respect any DHCP server-mandated static address ranges.

Subnet mask
Specify the mask for the IP address.

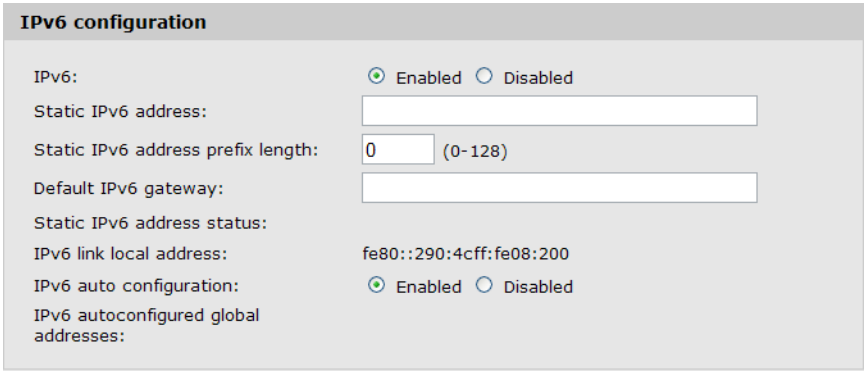
Default gateway
Set the IP address of the gateway on the network.

DNS nameservers:
Select **Dynamic** to have the DNS nameservers assigned through DHCP, or select **Manual** to configure up to two static DNS nameserver addresses.

IPv6 configuration

If the attached network uses the IPv6 protocol, you can enable IPv6 support on the M220. IPv6 functionality is enabled by default.

To configure IPv6 functionality, select **Network** > **IP** and configure the following fields:



IPv6
Enable or disable the ability to use IPv6 addressing to access the web user interface for AP configuration. This setting does not enable or disable IPv6 functionality on the network itself.

Static IPv6 address
The AP can have a static IPv6 address even if addresses have already been configured automatically. Enter an address in the form XXXX:XXXX:XXXX:XXXX.

Static IPv6 address prefix length
The prefix length must be an integer in the range from 0 to 128. The prefix length determines the part of the IPv6 address that identifies the network that the M220 is attached to.

Default IPv6 gateway
The default gateway address for IPv6 traffic destined outside the network.

Static IPv6 address status
The operational status of the static IPv6 address assigned to the M220 management interface. The possible values are as follows:

- **Operational**: The IP address has been verified as unique on the LAN and is usable on the interface.
- **Tentative**: The M220 initiates a duplicate address detection (DAD) process automatically when a static IP address is assigned. An IPv6 address is in the tentative state while it is being verified as unique on the network. While in this state, the IPv6 address cannot be

used to transmit or receive traffic, except to exchange messages with other network nodes to verify the uniqueness of the address.

- **Blank (no value)**: No IP address is assigned or the assigned address is not operational.

IPv6 link local address

The IPv6 link local address is the IPv6 address used by the local physical link. The link local address is not configurable and is assigned by using the IPv6 Neighbor Discovery process.

IPv6 auto configuration

When IPv6 auto configuration is enabled, the M220 processes the Router Advertisements received on the LAN port to determine its IPv6 addresses. The M220 can have multiple autoconfigured IPv6 addresses. The autoconfigured addresses coexist with the statically configured address. The AP can be accessed using either the statically configured or the automatically obtained IPv6 address.

IPv6 autoconfigured global addresses

If the AP has been assigned one or more IPv6 addresses automatically, the addresses are listed.

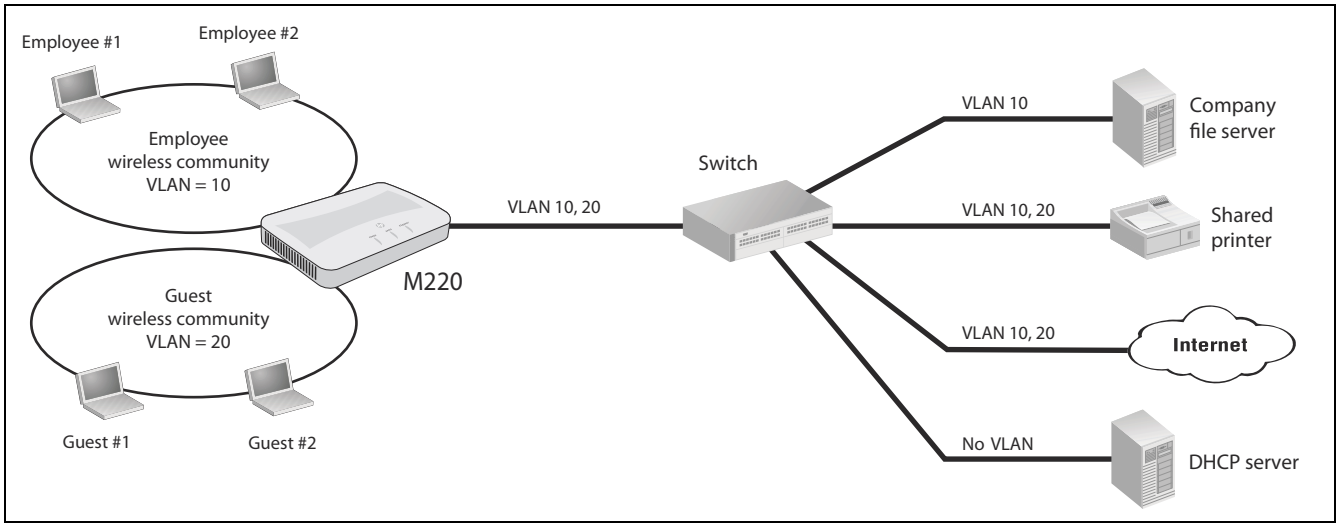
VLAN configuration

When the AP receives traffic from a wireless client, the AP may forward it on the Ethernet network to which the AP connects. Client traffic may be associated with a VLAN as it is forwarded to the Ethernet network.

VLAN assignment via wireless communities

The easiest way to assign user traffic to a VLAN is to configure the **VLAN ID** setting in a wireless community (See *Wireless community configuration options on page 34*). This puts all the traffic from users that connect to the wireless community onto the specified VLAN via the M220 Ethernet port.

In the following scenario, two wireless communities are defined, each with its own VLAN:



- The Employee wireless community is configured with VLAN 10. All employee traffic exits the M220 on VLAN 10, providing access to the company file server, shared printer, and the Internet.
- The Guest wireless community is configured with VLAN 20. All traffic from the Guest community exits the M220 on VLAN20, providing access to the shared printer and the Internet.

VLAN assignment via RADIUS

VLANs can also be assigned on a per-user basis by setting VLAN attributes in a user's RADIUS account. To use this option, you need to do the following:

- Configure a wireless community with **Security method** set to **WPA Enterprise** or **IEEE802.1X**. For configuration details, see *Wireless protection on page 35*.
- Configure a RADIUS server information for the selected security type.
- On the RADIUS server, configure user accounts with the appropriate VLAN attributes.

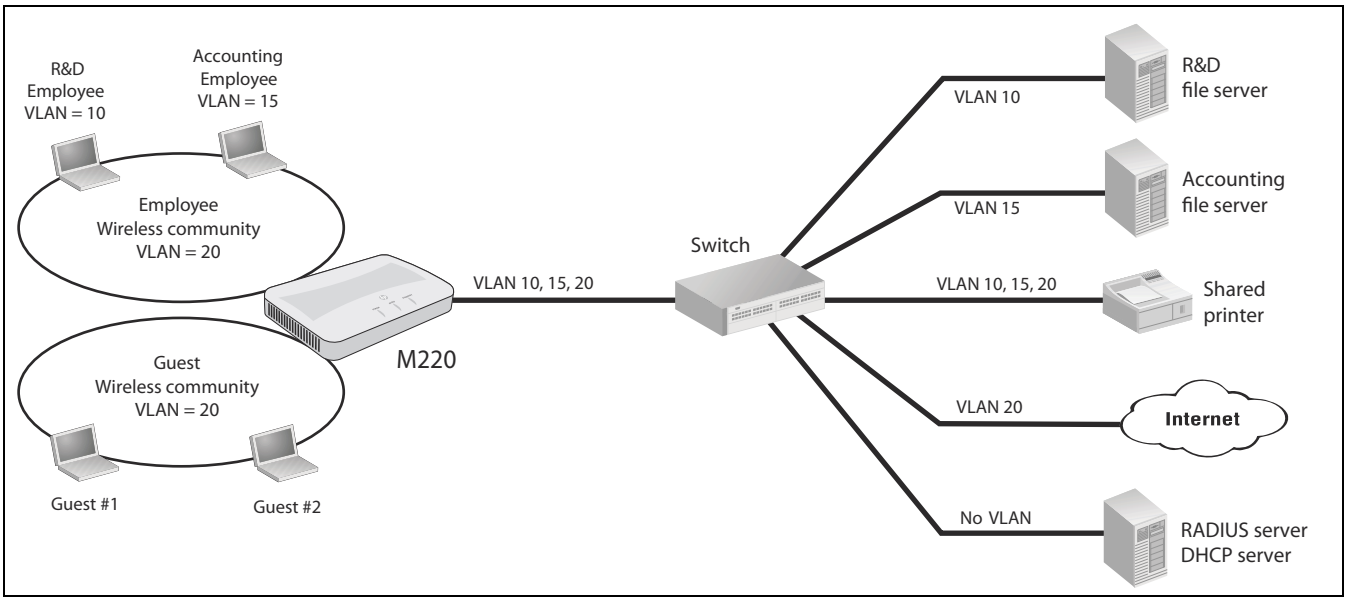
Note

When a VLAN is defined in a user's RADIUS account, it always overrides the VLAN defined for a wireless community. This enables you to define an VLAN setting for a community and then override it on a per-user basis as required.

RADIUS-assigned VLANs are created and deleted dynamically as clients associate and disassociate with the M220. When the first client assigned by RADIUS to a particular VLAN authenticates with the M220, the M220 creates the VLAN. When the last client using that VLAN disassociates, the VLAN is deleted from the M220. The maximum number of dynamic VLANs is equal to the maximum number of configurable clients on the AP.

Example

In the following scenario, RADIUS user accounts are configured to assign employees to different VLANs depending on the workgroup to which an employee belongs:



Employee wireless community

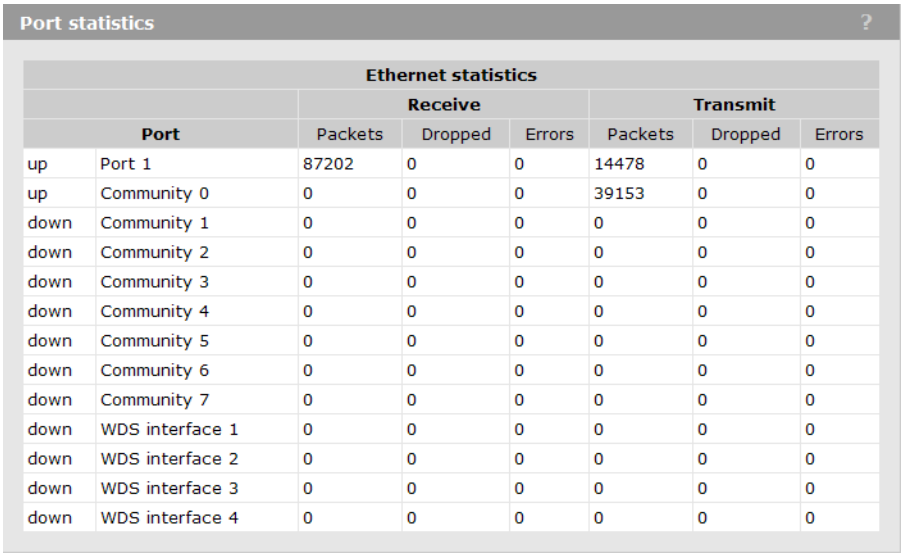
- R&D employees are assigned to VLAN 10 via attributes in their RADIUS account.
- Accounting employees are assigned to VLAN 15 via attributes in their RADIUS account.
- Employees without a VLAN assignment in their RADIUS account get assigned to the VLAN that is configured for the wireless community, which in this example is 20. This enables these employees to access the shared printer and the Internet.

Guest wireless community

- The Guest community does not use RADIUS. All traffic on the Guest community is assigned to VLAN 20, providing access to the shared printer and the Internet.

Port statistics

To view statistics on Ethernet packets received and transmitted on the wired and wireless ports, select **Status** > **Ports** The *Port statistics* page displays.



Ethernet statistics							
		Receive			Transmit		
Port		Packets	Dropped	Errors	Packets	Dropped	Errors
up	Port 1	87202	0	0	14478	0	0
up	Community 0	0	0	0	39153	0	0
down	Community 1	0	0	0	0	0	0
down	Community 2	0	0	0	0	0	0
down	Community 3	0	0	0	0	0	0
down	Community 4	0	0	0	0	0	0
down	Community 5	0	0	0	0	0	0
down	Community 6	0	0	0	0	0	0
down	Community 7	0	0	0	0	0	0
down	WDS interface 1	0	0	0	0	0	0
down	WDS interface 2	0	0	0	0	0	0
down	WDS interface 3	0	0	0	0	0	0
down	WDS interface 4	0	0	0	0	0	0

The statistics accumulate until the AP is rebooted.

Port

The LAN port is listed as Port 1. The Wireless port entry includes all wireless communities and WDS interfaces, even when not configured.

Packets

The total number of packets received or transmitted on the interface.

Dropped

The number of packets dropped upon receipt or transmission.

Errors

The number of packets received or transmitted that had errors.

8 Clustering multiple M220s

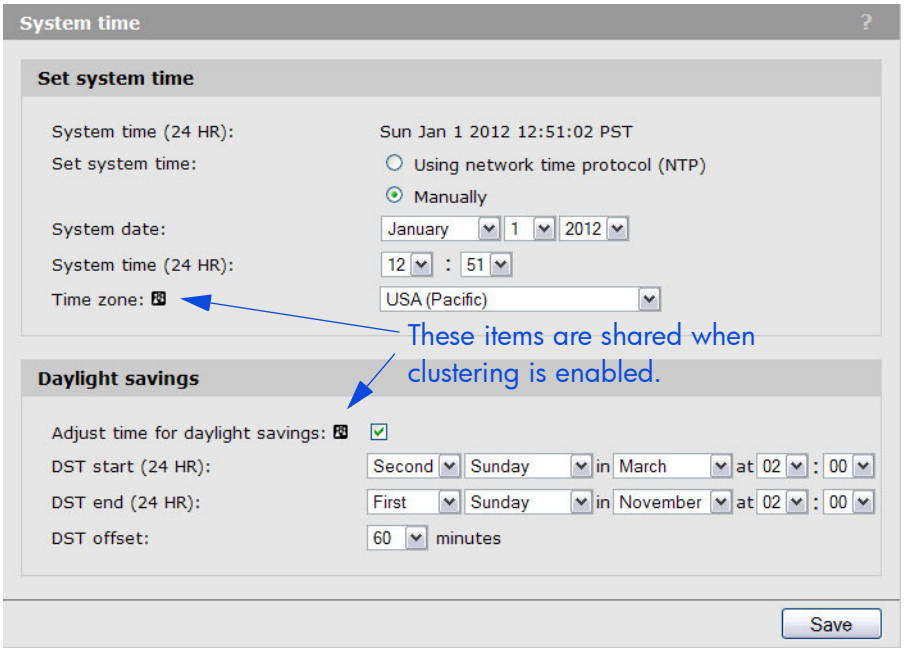
Overview

The M220 supports AP clustering. A cluster provides a single point of administration and lets you view, deploy, configure, and secure the wireless network as a single entity rather than a series of separate wireless devices. When APs are clustered, you can also configure channel planning, which helps to reduce radio interference and maximize bandwidth on the wireless network.

The AP cluster is a dynamic, configuration-aware group of APs in the same wired subnet of a network. Multiple clusters can exist within a subnet. Each cluster can have up to 10 members.

Shared settings in a cluster

When clustering is enabled, some configuration items are shared by the entire cluster, and other items remain unique to each M220. In the management tool, an icon displays next to items that are shared. When clustering is disabled, the icon does not display.



Settings that are shared/not shared by the cluster

Settings that are shared	Settings that are not shared
Event logging settings	WDS links
Neighboring AP detection mode	Ethernet (wired) settings
Wireless settings (Exception: Static channel configuration is not shared.)	Radio settings
Network Time Protocol (NTP), time, and daylight savings time settings	Channel
Radio settings, as follows: • Enabling radio • Radio mode • Channel bandwidth • Primary channel • Station Isolation • Multi-domain regulatory mode • Short guard interval supported • STBC mode • Protection • Fragmentation threshold • RTS threshold • Fixed multicast rate • Broadcast/multicast rate limiting	Beacon interval DTIM period Transmit power Country setting Network trace Management settings Settings collected in the showtech.rtf and showdev.out files. Developer info collection
Wireless community settings	
MAC authentication	
Basic SNMP settings	
Channel planning	
Admin password to secure any new cluster members	
Email alert settings	

IPv4 and IPv6 clusters

The M220 supports IPv4 and IPv6 mode clusters.

Cluster formation

Cluster criteria

A cluster can be formed between two or more M220 APs if the following conditions are met:

- The APs have the same part number. For example, part number J9798A cannot be clustered with part number J9799A. You can view the part number on the *System summary* page.
- The APs are configured with the same **Country** setting.
- The APs are connected on the same wired subnet. Clustering is not supported over a wireless connection such as a WDS link.
- The APs joining the cluster have the same **Cluster name** setting.
- The APs are configured with the same **Cluster IP version** setting (IPv4 or IPv6).
- Clustering is enabled on each AP.

Cluster negotiation

When an M220 is configured with a cluster name and clustering is enabled, it begins sending periodic advertisements every 10 seconds to announce its presence. If there are other M220s that match the criteria for the cluster, arbitration begins to determine which AP provides its configuration to the others. The first AP to advertise itself as a member of the cluster wins the arbitration.

The following rules apply to cluster formation:

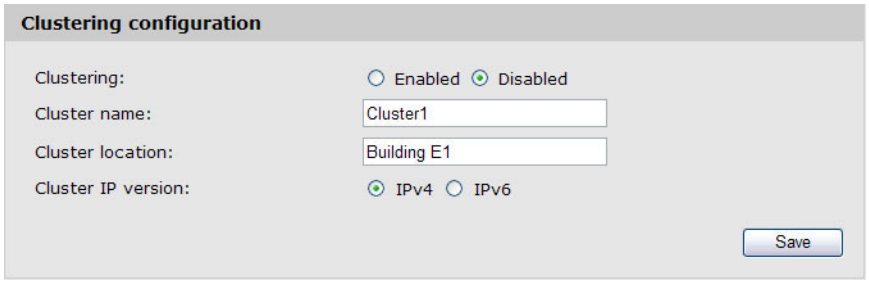
- For existing clusters, whenever the administrator updates the configuration of any member of the cluster, the configuration change is shared with all members of the cluster, and the configured AP assumes control of the cluster.
- When two separate clusters join into one, then the cluster that was created first wins arbitration for cluster control. The configuration on the newly formed cluster is overwritten by the configuration on the new cluster controller.
- If a cluster does not receive cluster advertisements from an AP for more than 60 seconds (when, for example, the AP loses connectivity to other APs in the cluster), the AP is removed from the cluster.
- If a clustered AP loses connectivity, it is not immediately dropped from the cluster. If it regains connectivity and rejoins the cluster without having been dropped, and configuration changes were made to that AP during the lost connectivity period, the changes will be propagated to the other cluster members when connectivity resumes.
- If a clustered AP loses connectivity, is dropped from the cluster, and later rejoins the cluster, and configuration changes were made in the cluster during the lost connectivity period, the changes will be propagated to the AP when it rejoins. If there are configuration changes in both the disconnected AP and the cluster, then the AP with the greatest number of changes and, secondarily, the most recent change, will be selected to propagate its configuration to the cluster. (That is, if AP1 has more changes, but AP2 has the most recent change, AP1 is

selected. If they have an equal number of changes, but AP2 has the most recent change, then AP2 is selected.)

Creating a cluster

To create a cluster:

1. On the first M220 that you want to be clustered, select **Cluster** > **Configuration**.



2. For the **Clustering** mode, select **Enabled**.
3. Enter a **Cluster name** (required). The cluster name must be the same on all APs. It can consist of up to 64 alphanumeric and special characters.
4. Enter a **Cluster location**, which describes where the AP is physically located. This setting is used for information purposes only.
5. Select a **Cluster IP version**.

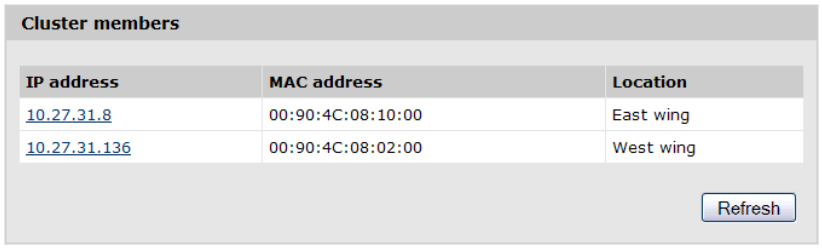
   All members of a cluster must have the same IP version (**IPv4** or **IPv6**).

   If you choose **IPv6**, clustering can use the link local address, autoconfigured IPv6 global address, and statically configured IPv6 global address. Ensure that when using IPv6 for clustering all the APs in the cluster either use link-local addresses only or use global addresses. Clustering will not work with mixed address versions.
6. Select **Save**.

   The M220 begins searching for other APs in the subnet that are configured with the same cluster name and IP version. A potential cluster member sends advertisements every 10 seconds to announce its presence.

   A **Cluster members** area displays to indicate whether a cluster is formed. If no matching APs are found, the message "Waiting to Join ..." displays. If the cluster already exists, information on each cluster member displays in a table.
7. Repeat steps 1 to 6 on each of up to 9 additional APs that you want to join the cluster.

   As subsequent APs are configured with the same clustering information, the **Cluster members** area displays a table with IP and other information for each cluster member.



Removing an AP from the cluster

To remove an AP from the cluster:

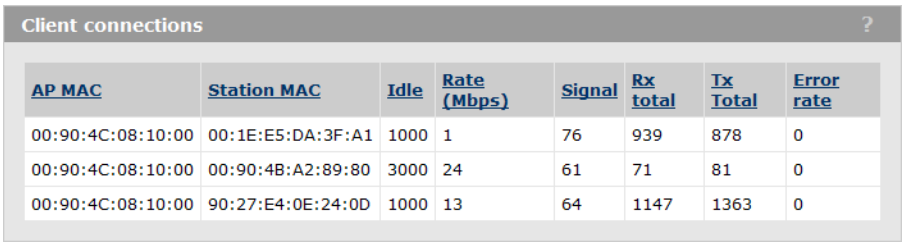
1. On the M220 that you want to remove from the cluster, select **Cluster** > **Access points**.
2. For the Clustering setting, select **Disabled**, then select **Save**.

Client connections

From any AP in a cluster, you can select **Cluster** > **Client connections** to view information about clients connected to any clustered AP.

Note

This page displays data only if clustering is enabled on the *Cluster* > *Configuration* page.



Information shown in tables can be sorted by selecting the desired column label.

Note

This page shows a maximum of 20 clients on each clustered AP. To see all clients associated with a particular AP, view the *Wireless* > *Client connections* page directly on that AP.

AP MAC

Media Access Control (MAC) address of the AP.

The address shown here is the MAC address for the Ethernet interface and the default wireless community (wlan0). This is the address by which the AP is known externally to other networks.

Station MAC

The Media Access Control (MAC) address of the client.

Idle

The time in seconds that has elapsed since the last client activity.

Rate (Mbps)

The speed in Mbps at which this AP is transferring data to the specified client. This value should fall within the range of the advertised rate set for the mode in use on the AP. For example, 6 to 54 Mbps for 802.11a.

Signal

The strength of the radio frequency (RF) signal the client receives from the AP.

This measurement is known as *Received Signal Strength Indication* (RSSI), which is indicated by a value ranging from 0 to 100. RSSI is determined by a mechanism implemented on the wireless interface of the client.

Rx total

The number of total packets received by the client during the current session.

Tx total
The number of total packets transmitted to the client during the current session.

Error rate
The percentage of time frames are dropped during transmission to or from this client.

Channel planning

When channel planning is enabled, the M220 automatically assigns radio channels used by clustered APs. Automatic channel assignment reduces mutual interference (or interference with other APs outside of its cluster) and maximizes Wi-Fi bandwidth to help maintain the efficiency of communication over the wireless network.

You must start channel planning to get automatic channel assignments. It is disabled by default.

At a specified interval, the channel manager maps APs to channel use and measures interference levels in the cluster. If significant channel interference is detected, the channel manager automatically reassigns some or all of the APs to new channels according to an efficiency algorithm (or *automated channel plan*). If the channel manager determines that a change is necessary, it sends the new channel assignments to all members of the cluster and generates a syslog message that indicates the sender AP and the new and old channel assignments.

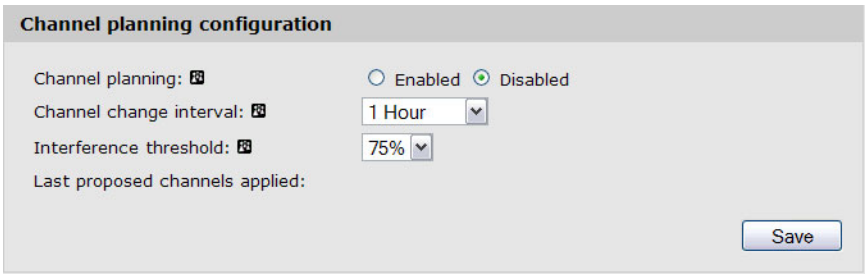
The *Cluster* > *Channel planning* page shows previous, current, and planned channel assignments for clustered APs. You can start channel planning to optimize channel usage across the cluster on a scheduled interval.

Note

This page displays channel planning fields only if clustering is enabled on the *Cluster* > *Configuration* page.

Configuration

Use this section to enable channel planning and configure basic settings.



Channel planning
Enable or disable channel planning. It is disabled by default.

Channel change interval
Select the schedule for automated updates. At the selected interval, channel usage is reassessed and the resulting channel plan is applied. A range of intervals is provided, from 30 minutes to 6 months. The default is 1 hour.

Interference threshold

Select the minimum percentage of interference reduction a proposed plan must achieve to be applied. The default is 75 percent. You can select percentages ranging from 5 percent to 75 percent.

This setting lets you set a gating factor for channel reassignment so that the network is not continually disrupted for minimal gains in efficiency.

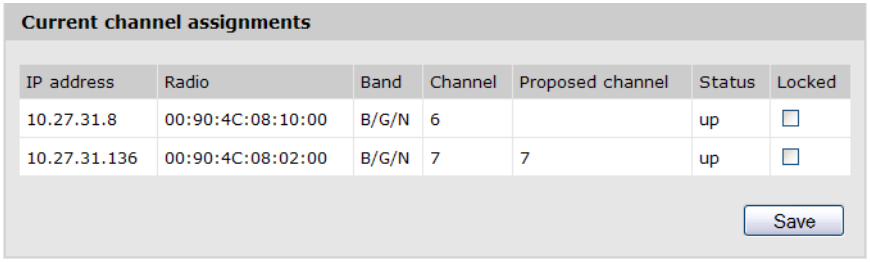
For example, if channel interference must be reduced by 75 percent and the proposed channel assignments will only reduce interference by 30 percent, then channels will not be reassigned. However, if you reset the minimal channel interference threshold to 25 percent, the proposed channel plan will be implemented and channels will be reassigned as needed.

Last proposed channels applied

If a channel plan was previously applied on the AP, this field shows the number of hours and minutes that have passed since it was applied.

Current channel assignments

Use this section to view the list of all APs in the cluster by IP address. The display shows the band on which each AP is broadcasting (a/b/g/n), the channel currently used by each AP, and an option to lock an AP on its current radio channel so that it cannot be reassigned to another.



IP address

The AP IP address.

Radio

The MAC address of the radio.

Band

The band on which the AP is broadcasting.

Channel

The radio channel on which this AP is broadcasting.

Proposed channel

The channel to which this AP will be reassigned when the current channel plan is applied. The proposed channel and current channel can be different if any of the following have occurred:

- DFS is enabled and has marked the proposed channel out of service.
- The channel is locked because the **Locked** checkbox is selected.
- The proposed channel has not yet been applied (there is a small window of time between the proposal and the application of the proposed channel).

Status

Indicates whether the channel is up or down.

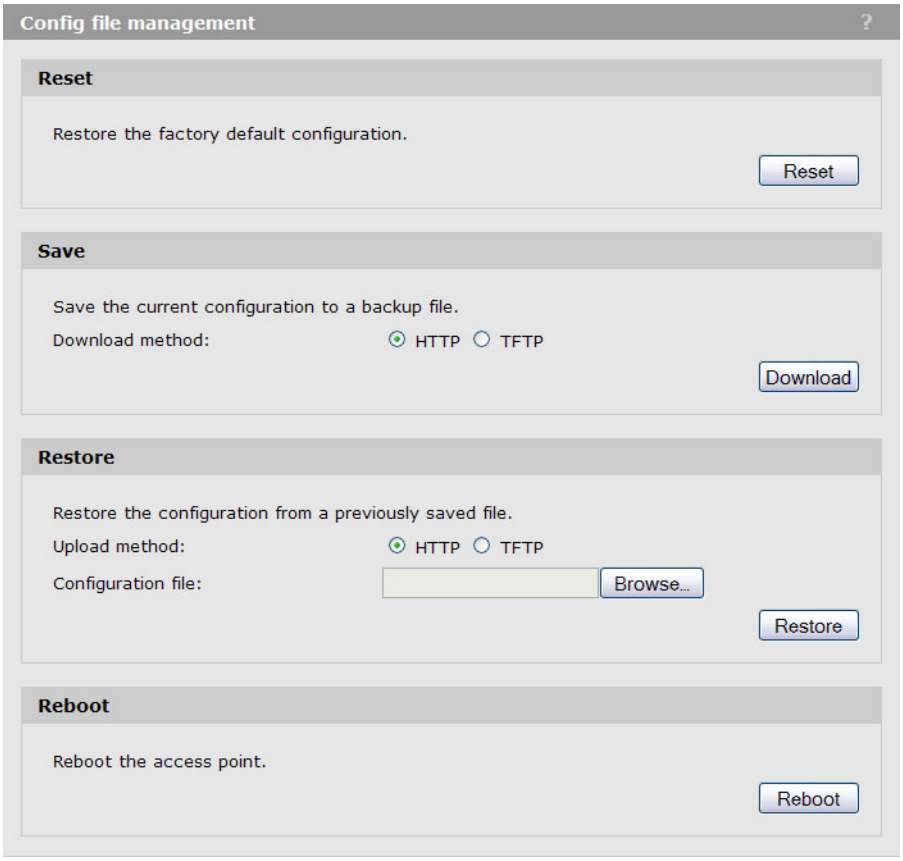
Locked

You can select to lock the AP onto the current channel. When selected, automated channel plans cannot reassign the AP to a different channel as a part of the optimization strategy. Instead, APs with locked channels will be factored in as requirements for the plan.

9 Maintenance

Configuration file management

The configuration file contains all the settings that customize the operation of the M220. You can save and restore the configuration file by selecting **Maintenance** > **Config file management**.



Reset

See *Resetting to factory defaults on page 105*.

Save

The Save feature enables you to back up your configuration settings so that they can be easily restored in case of failure.

Before you install new software, you should always back up your current configuration.

To start the process, select a **Download method** and then select **Download**.

For HTTP downloads, you are prompted for the location in which to save the configuration file. For TFTP downloads, specify the file path and file name under which to save the file, and the TFTP server name.

Restore

The Restore feature enables you to load a previously saved configuration file.

For an HTTP restore, select **Browse** to select to the configuration file that you want to restore, then select **Restore**.

For a TFTP restore, specify the file path and file name on the TFTP server, and enter the TFTP server address. Then, select **Restore**.

After restoring the configuration file, the system automatically reboots.

Note The M220 automatically restarts when the upload is completed.

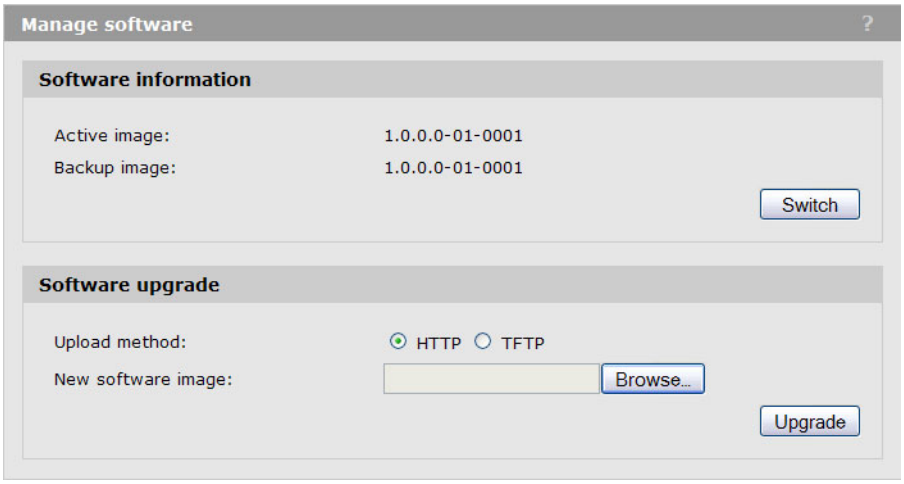
Reboot

For maintenance purposes or as a troubleshooting measure, you can reboot the M220 by selecting **Reboot**.

The process may take several minutes during which time the AP will be unavailable. The M220 resumes normal operation with the same configuration settings it had before the reboot.

Software updates

To update the M220 software, select **Maintenance** > **Software updates**. The *Manage software* page displays.



Software information

The M220 maintains both a primary software image and a backup image. The M220 always tries to boot with the primary image. If it fails to load, then the secondary image is used. Whenever such a failover occurs, the system creates a log message to help you troubleshoot the software failure.

The **Software information** area shows the active image and backup image versions. To make the backup image the active image, and the active image the backup image, select **Switch**.

The AP will reboot with the new image. The process may take several minutes during which time the AP will be unavailable. Do not power down the AP while the image switch is in progress. When the image switch is complete, the AP restarts. The M220 resumes normal operation with the same configuration settings it had before the upgrade.

Software upgrade

When a software upgrade is available, you can download the image to the M220.

Caution

- Before updating be sure to check for update issues in the Release Notes.
- Even though configuration settings are preserved during software updates, it is recommended that you back up your configuration settings before updating. See *Configuration file management on page 87*.

To update the M220 software using HTTP, select **Browse** to locate the software file (with the extension *.tar*) and then select **Upgrade.**

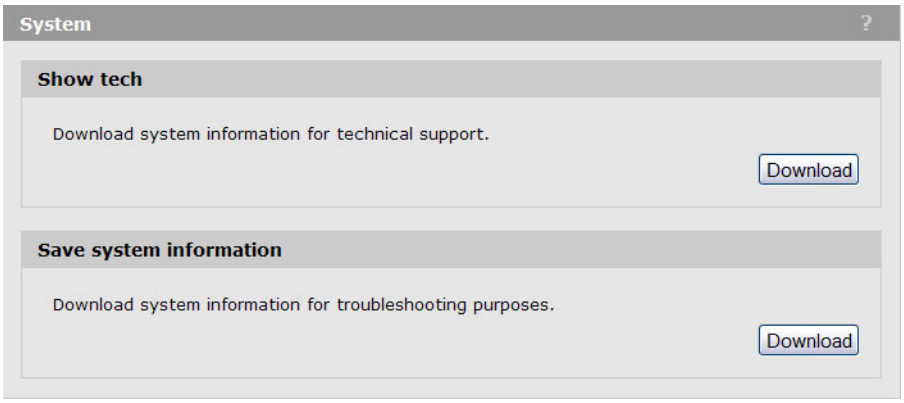
To update the software using TFTP, specify the file path and file name on the TFTP server, and enter the TFTP server address. Then, select **Upgrade**.

At the end of the update process, the M220 automatically restarts, disconnecting the current management session. Once the M220 resumes operation, you can reconnect.

System information

The *System* page enables you to download logs, settings, system tools outputs, and other information that customer support may find helpful in diagnosing problems.

To download system information, select **Maintenance** > **System**.



In the **Show tech** area, you can download a file that can be read in a text editor. The file contains configuration settings, including those that have been customized by the user. The file is named **showtech.rtf** by default.

In the **Save system information** area, you can download an encrypted binary file. Although you cannot read this file, you can provide it to customer support to assist in debugging efforts. This file contains additional configuration and device information. It is named **showdev.out** by default.

When you select **Download** in either section, you are prompted to select a location to save the file.

10 Tools

System log

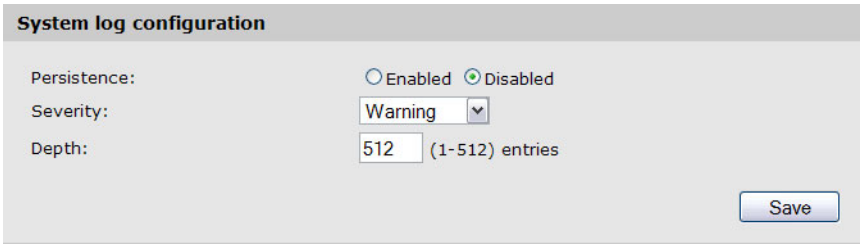
The system log is a comprehensive list of system messages and kernel messages, which may indicate error conditions such as dropped frames. The M220 stores up to 512 system error messages in volatile memory (RAM). You can view these events using the M220 management tool, and you can configure M220 to relay them as syslog messages to a syslog server residing on the network.

You can also configure the M220 to store up to 512 messages in nonvolatile memory (flash). When full, the oldest log message gets overwritten by the new log message. Logged messages often indicate severe errors in M220 operation, and they may prove useful in diagnosing system crashes. All log messages are time stamped.

To configure system log settings, and view a limited number of log messages from RAM, select **Tools** > **System log**.

System log configuration

You can use the **System log configuration** section of the *System log* page to configure the size of the system log and specify which system events result in messages to store in the log, based on their severity level.



You can configure the following log settings:

Persistence

If the system unexpectedly reboots, log messages can be useful to diagnose the cause. However, log messages in volatile memory are lost when the system reboots. You can enable persistent logging to store log messages in flash memory so that they are retained after a reboot.

Choose **Enabled** to save system logs to flash memory. Choose **Disabled** to save system logs to volatile memory only.

Caution

Persistent logging can eventually wear out the flash memory and degrade network performance. You should only enable persistent logging to debug a problem. Make sure you disable persistent logging after you finish debugging the problem.

Severity

Specify the severity level of the log messages to write to the system log(s). This setting applies to messages stored in RAM and flash. In the following list, the severity levels are listed from most severe (top) to least severe (bottom):

- **Emergency** indicates that the system is unusable. It is the highest level of severity.
- **Alert** indicates action must be taken immediately.
- **Critical** indicates critical conditions.
- **Error** indicates error conditions.
- **Warning** indicates warning conditions.
- **Notice** indicates normal but significant conditions.
- **Informational** indicates informational messages.
- **Debug** indicates debug-level messages.

For example, if you specify **Critical**, then only critical, alert, and emergency messages are written to the log(s).

Depth

RAM and flash memory can store up to 512 messages each. When the depth value you configure is reached, the oldest log message is overwritten by the new log message.

Remote syslog configuration

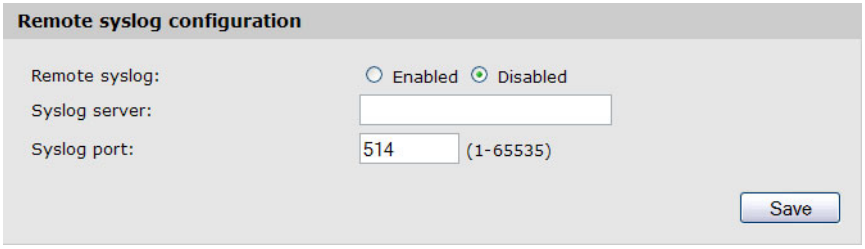
You can view up to 512 messages stored in RAM in the **Events** section of the *System log* page. To view a longer history of messages, you must set up a remote syslog server that acts as a syslog log relay host on your network. Then, you can configure the M220 to send syslog messages to the remote server. The **Severity** level setting configured in the **System log configuration** section determines which messages are stored in RAM and are available for relay to a remote syslog server.

Using the remote syslog feature provides these benefits:

- Allows aggregation of syslog messages from multiple M220s. The MAC address of the sending AP displays at the start of each message.
- Stores a longer history of messages than those that are kept on a single M220.
- Can trigger scripted management operations and alerts.

The procedure for configuring a remote log host depends on the type of system you use as the remote host.

You can use the **Remote syslog configuration** section of the *System log* page to configure M220 remote log settings.



Remote syslog

Use this setting to enable or disable this feature. When enabled, messages of the selected **Severity** level or higher are sent to the configured syslog server. When disabled, a limited number of these messages will be stored locally and can be viewed in the **Events** section of the *System log* page.

Syslog server

Specify the IP address or DNS name of the remote log server.

Syslog port

The syslog process uses logical port 514 by default. It is recommended that you keep this default. If you specify a different port number, ensure that the port number is not being used by another protocol on your network and that your syslog server is also configured to use that port.

Events

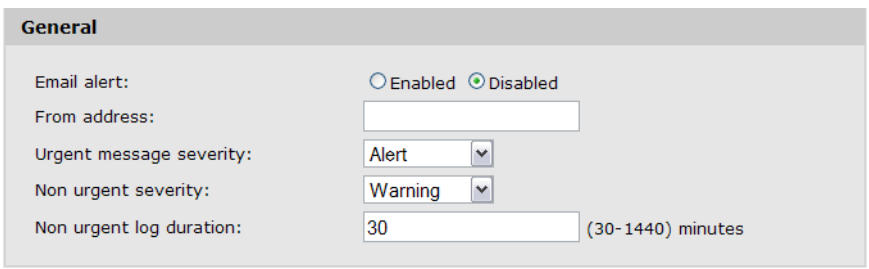
The **Events** section of the *System log* page shows real-time system events on the AP, such as wireless clients associating with the AP and being authenticated. The log shows the date the event occurred, its severity level, the software program or process that caused the event message, and the message text.

You can select **Refresh** to display the most recent data from the AP, or **Clear All** to remove all entries from the list.

Email alert

The Email alert feature allows the AP to automatically send email messages when an event at or above the configured severity level occurs. To configure email alert settings, select **Tools** > **Email alert**.

General configuration



Email alert

Globally enable or disable the Email alert feature. It is disabled by default.

From address

Specify the email address that appears in the From field of alert messages sent from the AP, for example AP23@company.com. It is recommended that you use an email address that exits on your own network, so that the address will receive a notification if an email from the AP is undeliverable, and to prevent spam filters on the network from blocking the sending or delivery of emails from the AP.

The address can be a maximum of 255 characters and can contain only printable characters. By default, no address is configured.

Urgent message severity

This setting determines the severity level for log messages that are considered to be urgent. Messages in this category are sent immediately upon being generated. The security level you select and all higher levels are considered urgent:

- **Emergency** indicates that the system is unusable. It is the highest level of severity.
- **Alert** indicates action must be taken immediately.
- **Critical** indicates critical conditions.
- **Error** indicates error conditions.
- **Warning** indicates warning conditions.
- **Notice** indicates normal but significant conditions.
- **Informational** indicates informational messages.
- **Debug** indicates debug-level messages.

Non-urgent severity

This setting determines the severity level for log messages that are considered to be non-urgent. Messages in this category are collected and sent in a digest form at the time interval specified by the non-urgent log duration. The security level you select and all levels up to but not including the lowest urgent level are considered non-urgent. Messages below the security level you specify are not sent via email.

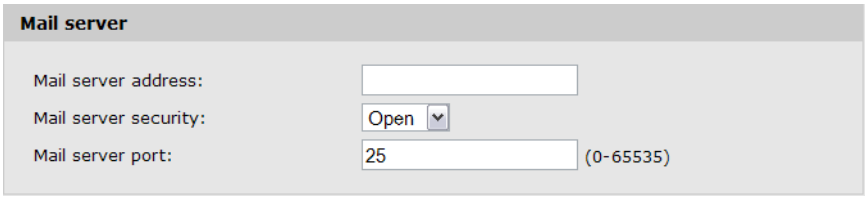
See the **Urgent message severity** description for information about the security levels.

Non urgent log duration

This setting determines how frequently the non-urgent messages are sent to the email (SMTP) server. The range is 30 to 1440 minutes. The default is 30 minutes.

Non-urgent messages are sent when the time duration is reached or the number of messages exceeds the configured **Depth** value on the *System log* page, whichever is first.

Mail server configuration



Mail server address

Specify the IP address or hostname of the SMTP server on the network.

Mail server security

Specify whether to use SMTP over SSL (**TLSv1**) or no security (**Open**) for authentication with the mail server. The default is **Open**.

Mail server port

Configure the TCP port number for SMTP. The range is a valid port number from 0 to 65535. The default is 25, which is the standard port for SMTP.

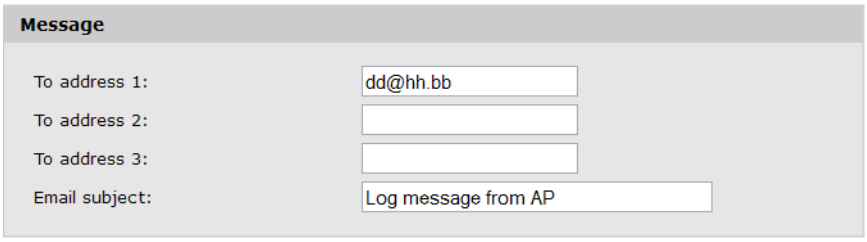
Username

This field displays only when **TLSv1** is selected as the **Mail server security** setting. Specify the username to use for authentication with the mail server. The username can be up to 64 characters long and can include any printable characters.

Password

Specify the password associated with the username configured in the previous field.

Message configuration



To address 1/2/3

Configure the first email address to which alert messages are sent and, optionally, a second and third email address. The address must be in email address format, for example abc@def.com. By default, no addresses are configured.

Email subject

Specify the text to be displayed in the subject of the email alert message. The subject can contain up to 255 alphanumeric characters. The default is **Log message from AP**.

Sending a test message

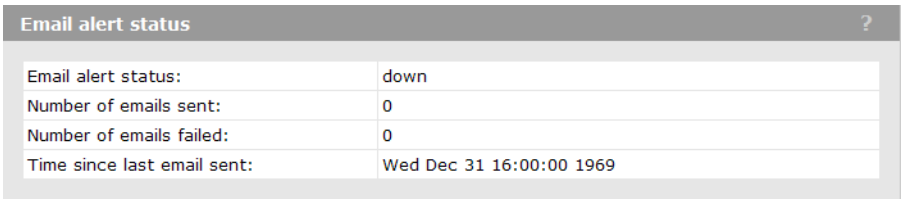
To validate the configured email server credentials, select **Test Mail**.

The following text shows an example of an email alert sent from the AP to the network administrator:

```
From: AP-192.168.1.1@mailserver.com
Sent: Wednesday, February 08, 2012 11:16 AM
To: administrator@mailserver.com
Subject: log message from AP
TIME              Priority    Process Id             Message
Feb 8 03:48:25    info        login[1457]            root login on 'ttyp0'
Feb 8 03:48:26    info        mini_http-ssl[1175]    Max concurrent connections
                                                     of 20 reached
```

Viewing email alert status

You can select **Status** > **Email alert** to view the status of the email alert feature and information about past activity.



Email alert status

Indicates whether the Email alert feature is administratively enabled or disabled.

Number of emails sent

The number of alert emails sent since the feature was enabled.

Number of emails failed

The number of alert emails sent since the feature was enabled that did not reach the intended destination.

Time since last email sent

The date and time of the last alert email sent.

Network trace configuration

Overview

Network administrators can perform network traces to capture and analyze network traffic. Network trace operates in two modes:

- **Packet file trace mode**: Captured packets are stored in a file on the M220. The M220 can transfer the file to a TFTP server. The file is formatted in pcap format and can be examined using tools such as Wireshark and OmniPeek.
- **Remote packet trace mode**: The captured packets are redirected in real time to an external PC running the Wireshark tool.

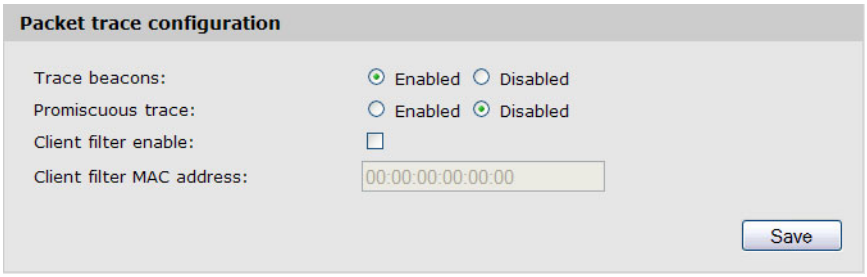
The AP can trace the following types of packets:

- 802.11 packets received and transmitted on radio interfaces. Packets captured on radio interfaces include the 802.11 header.
- 802.3 packets received and transmitted on the Ethernet interface.
- 802.3 packets received and transmitted within wireless communities or on internal logical interfaces, such as WDS interfaces.

To configure network trace settings and initiate packet captures, select **Tools** > **Network trace**.

Packet trace configuration

Use this section to configure parameters that affect how packet trace functions on the radio interfaces.



Trace beacons

Enable to trace the 802.11 beacons detected or transmitted by the radio.

Promiscuous trace

Enable to place the radio in promiscuous mode when the trace is active.

In promiscuous mode, the radio receives all traffic on the channel, including traffic that is not destined to the M220. While the radio is operating in promiscuous mode, it continues serving associated clients. Packets not destined to the AP are not forwarded.

As soon as the trace is completed, the radio reverts to non-promiscuous mode operation.

Client filter enable

Enable to use the WLAN client filter to trace only frames that are transmitted to, or received from, a WLAN client with a specified MAC address.

Client filter MAC address

Specify a MAC address for WLAN client filtering. Note that the MAC filter is active only when a trace is performed on an 802.11 interface.

Note

Changes to packet trace settings take effect after a packet trace is restarted. Modifying the parameters while a packet trace is running does not affect the current packet trace session. To begin using new parameter values, an existing packet trace session must be stopped and restarted.

Packet file trace

In packet file trace mode, the M220 stores captured packets in a file on the device.

Upon activation, the packet trace proceeds until one of the following occurs:

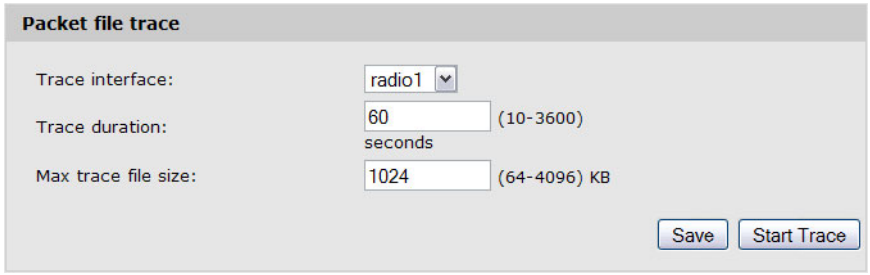
- The trace time reaches configured duration.
- The trace file reaches its maximum size.
- The administrator stops the trace.

During the trace, you can monitor the trace status, elapsed trace time, and the current trace file size. You can select **Refresh** to update this information while the trace is in progress.

Performing a packet file trace

To perform a packet file trace.

1. Select **Tools** > **Network trace**.



2. Select a **Trace interface**. The following M220 interfaces are available for packet trace:
   - **radio1**: 802.11 traffic on the radio.
   - **eth0**: 802.3 traffic on the Ethernet port.
   - **wlan0**: Traffic for the default wireless community.
   - **wlan0vap***x*: Traffic for wireless community *x*, where *x* is the community ID and can be from 1 to 7. Wireless community IDs are shown in the first column of the Communities table on the *Wireless* > *Communities* page.
   - **brtrunk**: Traffic that is forwarded among different wireless communities, the Ethernet interface, and WDS interfaces.
   - **wlan0wds***x*: Traffic for WDS interface *x*, where *x* is the WDS interface ID and can be from 1 to 4. Configured WDS interfaces are shown on the *Wireless* > *WDS* page.
3. Specify the following parameters:
   - **Trace duration**: The time duration in seconds for the trace (range 10 to 3600).
   - **Max trace file size**: The maximum allowed size for the trace file in KB (range 64 to 4096).

   If you change either of these values, you must select **Save** before initiating a trace.
4. Select **Start Trace**.

   The trace session will run for the specified duration. You can view the trace status in the **File trace status** section. Select **Refresh** to see updated trace time and file size values. You can also select **Stop Trace** to stop a trace before the specified duration has elapsed.

Remote packet trace

Remote packet trace enables you to specify a remote port as the destination for packet captures. This feature works in conjunction with the Wireshark network analyzer tool for Windows. A packet trace server runs on the M220 and sends the captured packets via a TCP connection to the Wireshark tool.

A Windows PC running Wireshark enables you to display, log, and analyze captured traffic.

When the remote trace mode is in use, the M220 does not store any captured data locally in its file system.

Setting up Wireshark sessions

You can trace up to five interfaces on the M220 at the same time. However, you must start a separate Wireshark session for each interface. You can configure the IP port number used for connecting Wireshark to the M220. The default port number is 2002. The system uses five consecutive port numbers starting with the configured port for the packet trace sessions.

If a firewall is installed between the Wireshark PC and the M220, these ports must be allowed to pass through the firewall. The firewall must also be configured to allow the Wireshark PC to initiate TCP connection to the M220.

To configure Wireshark to use the M220 as the source for captured packets, you must specify the remote interface in the *Capture Options* menu. For example, to trace packets on an M220 with IP address 192.168.1.10 on radio 1 using the default IP port, specify the following interface:

```
rpcap://192.168.1.10/radio1
```

To trace packets on the Ethernet interface of the M220 and on the default wireless community (wlan0) using IP port 58000, start two Wireshark sessions and specify the following interfaces:

```
rpcap://192.168.1.10:58000/eth0
rpcap://192.168.1.10:58000/wlan0
```

When you are capturing traffic on the radio interface, you can disable beacon trace, but other 802.11 control frames are still sent to Wireshark. You can set up a display filter to show only the following:

- Data frames in the trace
- Traffic on specific BSSIDs
- Traffic between two clients

Some examples of useful display filters are the following:

- Exclude beacons and ACK/RTS/CTS frames:

  ```
  !(wlan.fc.type_subtype == 8 || wlan.fc.type == 1)
  ```

- Data frames only:

  ```
  wlan.fc.type == 2
  ```

- Traffic on a specific BSSID:

  ```
  wlan.bssid == 00:02:bc:00:17:d0
  ```

- All traffic to and from a specific client:

  ```
  wlan.addr == 00:00:e8:4e:5f:8e
  ```

Performance and security considerations

In remote packet trace mode, traffic is sent to the PC running Wireshark via one of the network interfaces. Depending on where the Wireshark tool is located, the traffic can be sent on an Ethernet interface or one of the radios. To avoid a traffic flood caused by tracing the trace packets, the M220 automatically installs a trace filter to filter out all packets destined to the Wireshark application. For example, if the Wireshark IP port is configured to be 58000, then the following trace filter is automatically installed on the M220:

not portrange 58000-58004

Enabling the packet trace feature impacts M220 performance and can create a security issue (unauthorized clients may be able to connect to the AP and trace user data). The M220 performance is negatively impacted even if there is no active Wireshark session with the AP. The performance is negatively impacted to a greater extent when packet trace is in progress.

Due to performance and security issues, the packet trace mode is not saved in nonvolatile memory on the M220. If the M220 resets, the trace mode is disabled and you must re-enable it to resume capturing traffic. Packet trace parameters (other than mode) are saved in nonvolatile memory.

To minimize any performance impact on the M220 while traffic trace is in progress, you should install trace filters to limit which traffic is sent to the Wireshark tool. When capturing 802.11 traffic, a large portion of the captured frames tend to be beacons (typically sent every 100 ms by all APs). Although Wireshark supports a display filter for beacon frames, it does not support a trace filter to prevent the M220 from forwarding captured beacon packets to the Wireshark tool. To reduce the performance impact of capturing the 802.11 beacons, you can disable the trace beacons mode.

The remote packet trace facility is a standard feature of the Wireshark tool for Windows.

Note

Remote packet trace is not standard on the Linux version of Wireshark. The Linux version does not work with the AP.

Wireshark is an open source tool and is available for free. It can be downloaded from www.wireshark.org.

Performing a remote packet trace

To perform a remote packet trace.

1. Set up the Wireshark session as described in *Setting up Wireshark sessions on page 99*.
2. On the M220 management tool, select **Tools** > **Network trace**.

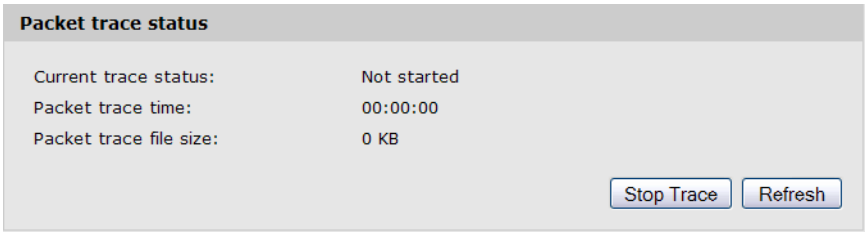
3. In the **Remote packet trace** section, specify the Remote trace port. Specify the remote port to use as the destination for packet captures. The range is 1 to 65530 and the default port is 2002. If you change this value, you must select **Save** prior to starting the remote trace.

4. Select **Start Remote Trace**.

   The trace session will run for the specified duration. You can view the trace status in the **Packet trace status** section. Select **Refresh** to see the updated trace time. You can also select **Stop Trace** to stop a trace before the specified duration has elapsed.

Packet trace status

This section enables you to view the status of the packet trace on the AP.



Current trace status

Whether a packet trace is running or is stopped.

Packet trace time

The elapsed trace time for a trace in progress.

Packet trace file size

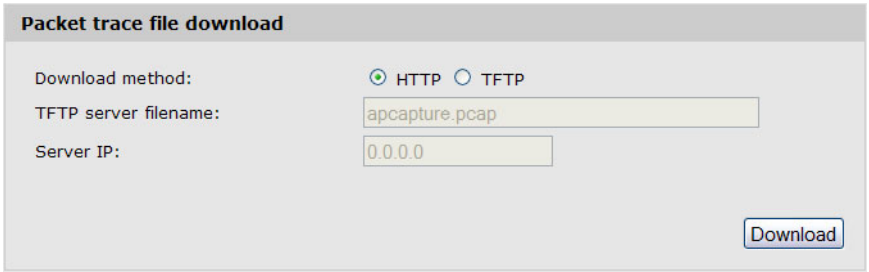
The current trace file size.

Packet trace file download

This section enables you to download the trace file by TFTP to a configured TFTP server, or by HTTP(S) to a PC. A trace is automatically stopped when the trace file download command is triggered.

HTTP download

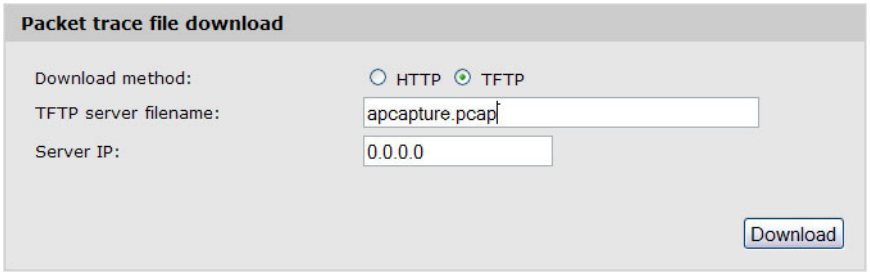
Select **HTTP** to download to your PC or a network location.



When you select **Download**, you will be able to browse to the desired location.

TFTP download

Select **TFTP** to download to download to a TFTP server.



TFTP server filename

The file will be saved to the TFTP server under this name and path.

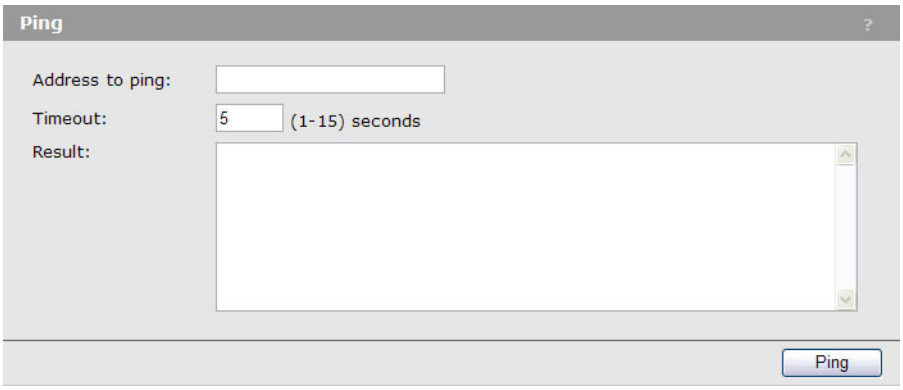
Server IP

Enter the IP address of the TFTP server.

When you select **Download**, a progress bar displays to indicate download status.

Ping

The M220 supports ping functionality to enable basic diagnostics of network devices. To ping another device, select **Tools** > **Ping**.



Address to ping

You can specify an IPv4 address, an IPv6 address, or a hostname.

Timeout

Specify the amount of time in seconds after which an unsuccessful ping will time out.

Results

The results window shows the size and number of each packet sent and, if the host is reached, the size and number of each packet received in response and its round-trip time. It also displays statistics about packet loss and, if the host is reached, the average round-trip time for all packets.

11 Support and other resources

Online Documentation

You can download documentation from the HP Support Website at: www.hp.com/networking/support. Search by product number or name.

Contacting HP

For worldwide technical support information, see the HP Support Website: www.hp.com/networking/support

Before contacting HP, collect the following information:

- Product model names and numbers
- Technical support registration number (if applicable)
- Product serial numbers
- Error messages
- Operating system type and revision level
- Problem description and any detailed questions

HP Websites

For additional information, see the following HP Websites:

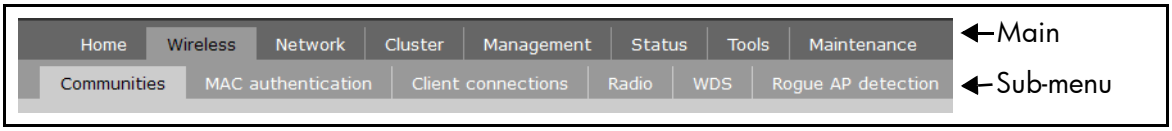
- www.hp.com/networking
- www.hp.com

Conventions

The following conventions are used in this guide.

Management tool

This guide uses specific syntax when directing you to interact with the management tool user interface. Refer to the following image for identification of key user-interface elements and then the table below for example directions:



Example directions in this guide	What to do in the user interface
Select **Wireless** > **Radio**.	Select **Wireless** on the main menu, and then select **Radio** on the sub-menu.
Set **Mode** to **5 GHz IEEE 802.11n**.	For the **Mode** setting, select the **5 GHz IEEE 802.11n** from the list.

A Resetting to factory defaults

Factory reset procedures

To force the M220 into its factory default state, follow the procedures in this section.

Caution

Resetting the M220 to factory defaults deletes all configuration settings, resets the manager user name and password to **admin**, and enables the DHCP client on the Ethernet port. If no DHCP server assigns an address to the M220, its address defaults to 192.168.1.1.

Using the reset button

Using a tool such as a paper clip, press and hold the reset button for a few seconds until the status lights blink three times.

Using the management tool

To reset the M220 to factory defaults:

1. Launch the management tool (default https://192.168.1.1).
2. Select **Maintenance** > **Config file management**.
3. Under **Reset configuration**, select **Reset**.